The Effect of Universal Health Insurance on Health Care Utilization in Taiwan

Results From a Natural Experiment

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Context.—The government of Taiwan introduced universal health insurance to cover all citizens in 1995. This national health insurance program was proposed to assure the accessibility to health care at reasonable cost. Evaluation of the consequences, including health care utilization and expenditure, is crucial for policy adjustment.

Objectives.—To evaluate the effect of Taiwan's national health insurance on health care utilization.

Design.—Cohort survey conducted before and after the implementation of the national health insurance program.

Participants.—A total of 1021 randomly selected Taiwanese adults.

Main Outcome Measures.—Physician visits in the 2 weeks prior to the survey and hospital admissions and emergency department visits in the immediate past year.

Results.—After the introduction of universal health insurance, the newly insured consumed more than twice the amount of outpatient physician visits (0.21 vs 0.48, $P<.05$) and hospital admissions (0.04 vs 0.11, $P<.05$) than before universal health insurance was implemented, bringing them to the same amount of health care contacts as the previously insured group. The newly insured also experienced an insignificant increase in emergency department visits. In contrast, the previously insured group had a small but statistically significant increase in outpatient visits (0.48 vs 0.59, $P<.05$) and insignificant changes in hospital admissions and emergency department visits.

Conclusion.—The universal health insurance removed some barriers to health care for those newly insured. The copayment design in the insurance scheme seemed to have an insignificant effect on curbing medical care utilization. Taiwanese health policy analysts should seriously consider the growth of health care expenditures since the implementation of universal health insurance.

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LIKE MANY industrialized countries, the demand for universal access to health care in Taiwan led to the introduction of a national health insurance program in 1995. The government of Taiwan consolidated all of its social insurance programs and launched the national health insurance program on March 1, 1995, to cover the entire civilian population.

Levels of health care utilization are determined by many factors. As summarized in the expanded behavior model by Aday and Andersen,[1] need characteristics (such as illness severity), enabling factors (such as insurance coverage and family income), and predisposition features (such as age and sex), are the 3 major components affecting health care utilization. The effect of insurance in increasing the use of health care services has been investigated intensively and well documented.[2-9] However, the effects of health insurance have rarely been examined systematically in natural experiments on large-scale populations. The impact of 2 well-known universal health systems have been previously evaluated. The introduction of the National Health Service in England and Wales showed a small increase in physician utilization (less than 20%) among lower-income groups and among populations that were previously uninsured.[10] The introduction of Medicare in Quebec led to a shift in physician visits from persons in higher-income to those in lower-income groups. However, the overall number of physician visits per person remained constant at about 5 times per year.[11,12] The Quebec Medicare program also prolonged the waiting time for a physician's appointment and waiting time in a physician's office.

In a previous Letter From Taipei, Peabody et al[13] reported that Taiwan's market-based health system reform encountered 2 major problems: access to care and rising costs of health services. Herein, we describe the implementation of universal health insurance in Taiwan and report on health care utilization by a cohort of adults before and after the introduction of universal health insurance. This report focuses on Taiwanese adults older than 20 years. The influence on children's medical utilization is not included in this report. We examine changes in health care usage among the previously insured and previously uninsured.

HEALTH CARE SERVICES IN TAIWAN BEFORE 1995

By the end of 1994, before the implementation of national health insurance, Taiwan had a population of nearly 21 million people, with about 24 450 physicians practicing Western medi-

cine in 719 hospitals and 8511 clinics. In addition, there were 2833 Chinese doctors practicing in nearly 2000 Chinese medicine hospitals and clinics.[14] (The use of Chinese medicine was not included in this report.) At that time, approximately 76 300 acute beds were available with 36 beds per 10 000 people. In all of the hospitals, physicians were hired as full-time employees and most of them were paid salaries plus a performance bonus. Approximately 62.8% of physicians worked in hospitals and 32% worked in clinics. The nationwide hospital occupancy rate was 73.1% in 1994.[14] Each of the hospitals had a large outpatient department. Most of the private physicians were self-employed and completely independent of hospitals.

In addition to the pharmacists working in hospitals, there were 15 329 dispensary or drug stores owned or operated by pharmacists.[14] On average, each person in Taiwan visited a physician 11 times per year, was admitted to a hospital once per year, and consumed nonprescription medications for 17 days per year in 1994.[15]

Average household income was about US $21 480 per year (US $1 is equal to 27 New Taiwan [NT] dollars).[16] The per capita health expenditure was about US $560, and the national health expenditure was 4.99% of the gross domestic product in 1994.[14]

Health Insurance

Three major social health insurance schemes existed in Taiwan before the implementation of national health insurance in March 1995: labor insurance for private sector employees; government employees' insurance for all government employees, retirees, and their family members; and farmers' health insurance for all farmers. Those programs covered approximately 57% of the total 1994 population and 78.3% of adults (older than 20 years) in Taiwan.[17,18] Children, students, women not employed outside the home, and the elderly were the main components of the uninsured population. In other words, before the implementation of universal health insurance, 43% of Taiwanese citizens were uninsured. (Military personnel who received health care from military hospitals were not covered by social health insurance, nor are they covered by the national health insurance program.)

All of the social insurance programs provided a similar range of benefits, including outpatient visits, hospital inpatient care, and prescription drugs. Approximately 85% of hospitals and 70% of clinics were contracted with the social insurance schemes in 1994.[19] A detailed description of premiums, payment to hospitals and clinics, and health care delivery systems for the 3 social insurance programs was reported by Peabody et al.[13]

To ensure the prompt availability of universal coverage, the government of Taiwan made contingent arrangements to commence immediately after the launching of national health insurance. For example, beginning on March 1, 1995, all labor insurance–contracted facilities were transferred automatically to hospitals and clinics contracted with the national health insurance program. Health insurance cards were distributed to beneficiaries in about 2 months. Individuals who did not receive a health insurance card at that time could use their national identification card as a substitute and obtain health care from the contracted hospitals and clinics. After the compulsory universal health insurance was implemented, the Bureau of National Health Insurance became the sole buyer of health services. Two years later, in 1997, the proportion of contracted institutions increased to about 96.5% of hospitals and 89.5% of clinics.[20]

Insurance coverage was similar to the original programs with some expansion for severe illnesses and home health care. For the current national health insurance plan, 2 levels of co-payment schemes were set for outpatient visits: NT $50 for a visit to clinic physicians (private practitioners) or a referred visit to specialists (hospital physicians); NT $100 for an unreferred visit to specialists. Physicians usually charged a registration fee, ranging from NT $50 to $100 for each visit. Therefore, patients generally paid NT $100 to $200 (out of pocket) for a physician visit. There was a 10% co-payment for inpatient services. (Patients usually were hospitalized through the outpatient department or emergency department at the same hospital.)

METHODS

Samples

Initial Survey.—Data for this study came from 2 surveys of a cohort before and after the implementation of universal health insurance (launched on March 1, 1995) in Taiwan. The first survey (the 1994 Taiwan Health Interview Survey) was conducted during October and December in 1994.[15] The survey sought to obtain a nationally representative sample of households in Taiwan by using a 3-stage, stratified random sampling with probability proportional to size. Township was the primary sampling unit. At the first stage, all of the 359 townships in Taiwan were divided into 10 strata according to the administrative structure and level of socioeconomic development, and 58 townships were selected. The secondary sampling unit was *tsun/li* (ie, a village). At the second stage, 149 *tsun/lis* from the selected townships were drawn. Finally, 3814 households, the ultimate sampling unit, were selected from the 149 *tsun/lis*.

A total of 3119 (81.1%) of the 3814 households responded to the interview. All members who lived in the selected household were the subjects of the interview. Information was gathered by a structured questionnaire that included household socioeconomic indicators; demographic characteristics; and self-described health status, health care spending, health behavior, and mental well-being. Questionnaires for persons who were unable to answer the questions were completed by close relatives. A total of 11 925 persons (with 7729 adults older than 20 years) were interviewed.

Follow-up Survey.—A follow-up telephone interview was conducted in December 1995 on a subsample of adults randomly selected from the original 7729 persons. After setting a target sample size of 1000 participants, 1000 subjects and 2000 alternates were selected for the telephone interview by using the random selection function in the SAS package.[21] Telephone numbers were obtained from the 1994 data file; 14 of the selected individuals did not have a telephone and were deleted. (Approximately 96.7% of all households in Taiwan had telephones in 1995.[22])

The follow-up telephone interview was conducted with a short questionnaire that focused only on health care utilization, spending, and self-described health status by using selected subsets of questions asked in the original interview. A shorter questionnaire, taking about 5 to 6 minutes to complete, was used to ensure subjects' willingness to respond. Identical questions were included to enhance comparability between results of the 2 surveys.

About 67% of the 1000 selected subjects responded to the interview; the nonrespondents were replaced with alternates, and the final number of follow-up interviews totaled 1021 subjects. All analyses reported here are based on the information from this subsample before and after national health insurance was introduced.

Health Care Utilization Measures

Three types of health care services were analyzed: physician visits, emergency department services, and inpatient services. Measurement of health care utilization included 2 parts: (1) the number of physician visits conducted the 2 weeks before the interviews; and (2) the number of hospital admissions and the number of emergency department visits made during the previous year for the initial survey and in the past 9 months since national health insurance began for the follow-up interview. Compared with physicians trained in Western medicine, traditional Chinese doctors did not provide emergency services, and they provided little inpatient care to those surveyed. To obtain consistent estimates of physician visits, hospital admissions, and emergency services, this study excluded the use of Chinese medicine, which was listed separately in the survey questionnaires. Data on utilization during the 9-month follow-up period in the second survey were then converted into 1-year data to compare with data from the initial survey.

Statistical Analysis

To examine the statistical significance of the changes in health care utilization before and after the implementation of universal health insurance, tests for repeated measures were employed. McNemar χ^2 tests were performed for variables representing rates of utilization; paired t tests were used for variables representing the amount of utilization. Those tests were carried out for the previously insured group and the newly insured group, respectively, rather than for a comparison of the changes between the 2 groups. Because there were fewer subjects in the newly insured group (177 persons) compared with those previously insured (844), statistical inferences from the analyses should be interpreted with caution.

RESULTS

The cohort subsample was 53% male with a mean age of 43 years. Seventy-seven percent of the 1021 subjects were married, and 16% were single. The average length of education for these individuals was 9 years. Approximately 83% of the individuals were covered by 1 of the 3 social insurance programs before the universal health insurance. (The higher rate is due to the exclusion of people younger than 20 years in this cohort.) A comparison of the demographic characteristics of the subsample with the 1994 sample yielded 2 different features. The participants in the subsample were older and more likely to be married (Table 1). Although these differences were small, caution is recommended when interpreting these findings. A comparison of the characteristics of the previously insured with that of the previously uninsured revealed several differences: the previously uninsured group tended to have fewer males, to be older, less likely to be married, and less educated (Table 1).

Table 2 summarizes health care utilization among persons in this cohort before and after the universal insurance. To explore the impact of national health insurance on health care utilization among those newly insured (ie, previously uninsured), we consider the "previously insured" as a comparison group in the analysis. Before national health insurance implementation, health care utilization among those previously insured is notably higher than that of the previously uninsured (indicated as "newly insured" in Table 2). For example, the likelihood of seeing a physician in the previous 2 weeks was 27.3% for the insured compared with 14.7% for the uninsured.

Table 1.—Distribution of Basic Demographic Variables for Study Samples by Their Insurance Status Before the National Health Insurance Was Implemented in Taiwan (1994)*

Characteristics	Entire Sample	Subsample for Follow-up		
		Total	Insured	Uninsured
No. of subjects (% male)	7729 (50.9)	1021 (52.9)	844 (53.3)	177 (51.4)
Age, y†				
20-39	50.6	40.9	41.2	39.2
40-59	31.8	38.3	40.8	26.7
≥60	17.6	20.8	18.0	34.1
Marital status†				
Single	19.6	15.8	14.6	21.6
Married	71.0	76.8	79.2	65.3
Other	9.4	7.4	6.2	13.1
Education				
Primary or less	37.9	38.1	37.2	42.2
High school	42.6	43.7	44.2	41.2
College or higher	19.5	18.2	18.6	16.4
Insurance	80.9	82.7	...	...

*All values are percentages, except as indicated.
†$P<.001$, based on χ^2 test for the distribution between the entire sample and the subsample.

The likelihood of using hospital inpatient services was 11.6% for the insured and 4.0% for the uninsured. Utilization of emergency department services reflects a similar pattern. The number of physician visits in the previous 2-week period for the insured was more than twice that for the uninsured (0.480 vs 0.209). Hospital admissions and emergency department services appear to share the same pattern.

After universal health insurance was implemented, the likelihood of visiting a physician in the 2 weeks prior to the interview increased by almost 70% (from 14.7% to 24.9%, $P< .05$) for the newly insured persons, compared with an insignificant 8% increase for the previously insured group. The likelihood of using other medical services during the previous year also increased for the newly insured: the likelihood of being admitted to hospitals increased from 4.0% to 9.8% ($P<.05$), and utilization of emergency services increased by about 90% (from 5.6% to 10.6% 1 year after national health insurance was implemented. In contrast, the changes in the previously insured were relatively small and not statistically significant, with an 8.6% decrease in hospital admissions and a 7.4% increase in emergency services.

Finally, medical services consumption was examined. The average number of physician visits in the previous 2 weeks per 100 newly insured persons substantially increased from 20.9 to 48.0 visits (a 129% increase, $P<.01$). The number of physician visits in the 2-week period per 100 previously insured persons was 48.0 vs 59.4 visits (a 23% increase, $P<.05$). The mean numbers of hospital admissions and emergency services used during the previous year were more than double per 100 newly insured persons, from 4.0 to 11.3 and 5.1 to 11.4. However, for each 100 previously insured persons, the number of hospital admissions decreased slightly from 12.5 to 10.3, and the number of insured persons using emergency services changed slightly from 10.6 to 11.1. These changes did not reach the level of statistical significance.

Because a self-perceived "need" factor is a major determinant of medical care utilization, we examined the changes in respondents' self-described health status. Two indicators, perceived health in general and "unwellness" in the 2 weeks before the survey was conducted, are shown in Table 3. For those insured before the national health insurance program was implemented, respondents reported changes in health status:

Table 2.—Rate and Amount of Medical Care Utilization* Before and After the National Health Insurance Was Implemented by Previous Insurance Status in Taiwan in 1995

Services	Previously Insured (n=844)		Newly Insured (n=177)	
	Before	After	Before	After
Rate, %				
Physician visits	27.3	29.5	14.7	24.9†
Hospital admissions	11.6	10.6	4.0	9.8†
Emergency services	9.4	10.1	5.6	10.6
No. of visits, mean (SE)				
Physician visits	0.480 (0.034)	0.594 (0.045)†	0.209 (0.006)	0.480 (0.078)†
Hospital admissions	0.125 (0.013)	0.103 (0.013)	0.040 (0.015)	0.113 (0.032)†
Emergency services	0.106 (0.012)	0.111 (0.015)	0.051 (0.018)	0.114 (0.032)

*Time period for physician visits was 2 weeks prior to the interview and 1 year for other medical services.
†$P<.05$.
‡$P<.01$ based on the McNemar χ^2 test and paired t test on the changes before and after the national health insurance was implemented.

Table 3.—Self-described Health Status Before and After the National Health Insurance Was Implemented in Taiwan in 1995*

Health Status	Previously Insured (n=844)		Newly Insured (n=177)	
	Before	After	Before	After
Perceived health				
Good	48.5	49.6	50.3	52.8
Fair	40.0	39.0	41.2	34.7
Poor	11.5	11.4	8.5	12.5
Illness in 2 wk				
Often	11.0	12.6	8.5	11.9
Seldom	24.1	26.7	27.1	24.9
Never	64.9	60.7	64.4	63.3

*No statistical difference was observed within each group based on the McNemar χ^2 tests for the changes before and after the National Health Insurance was implemented.

about half of those previously insured reported being in good health and about 11.5% of them reported being in poor health. There was a slightly greater change in the newly insured group. The proportions of good and poor health increased from 50.3% to 52.8% and 8.5% to 12.5%, respectively. The percentage of respondents reporting that their health was fair decreased from 41.4% to 34.7%. However, these changes were not statistically significant.

For illness in the 2 weeks prior to the interview, we found that the proportion of respondents who reported feeling "unwell" increased in both groups, with 11% to 12.6% for the previously insured and 8.5% to 11.9% for the newly insured (both increases were statistically significant). The percentage who reported not feeling unwell decreased only slightly. Generally speaking, no evidence of a major health-related event (such as an epidemic outbreak) was observed during the time periods surveyed.[23]

COMMENT

Out-of-Pocket Payments and Co-payments

The major purposes of universal health insurance are to remove the financial barrier to care and enhance accessibility to comprehensive health care for all citizens in Taiwan. The out-of-pocket price before and after the universal insurance differs notably. For example, in 1994 insured persons paid only US $2.70 (NT $73) as co-payment for an outpatient visit, while the uninsured paid full price—US $15.80 (NT $427). After the implementation of universal health insurance, the average co-payment was US $4.90 (NT $132) for a physician visit. For those previously insured, the out-of-pocket price increased by about 80%. On the other hand, the price for the newly insured decreased markedly to less than one third of the original price. We believe that the sharp reduction of the out-of-pocket price for the newly insured is the primary reason for a more than 2-fold increase in using medical care services.

Although the out-of-pocket payment for the previously insured individuals increased by 80%, the previously insured had 23% more physician visits after the implementation of universal health insurance. Several factors could explain this increase: (1) The need for medical care had risen during the second interview period; (2) the expansion of contracted institutions might have increased the accessibility to medical care and resulted in more visits; and (3) the relatively inexpensive cost sharing had an insignificant effect on curbing the use of medical care. These explanations may also account for the increased utilization among the newly insured to some degree.

Number of Physician Visits

Income is positively related to health care expenditure as well as medical care consumption.[5,7,24-26] The influence of a universal health insurance program on medical care utilization may differ among income groups.[10-12] After examining the changes in per capita physician visits, we found that persons in the top quarter of household income had the smallest increase (11%, from 0.37 to 0.41). The increase in physician visits for people in the middle-income group was 47% (from 0.43 to 0.63), and that for the lowest quarter was 31% (from 0.51 to 0.67). In Taiwan, the number of overall physician visits per person increased after the implementation of universal insurance with the higher income individuals having less increase and consuming less physician visits than the others.

The high number of per capita physician visits in Taiwan is worth mentioning. The average number of physician visits for the general population was about 10 to 12 per year in 1994.[15] Not surprisingly, the average time for each physician contact was only about 5 minutes. In the follow-up survey, the average length of time a physician spent with a patient increased from 5.8 minutes in 1994 to 7.7 minutes in 1995. The number of private practitioners (in clinics) increased each year during 1990 through 1994, with the increase rates ranging from 4.4% to 6.3% annually. Notably, the increase rate after universal insurance was implemented was 10.0% between 1994 and 1995.[27] The national health insurance program increased the payment scheme to primary care clinics from an average of US $9.40 to US $11.50 per patient visit (a 22% raise), which might contribute to the increase in the number of private physicians.[27]

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(n=177)

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Patients' Perception of Quality

In addition, the appointment system for outpatient service is not widely used in Taiwan. Most of the patients may visit physicians whenever they wish. Therefore, long waiting times at clinics or in physicians' offices are common. However, waiting times decreased from 37 minutes to 31 minutes after the implementation of universal health insurance.

Has patient-perceived medical care quality improved or worsened after universal insurance? Seventy-eight percent of the sample reported that the quality was unchanged, 14% reported that quality had declined, and 8% reported receiving better care.

In addition, the increase in physician visits had reduced the self-prescribed pharmacy visits among the newly insured individuals. After universal health insurance began, the likelihood of visiting a pharmacy decreased from 19.2% to 14.7% among the newly insured, while the figures remained almost unchanged for the previously insured (13.2% in 1994 and 13.6% in 1995).

National Health Care Service Expenditures

The total expenditure on health in Taiwan was US $11.78 billion in 1994, while the social insurance programs accounted for 40.7% (US $4.8 billion) of the total health care expenditure.[14] In 1995, the total expenditure on health was US $13.36 billion; social insurance programs (including the national health insurance) accounted for 54.1% (US $7.23 billion) of the total. The national health insurance program made US $6.04 billion in payments to all contracted institutions in its first 10 months of operation and balanced its budget in the first year.[27] The total health expenditure consisted of 3 parts: (1) government sector for health administration, public hospitals, and public health tasks; (2) the insurance sector for 3 social insurance programs before the implementation of universal health insurance (ie, January and February 1995) and the national health insurance program; and (3) the private sector for household health-related expenditures. In 1995, the insurance sector accounted for US $7.23 billion (54.1% of the total health expenditure); US $6.04 billion was designated for the universal health insurance for its first 10 months, and the rest was for the 3 social insurance programs for the first 2 months of 1995. Between 1994 and 1995, overall health care expenditures increased by 13.4% (US $11.8 billion vs US $13.4 billion). However, the rate of increase for Taiwan's gross domestic product was only about 8.1%[27] (US $236.2 billion in 1994 vs US $255.3 billion in 1995). The government is understandably concerned about these figures.

CONCLUSION

Within the first year after the implementation of national health insurance in Taiwan, we observed increases in health care utilization for those newly insured. Those previously insured had a small decrease in hospital admissions, but they also had more outpatient visits, even though the co-payments increased by 80%. Relatively inexpensive cost sharing in the national health insurance program might explain the insignificant effect on curbing the use of physician services. Are the changes in health care utilization after the implementation of universal health insurance a shock effect or will they be long lasting? This question must be answered by a large-scale study with a longer period of follow-up.

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1. Aday LA, Andersen RM. A framework for the study of access to medical care. *Health Serv Res.* 1974;9:208-220.
2. Manning WG, Newhouse JP, Duan N, Keeler EB, Leibowitz A, Marquis MS. Health insurance and the demand for medical care: evidence from a random experiment. *Am Econ Rev.* 1987;77:251-277.
3. Hanh B. Health care utilization: the effect of extending insurance to adults on Medicaid or uninsured. *Med Care.* 1994;32:227-239.
4. Trevino FM, Moyer ME, Valdez RB, Stroup-Benham CA. Health insurance coverage and utilization of health services by Mexican Americans, mainland Puerto Ricans, and Cuban Americans. *JAMA.* 1991;265:233-237.
5. Hafner-Eaton C. Physician utilization disparities between the uninsured and insured: comparison of the chronically ill, acutely ill, and well nonelderly populations. *JAMA.* 1993;269:787-792.
6. Davis K. Inequality and access to health care. *Milbank Q.* 1991;69:253-273.
7. Saver BG, Peterfreund N. Insurance, income, and access to ambulatory care in King County, Washington. *Am J Public Health.* 1993;83:1583-1588.
8. Muller C. Review of twenty years of research on medical care utilization. *Health Serv Res.* 1986;21:129-144.
9. Frank RG, McGuire TG. A review of studies of the impact of insurance on the demand and utilization of specialty mental health services. *Health Serv Res.* 1986;21:241-265.
10. Stewart WH, Enterline D. Effects of the National Health Service on physician utilization and health in England and Wales. *N Engl J Med.* 1961;265:1187-1194.
11. Enterline PE, Salter V, McDonald AD, McDonald JC. The distribution of medical services before and after 'free' medical care: the Quebec experience. *N Engl J Med.* 1973;289:1174-1178.
12. Enterline PE, McDonald JC, McDonald AD, Davignon L, Salter V. Effect of 'free' medical care on medical practice: the Quebec experience. *N Engl J Med.* 1973;288:1152-1155.
13. Peabody JW, Yu JC-I, Wang Y-R, Bickel SR. Health system reform in the Republic of China: formulating policy in a market-based health system. *JAMA.* 1995;273:777-781.
14. Department of Health. *Health and Vital Statistics, I: General Health Statistics, 1994: Republic of China.* Taipei, Taiwan: Department of Health, the Executive Yuan; September 1995:48, 49, 234-236, 338, 518.
15. Chiang TL, Chang MC, Hong YT. *The 1994 Taiwan Health Interview Survey.* Taipei, Taiwan: Department of Health, the Executive Yuan; December 1995. Final report.
16. Department of Budget, Accounting and Statistics. *Report on the Survey of Family Income and Expenditure, Taiwan Province, Republic of China.* Taichung, Taiwan: Department of Budget, Accounting & Statistics, Taiwan Provincial Government; 1995.
17. Wu KS. Social health insurance in Taiwan: a review. In: Yaung CL, ed. *Health Insurance.* 2nd ed. Taipei, Taiwan: Chu-Liu Book Co; 1996:177-186.
18. Central Trust of China. *Statistical Data for Government Employees' Insurance, Republic of China.* Taipei, Taiwan: Central Trust of China; 1995:474.
19. Bureau of Labor Insurance. *Statistical Data for Taiwan-Fukien–Area Labor Insurance, Republic of China.* Taipei, Taiwan: Bureau of Labor Insurance for Taiwan-Fukien Area; 1995:372-375.
20. Department of Health. *The First Two Years Evaluation Report on National Health Insurance.* Taipei, Taiwan: Department of Health, the Executive Yuan; 1997:102.
21. SAS Institute. *SAS Language Guide for Personal Computers, Version 6.03.* Cary, NC: SAS Institute Inc; 1988:92.
22. Directorate-General of Budget, Accounting and Statistics. *Social Indicators in Taiwan Area of the Republic of China, 1995.* Taipei, Taiwan: Directorate-General of Budget, Accounting and Statistics, the Executive Yuan; 1996:46.
23. Department of Health. *Statistics of Communicable Diseases, Taiwan Area, 1995.* Taipei, Taiwan: National Quarantine Service, Department of Health, the Executive Yuan; October 1996.
24. Cunningham PJ, Cornelius LJ. Access to ambulatory care for American Indians and Alaska natives: the relative importance of personal and community resources. *Soc Sci Med.* 1995;40:393-407.
25. Freeman HE. Insurance status and access to health services among poor persons. *Health Serv Res.* 1993;28:531-541.
26. Moore WJ, Newman RJ, Fheili M. Measuring the relationship between income and NHEs. *Health Care Financ Rev.* 1992;14:133-139.
27. Department of Health. *Health and Vital Statistics, I: General Health Statistics, 1995: Republic of China.* Taipei, Taiwan: Department of Health, the Executive Yuan; September 1996:44, 45.