

Does Universal Health Insurance Make Health Care Unaffordable? Lessons From Taiwan

Evidence from the first half-decade of universal coverage in Taiwan suggests that overall costs do not rise because of increased use of services.

by **Jui-Fen Rachel Lu and William C. Hsiao**

ABSTRACT: This paper examines the performance of Taiwan's National Health Insurance (NHI), a universal health insurance program, implemented in 1995, that covers comprehensive services. The authors address two key questions: Did the NHI cause Taiwanese health spending to escalate to an "unaffordable" level? What are the benefits of the NHI? They find that Taiwan's single-payer NHI system enabled Taiwan to manage health spending inflation and that the resulting savings largely offset the incremental cost of covering the previously uninsured. Under the NHI, the Taiwanese have more equal access to health care, greater financial risk protection, and equity in health care financing. The NHI consistently receives a 70 percent public satisfaction rate.

AS THE UNITED STATES faces another cycle of high health spending inflation, the nation again debates how to reform the structure of financing and delivery of health care to ameliorate the problem of the uninsured and contain health cost inflation. Taiwan, the latest advanced economy to establish a universal health insurance program, has accumulated seven years of experience. This experience can inform the U.S. public debate and experiments.

How did Taiwan fare after adopting its universal coverage program? Did health care costs escalate, and if so, by how much? Has Taiwan been able to manage its health spending inflation? Have people gained more equal access to health care? Has the quality of health care suffered? Is the public satisfied with the new system? In this paper we use international criteria and empirical evidence to answer these questions.

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Background

Taiwan has a population of twenty-three million people, who live on one major and several smaller islands, with land size of 36,000 square kilometers (the size of the Netherlands). Its gross national product (GNP) had reached \$13,000 per person by the late 1990s.¹

Reflecting its free-enterprise economy, Taiwan has a market-driven health care delivery system with a mix of publicly and privately owned hospitals (35 percent of beds are public, 65 percent private).² Sixty-three percent of physicians are employed by hospitals and paid on a salaried basis; some receive bonus payments based on productivity. The remainder are fee-for-service private practitioners. Doctors who practice in private clinics do not have hospital admitting privileges; hence, hospitals have developed large outpatient departments and affiliated clinics for primary care, to maintain their inpatient flows. As a result, Taiwan has a fragmented health care delivery system that lacks continuity of care. Its clinical quality of care suffers from years of *laissez-faire* policy toward clinical practices.³

Taiwan averages 5.7 hospital beds per thousand people, but more than 70 percent of the hospitals are small (fewer than fifty beds). The technical capabilities of hospitals and the staffing of hospital beds vary greatly across hospital types. They range from medical centers that rival the best medical facilities in Western nations to clinical beds that resemble outdated convalescent hospitals.

Taiwan has 1.4 physicians trained in Western medicine for every thousand people, as compared to 2.5 in the United States. About one-third of Western-medicine physicians have their own private clinics, where they deliver primary care. A clinic is similar, in many respects, to the private office of the American physician, with one major difference: Many clinics maintain about a dozen beds for their patients, because their physicians do not have hospital admitting privileges.

Before the implementation of its National Health Insurance (NHI), Taiwan's providers were paid fee-for-service. Physicians made sizable profits from pharmaceuticals because they were allowed to prescribe and dispense them freely. This practice encouraged overprescribing of drugs and frequent but short office visits. Fee-for-service payment further induced demand for and the proliferation of new medical technology, such as laboratory and imaging tests, resulting in duplications of facilities. Consequently, Taiwanese health spending per person was escalating rapidly: Beginning in 1960, it experienced an average increase of more than 6-8 percent in real terms, about 2-3 percent above the rise in real annual income per person.⁴

Before the NHI was introduced in 1995, 57 percent of Taiwan's people were insured through three separate major social health insurance programs: Labor Insurance, Government Employee Insurance, and Farmers Insurance. The uninsured were deterred from seeking necessary medical services, and this created unequal access to health care between socioeconomic classes.

The government planned its new NHI system to achieve two essential objec-

tives: providing equal access to health care for all citizens and controlling total health spending to a reasonable level.⁵ The NHI provided a comprehensive benefit package that covers preventive and medical services, prescription drugs, dental services, Chinese medicine, and home nurse visits.⁶ The NHI incorporated a \$5 copayment for each outpatient visit to clinics, an \$8 copayment for each visit to hospital outpatient clinics, and 10 percent coinsurance for inpatient services but capped the total amount that a patient has to pay each year at 10 percent of the average national income per person.

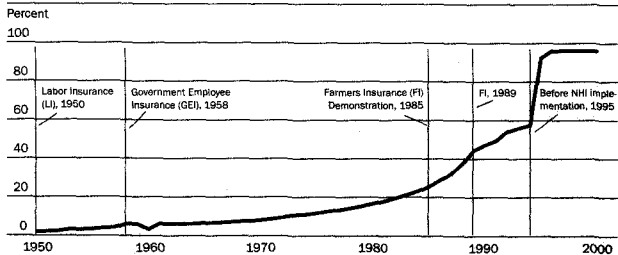
The NHI was implemented in March 1995. With astounding speed, 92 percent of the population had enrolled in the NHI by the end of 1995, and 96 percent had enrolled by the end of 1996 (Exhibit 1).⁷ By the end of 2001, 97 percent of the total eligible population had enrolled. The 3 percent not enrolled may be living overseas or in very remote areas, and perhaps includes the near-poor with irregular income sources or independent-minded, wealthy self-employed people.

Impacts Of National Health Insurance

Taiwan's NHI offers every citizen nearly equal financial access to comprehensive health services and provides all citizens with financial risk protection from large medical expenses. At the same time, it gives patients the right to freely choose their providers and for hospitals and physicians to freely choose their practice mode and be paid on a fee-for-service basis. What have been the benefits of the NHI to the Taiwanese? What has the NHI program cost Taiwanese citizens and taxpayers? Is the public satisfied with the program, and how much support does the program enjoy? We provide a brief assessment here.

EXHIBIT 1

Insurance Coverage Expansion in Taiwan, Insured People As Percentage Of Population, 1950-2000



SOURCES: For 1950-1994, J.R. Lu and C.R. Hsieh, "The National Health Insurance Program in Taiwan," in *Health Economics* (Taipei: Pro-Ed Publishing Company, August 2000), chap. 14, 401; for data after 1995, Taiwan Bureau of National Health Insurance.

NOTE: Taiwan's National Health Insurance (NHI) was implemented in 1995.

■ **Access to and use of services.** The comprehensive NHI benefit package has largely equalized people's financial access to health services. Most preventive services are completely free (annual checkups, maternal and child health care, and regular well-child care up to age six). Regular office visits have a modest copayment (US\$5 per visit), from which poor households are exempt. Nonetheless, the copayment and coinsurance rates are regressive because they are fixed and unvaried by a patient's income. However, they were so designed to avoid the burden of administering a complex individual income-related cost-sharing program.

Taiwan has not collected the comprehensive data needed to fully evaluate the NHI's effects on access to health care. One small cohort survey of randomly selected 1,025 adults found that after the NHI began, those who were previously uninsured had increased their use of outpatient visits to the same level as those who were previously insured.⁸ Aggregated hospital statistics show that the average hospital admission rate increased from 110 per 1,000 in 1994 to 120 per 1,000 in 1996.⁹

Nearly equal financial access does not necessarily mean that providers are physically available within a reasonable distance to everyone. Taiwan has low-income neighborhoods, and 1.64 percent of its population lives on remote islands and in mountainous areas.¹⁰ Although they may have nearly equal financial access, the poor and the people living in these remote areas may not have equal physical access, because of the maldistribution of health care resources. For example, 59 percent of residents in mountainous areas reported having more than thirty minutes of travel time (one way) to their primary doctor.¹¹ The Bureau of National Health Insurance (BNHI) has taken action to ameliorate this problem through a multifaceted program. On the supply side, it introduced incentives for providers to practice in remote areas. Also, the BNHI organized and encouraged services on wheels to travel to remote areas on a regular schedule. On the demand side, the government exempted cost sharing for the poor and for those who live in remote areas.

■ **Quality of care.** Taiwan has not collected comprehensive information on the clinical quality of health care. The crude indication is that clinical quality has neither declined nor improved since the NHI's implementation, as the BNHI has not made serious efforts to improve and monitor the quality of health care. Formal quality assurance is still at a primitive stage in Taiwan. The government did not initiate a voluntary hospital accreditation program until 1998.¹² This program is still voluntary. There is no regulation requiring the systematic reporting of clinical performance, patient outcomes, or adverse events. Furthermore, hospitals are not required to have uniform clinical records systems.

At the same time, the NHI has not made serious efforts to influence the diffusion of the latest sophisticated high-technology medicine. Before the NHI, the spread of technology was financed by government funds or by charges to patients, and this practice continues. However, a few manufacturers have alleged that in several cases there have been longer delays in approving new drugs and new medi-

"The population covered by the NHI is well protected against uncertain large medical expenses, other than long-term care."

cal devices since the NHI was implemented.

Taiwan has monitored waiting times for elective surgery and routine care, and no change has been reported. Public polls have not revealed any increase in waiting time for any type of service.¹³

■ **Financial risk protection.** Taiwan's NHI covers a comprehensive package of services, including all medical and laboratory services, dental care, drugs, Chinese medicine and drugs, and home nurse visits. The 10 percent coinsurance for hospitalization is capped at 6 percent of the average national income per person for each admission and at 10 percent for each calendar year. Poor households are exempted from all cost sharing. In short, the population covered by the NHI is well protected against uncertain large medical expenses, other than long-term nursing home care. Furthermore, our calculation of national health spending shows that patients' out-of-pocket payments fell from 48 percent of the total amount spent on health care in 1993 to 30 percent in 2000.

■ **Equity in financing the NHI.** One method of measuring equity in financing by socioeconomic class was developed by the World Health Organization (WHO).¹⁴ Although the WHO fairness in financial contribution (FFC) index method has been widely criticized, it is still the only method that has been used to evaluate equity in financing for all nations.¹⁵

WHO's FFC index intends to measure inequality in the share of households' income spent on health. A household's financial contribution to health is defined as the ratio of total household spending on health to the household's total capacity to pay. The value of the index ranges from 0 to 1. Countries with scores closer to 1 tend to be more equitable in the financing of their health care than those with lower scores. Using the WHO method to compute the FFC index based on the data from the annual government household surveys of income and expenditures, we found that the equity in financing health care in Taiwan has improved since the implementation of the NHI (0.992 in 1998 versus 0.881 in 1994). The change in the FFC index indicates that the share of health financing burden borne by households has become more equal since the NHI's introduction. Taiwan's score of 0.992 compares favorably with those of Canada (0.974), Germany (0.978), and Japan (0.977). Among the Organization for Economic Cooperation and Development (OECD) countries, the United States has been found to be the least equitable country in health care financing, with a score of 0.954.¹⁶

■ **Managing health spending increases.** While the NHI has made health care more affordable at the point of service for patients, how much has it increased total national health spending? Has Taiwan been able to manage health costs increases under the NHI? Compared to a situation in which Taiwan had not adopted universal

coverage, what have been the additional financial costs resulting from the NHI's adoption?

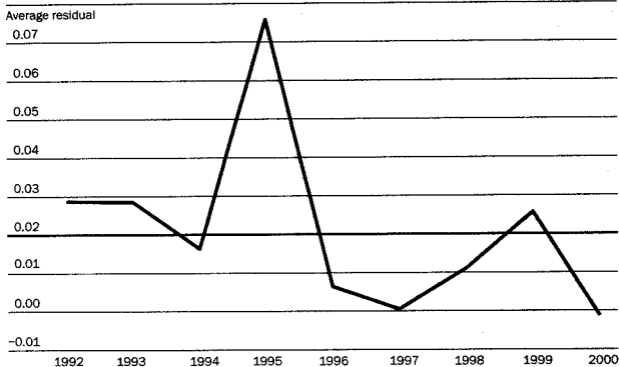
The NHI has had a number of direct impacts on Taiwanese health spending. Some changes that have likely increased health expenditure include the following: (1) Previously uninsured people have increased their use of health services; (2) free maternal and child care and annual checkups are likely to have increased the use of these services; and (3) remedial actions taken to redistribute providers to underserved areas may have caused residents in those areas to use more health services. On the other hand, various changes introduced by the NHI could have reduced health spending, including the following: (1) The introduction of cost-sharing provisions might have reduced the utilization rates of previously insured people who had smaller copayments before the NHI; and (2) the single-payer system provides Taiwan with the tools to manage health spending more effectively. These tools include provider and patient profiles to identify and reduce fraudulent claims, overcharges, duplication of services and tests, and so on; one uniform reporting procedure and claim filing system, which greatly reduced transaction costs; and negotiated fee schedules under global budgets, which might have reduced medical prices to a lower level than they would have been if the NHI had not been adopted.

To evaluate how much the NHI has affected Taiwan's aggregate level of national health spending and its rate of increase, we use the health spending figures compiled by the Department of Health (DoH) and revised them to be consistent with the OECD standard in compiling national health spending data. That involves adjusting the out-of-pocket payment upward for underreporting and including private insurance premiums in the national health spending figures.

We used an existing method to analyze the NHI's impacts on national health spending by isolating the NHI's probable financial impacts.¹⁷ First, we used our national health spending figures and calculated the nominal annual rate of spending increase.¹⁸ We isolate the NHI's probable effects on spending growth by first identifying the known causes for the spending growth: change in population, aging of the population, changes in input factor prices, and changes in real income times income elasticity of demand. The part that remains, the residual, has no clear empirical explanations. The residual includes the NHI's positive and negative impacts on health spending, as discussed previously; any change in medical technology; and improvements in production efficiency (we cannot isolate these individual components).¹⁹

We calculated the residual for the pre-NHI and post-NHI years. Then we compared the average residual level between the two periods. Since Taiwan didn't have any political and socioeconomic shocks that affected health spending other than the NHI, the differences in the residual levels are likely attributable to the NHI.

Exhibit 2 shows the residual for 1992-2000, which represents the unexplained causes of health spending increases after the plausible causes were removed. The

EXHIBIT 2**Residuals For Total Health Spending Per Person In Taiwan, In Real Terms, 1992-2000**

SOURCE: Residual was computed based on Taiwan's national health expenditures estimated by the authors (see text for details).
NOTES: When Taiwan's National Health Insurance was implemented in 1995, the residual jumped from its historical average of 0.02, then dropped.

residual, adjusted for the increasing insured population, has been approximately 2 percent per year between 1992 and 1995, similar to the average rate during 1970-1986.²⁰ However, the residual jumped to close to 8 percent in 1995, when the NHI was implemented. This jump is likely attributable to the insurance effect of the NHI.²¹ Then the residual fell measurably below the historical level, averaging close to 0.5 percent from 1996 to 2000, as a result of actions taken by the BNHI and other unknown reasons discussed below.

Single-payer NHI produces some direct savings. Before the NHI, Taiwan had a multipayer system that consisted of the three major social insurance programs plus direct out-of-pocket payments by patients. The separate insurance programs each had different benefit packages, their own rules governing claims payments, and their own payment rates. All three contracted separately with selected providers. These different administrations incurred additional costs while imposing additional administrative costs on providers. A universal uniform reporting procedure and claims-filing system reduces administrative costs and has economies of scale. The direct operating cost of Taiwan's NHI program is approximately 2 percent of its total expenditure.²² Clinics and hospitals have found that their administrative costs have been reduced under the one standard benefit package and the one standard reporting and claim procedure established by the single-payer system. In contrast, studies have found that transaction costs in the United States

“When a society is seriously concerned about its people having equitable access to care, the free market is not a good choice.”

amount to more than 20 percent of premium revenues.²³

The single-payer system also provided comprehensive information to create provider profiles to reduce potential fraudulent claims, abuses in coding, and the overuse of tests. It also allowed stringent control of claim payments across the board, which the BNHI adopted in 1999–2000. However, Taiwan’s NHI did not reform the organization of health care delivery to remove duplications of facilities, nor did it effectively separate prescribing from dispensing by physicians.

How else did the NHI manage spending inflation? One saving resulted from a single-payer system. Prior to the NHI, providers could shift costs and charge different payers different amounts for the same service. A single-payer system with a uniform payment schedule effectively controlled this cost shifting. Moreover, Taiwan instituted several other payment measures to achieve savings. First, the BNHI introduced a reasonable volume standard for outpatient visit coupled with a sliding fee schedule for visits above the volume standard. This measure discouraged induced demand and reduced the number of visits per person.²⁴ Then, a type of diagnosis-related group (DRG) payment system was phased in for the fifty most common diseases and treatments; this system reduced the average length-of-stay in hospitals. In recent years the BNHI reduced the high profit margin that clinics and hospitals can obtain from dispensing drugs by reducing the reimbursement rates for drugs and by using reference pricing. These measures reduced the NHI’s expenditures. At the same time, the BNHI also encourages the use of generic drugs. In addition, Taiwan also moved to set up separate global budgets for dental services, Chinese medicine, and office visits at clinics. In 2002 Taiwan created a separate global budget for hospital outpatient and inpatient services. It is too early to assess the effects of these global budgets.

On the demand side, the NHI took several measures to control the demand for selected types of health care. For example, it increased copayments for high users of drugs and rehabilitation services. In 2002 it also increased the copayment for outpatient services delivered by medical centers and regional hospitals.

■ **International spending comparisons.** For international comparison, Exhibit 3 shows national health spending as a percentage of gross domestic product (GDP) for selected countries. Taiwan spends a relatively smaller share of its GDP for health among the advanced economies, even after the NHI’s introduction. The crude health status of the Taiwanese people, measured by the infant mortality rate and life expectancy, compares relatively well with those of other advanced nations. Of course, these health outcomes are influenced by many other factors besides health services and how much a nation spends on health.

■ **Public satisfaction.** To monitor the NHI’s implementation and operations, the

EXHIBIT 3

Health Spending And Health Status Indicators In Selected OECD Countries, 1999

Country	Total health spending as percent of GDP	Total health spending per person (US\$ PPP)	Life expectancy at birth (years)	Infant mortality rate (deaths per 1,000 live births)
Taiwan	6.0%	\$ 686	74.9	6.5
Japan	7.4	1,852	80.6	3.4
Democratic Republic of Korea	5.6	758	75.5	7.7
Canada	9.2	2,616	79.0	5.3
Germany	10.7	2,428	77.8	4.5
United Kingdom	7.1	1,666	77.4	5.8
United States	13.0	4,373	76.7	7.1

SOURCE: Organization for Economic Cooperation and Development, *OECD Health Data 2002* (Paris: OECD, 2002); and J.R. Lu and W.C. Hsiao, "Development of Taiwan's National Health Account," *Taiwan Economic Review* 29, no. 4 (2001): 547-576.

NOTES: GDP is gross domestic product. US\$ based on exchange rates for Taiwan.

Taiwanese government has taken regular polls to gauge public satisfaction with the NHI program. In the first several months of implementation, the public satisfaction rate was low, around 40 percent, but it rose to 60 percent a year later. Since then it has fluctuated between 64 percent and 71 percent, so that the NHI enjoys the status of being Taiwan's most favored public program.

■ **Political theater.** Three years after its birth, Taiwan's NHI began to anticipate fiscal difficulties. This was predictable, and the reasons were simple. While the NHI had successfully managed the health spending increases, its revenue base, from which its revenues were derived, was not keeping pace with increases in national income. Because the earnings base was capped, it was growing more slowly than national income. Meanwhile, throughout the world, increases in medical costs caused by aging populations and new medical technology were demanding that a higher percentage of national income be used to fund health care. Any health care financing approach that relies on the current national income (or payroll) as a base to fund the program will have to raise its contribution rates periodically, as the U.S. Medicare program has had to do. Capping the earnings base only exacerbates the problem for Taiwan and will require more frequent rises in the contribution rate.

To raise the contribution rate, the government had to mobilize public opinion and support. Political theater ensued. The Taiwanese government hoped to sound the alarm early so that actions could be taken before the financial problem became a crisis (similar to what had been done for the U.S. Medicare program). In doing so, the government had to magnify the problem to gain public attention. Political opponents seized this opportunity to criticize the government. Since the public usually has a high degree of interest in the NHI, because it touches everyone's lives, many politicians would like to use the NHI as a platform to gain public notice. Every real or imagined weakness of the NHI was exposed and debated. Any charges against it were newsworthy; unfounded criticisms often made the headlines. Blame was laid on the government, patients, hospitals, physicians, and pharma-

ceutical companies. This uninformed and unreasoned debate confused the public. Nonetheless, the NHI's public satisfaction ratings remained high, because people's own experiences with the program remained positive. Only very recently (more than seven years after the NHI's implementation), the program began to run an actual deficit, and the government was forced to raise the contribution rate from 4.25 percent to 4.55 percent in 2002.²⁵

Major Lessons

Taiwan offers an opportunity to study how an advanced economy can structure its health care system to advance societal goals. Taiwan learned from worldwide experience that while the free market can often produce products and goods efficiently, it is incapable of distributing the goods equitably because the income and wealth of households are not distributed equitably. Moreover, the health insurance market suffers major market failures from adverse selection and risk selection. When a society is seriously concerned about its people having equitable access to care and about pooling health risks efficiently, the free market is not a good choice. Evidence from the United States amply supports this conclusion also.

Taiwan established a compulsory national health insurance program that provided universal coverage and a comprehensive benefit package to all of its residents. Besides providing more equal access to health care and financial risk protection, the single-payer NHI also provides tools to manage health spending increases. Our data show that Taiwan was able to adopt the NHI without using measurably more resources than what it would have spent without the program. It seems that the additional resources that had to be spent to cover the uninsured were largely offset by the savings resulting from reduced overcharges, duplication and overuse of health services and tests, transaction costs, and other costs. The total increase in national health spending between 1995 and 2000 was not more than the amount that Taiwan would have spent, based on historical trends.

Additionally, Taiwan did not experience any reported increase in queues or waiting time under the NHI. Meanwhile, the government has taken regular public opinion polls every three months to gauge the public's satisfaction with the NHI. It continuously enjoys a public satisfaction rate of around 70 percent, one of the highest for Taiwanese public programs.

One notable result that should interest Americans is that Taiwan's universal insurance single-payer system greatly reduced transaction costs and also offered the information and tools to manage health care costs. Alex Preker, a leading health economist at the World Bank, came to a similar conclusion from his research of OECD countries. He concluded that universal health care led to cost containment, not cost explosion.²⁶ Equally important, a single-payer system can gather comprehensive information on patients and providers, which can be used to monitor and improve clinical quality and health outcomes.

The Taiwanese experience and practices have limited value for less developed

nations. Taiwan's economy has advanced to a stage where most workers were employed in the formal sector, so a compulsory NHI can effectively collect premiums through employers. The government also has the revenue to subsidize the coverage of the poor, veterans, and farmers. Taiwan also has the organizational ability and human resources to manage a national health insurance scheme. Most developing nations do not; these nations cannot adopt the models of advanced nations.

Nonetheless, there is room for the Taiwanese NHI to improve. There is little government or professional self-regulation of the clinical quality of medicine or use of drugs. Competition in health services delivery has not yielded any measurable improvement in quality of care. On the payment side, Taiwan's fee-for-service payment method encourages more visits and rehabilitation services and overuse of drugs. Its irrational payment rates favor "higher" class of facilities and encourage hospitals to "upgrade" to a higher class by increasing their beds and high-tech medical capacity. Moreover, the payment rates seem to favor certain specialties. The profitability of performing routine visits motivates the medical centers to continuously expand their outpatient clinics for primary care.

AS THE UNITED STATES EMBARKS ON A DEBATE about its health policy and the development of a better health care system, international experience can be instructive and important. Taiwan, the latest advanced economy to have adopted an NHI program, developed its program using the most current experiences from countries around the world. Perhaps the United States can do the same.

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NOTES

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2. Department of Health, *Health and Vital Statistics, Republic of China 2001* (Taipei: DoH, 2001), Table 46.
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11. National Health Research Institute, Task Force on National Health Insurance Assessment, *The Equity of Taiwan's National Health Insurance, Technical Report* (Taipei: NHRI, February 2001).
 12. In 1999 the government, the hospitals, and the medical associations agreed to establish the nonprofit Taiwan Joint Commission on Hospital Accreditation (TJCHA), which regularly accredits hospitals to assure quality of care. Over recent years the TJCHA has gradually modified the indicators for accreditation, which range from hospital staffing ratios (structure aspect) to readmission rate (outcome aspect). The contents and format of medical records are also evaluated. The TJCHA announces that a hospital has passed the accreditation process, but details are not released. In other words, there is no publicly available information regarding quality of care for institutional providers or for individual clinics.
 13. The Department of Health conducts regular public polls to assess the public's satisfaction with the NHI. Periodically, these polls will include questions pertaining to waiting time. DoH, *Reports on Public Satisfaction, 1996-2000* (Taipei: DoH, 2000).
 14. World Health Organization, *World Health Report 2000, Health System: Improving Performance* (Geneva: WHO, 2000).
 15. A. Wagstaff, "Reflections on and Alternatives to WHO's Fairness of Financial Contribution Index," *Health Economics* (February 2001): 103-115.
 16. The authors calculated Taiwan's score using Taiwanese government surveys of income and spending. Scores for other countries came from WHO, *World Health Report 2000*. The WHO method lacks the precision to make the absolute value of the score to be meaningful. The score can only indicate the changes over time for a country and identify to which quintile a country belongs compared with other countries.
 17. R.H. Arnett et al., "Projections of Health Care Spending to 1990," *Health Care Financing Review* (Spring 1986): 1-36.
 18. National health spending data have been compiled by the Taiwan DoH since 1991. Based on OECD methods and DoH statistics, we have identified bias in the national health spending estimates. The major problems stem from omission of household payments for commercial health insurance and lack of an adjustment for the underreporting of out-of-pocket expenses in household surveys. Adopting the OECD method, we have previously reconstructed national health spending data from 1992 to 2000. Data on spending for private insurance came from the reports of commercial insurance companies, and data on out-of-pocket spending were validated and adjusted by comparing government statistics with the survey data. Nonetheless, as with any national health expenditure compilation, they are approximate estimates. See Lu and Hsiao, "Development of Taiwan's National Health Account."
 19. We calculated the residual by a formula that included the following factors: changes in input factor prices (wage rate, prices of supplies, and drug prices), proxied by GDP deflator; change in real income, proxied by changes in GDP per capita in real terms; income elasticity of demand for health care; national health expenditures at given points in time; and change in health status, such as aging and epidemics. Income elasticity was set to be 0.8, the value estimated using the OECD data by W.C. Hsiao and W. Yip, "Health System Structures and Their Impacts on Costs: An Econometric Study," Harvard Working Paper (Cambridge, Mass.: Harvard School of Public Health, 2002). The formula is available on request from the authors; send e-mail to Bill Hsiao at hsiao@hsph.harvard.edu.
 20. Hsiao et al., "Health Care Financing and Delivery in the ROC."
 21. This rate of increase indicates an approximate price elasticity of demand between 0.25 and 0.35 for those who were not insured before the NHI, estimated crudely based on their age- and sex-adjusted utilization rates before the NHI and their utilization rates after being insured. Our estimation did not control for income and other socioeconomic and health status variables.
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 24. Interview with Jen-Chuan Yeh, president and CEO, BNHI (1995-1998), Taiwan, 14 January 2003.
 25. In the National Health Insurance Act, the government did not put a schedule of automatic contribution rate increases into the law.
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