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Removing the Instability and Inequity in the Japanese Health Insurance System

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4.1 Introduction

Japan's current public medical insurance can be compared to an unstable two-story building whose second floor is becoming heavier each day while its first floor is losing strength. There are three pillars in the first floor that support the weight of the whole building. The first of the three consists of insurance programs that cover the health care costs of employees and their dependents. These include health insurance managed by associations (HIMAs), most of which are firm-specific; health insurance managed by government (HIMG), which is the largest insurance program in Japan; and health insurance for government employees (HIGEs), organized separately for various national government agencies and for municipal government employees. These programs provide uniform medical insurance benefits but collect different premiums from their employees as fixed proportions of their wages or salaries. These premium rates are set individually for each program. Because they collect far more revenue than is necessary to pay for their own benefits, they provide the most important support for the health care costs of the elderly.

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This paper closely follows Chapter 1 of *Iryo Seido Kaikaku*, edited by Seiritsu Ogura and David Wise, published by Nihon Keizai Shimbun in 2002 by the same authors. The original title of Chapter 1 is "Reengineering Japanese Health Insurance System." The second part of the paper was rewritten to reflect the subsequent changes in the health insurance law for the elderly. We would like to express our appreciation for the Project on Intergenerational Equity (PIE) of the Economic Research Institute of Hitotsubashi University, the Toyota Foundation and the Ministry of Education and Science and Technology for a special grant to Hosei University for financial support. We thank Ms. Megumi Fukuda for her help in the translation.

The second pillar consists of the group of national health insurance programs (NHIs), consisting mainly of more than 3,200 municipal programs. They provide health insurance for self-employed workers, the retired, and others who are not covered by employees' programs. They are financially very weak, and their premium revenues amount to only 60 percent of the benefits for these people. They receive generous subsidies from the national and local governments and do not contribute at all to pay for the health care costs of the elderly.

The third pillar consists of all the subsidies from the national and municipal governments. Particularly important are those from the national government, which has been subsidizing half of the NHI's benefits and half of the elderly's health care charges levied on NHIs. The government also subsidizes 13 percent of the expense of the benefits for the HIMG and some of the elderly's health care charges.

The second floor of our building consists of the health care insurance for the elderly, which provides medical care benefits to those over age seventy for very little cost.[1] The insurance program for the elderly does not collect premiums on its own, and the benefits are paid by collecting charges from other primary public insurance programs. Thus, most of the health care costs of the elderly have been shifted to those in the first floor, most notably to the employee health insurance programs and the national government. Under the current system, 70 percent of the health care costs of the elderly (net of their small out-of-pocket costs) are charged to the insurance programs in the first floor, with each insurance program contributing an amount in proportion to the number of its insured individuals and the average health care cost of elderly in the system.[2] Of the remaining 30 percent, the national government contributes 20 percent, and the local governments contribute 10 percent. Moreover, as we have already mentioned, the national government provides very substantial subsidies to HIMG and NHIs to help them pay their contributions to the health insurance for the elderly.

This two-story structure has become very unstable, particularly in the last few years, for two reasons, one cyclical and the other structural. The first reason is the prolonged economic slump Japan has been experiencing for almost a decade now. It has had a large negative effect on the revenues of all the insurance programs in the first floor. The ones hit hardest by the slump are those of the employees; their wage rates and the size of the employment have shown little, if any, growth. The second reason is structural: there has been a rapid increase in the number of individuals who are reach-

1. To be exact, the scheme is for those seventy years of age and over and their families and those sixty-five years of age and over who are bedridden.

2. The actual computation of charges for individual insurance programs is slightly more complicated: it multiplies the amount by the ratio of the average health care cost of the elderly in the program to the national average figure.

ing age seventy and moving from the first floor to the second. With each person moving from the first floor to the second, a very large weight is added to the second floor. The government has tried to control the cost of health care for the elderly through various measures, but the effects seem to last for a relatively short period of time, and soon the medical costs of the elderly have started to increase again.

Given the current two-story system, the bulk of the increase in health care costs of the elderly has been absorbed by increases in employee insurance premiums and budget deficits. Furthermore, employees' out-of-pocket costs have been raised in steps, from 10 percent to 20 percent in 1997, and from 20 percent to 30 percent in 2003 for employees, and from 20 percent to 30 percent for their dependents. These changes have left employees on par with individuals covered by NHIs as far as the out-of-pocket costs are concerned, while making them pay almost twice as much on average in premiums. Similarly, the government has to deal with the swelling need for subsidies and the deepening of the budget deficit amidst a rapid decline in tax revenues.

In the next twenty-five years, Japan's population will age at a faster rate as the baby boomers move beyond age sixty-five. Under the current medical insurance system, the imbalance between benefits and costs will continue to grow over time. With this imbalance, moral hazard and waste will grow in the health care sector, and inequity will intensify the social conflict among generations. These developments may lead to a fundamental reform in Japan's health insurance system.

Our analyses in this paper address the two major weaknesses in our current health insurance system. The first is the insurance of the elderly, or the second floor of our insurance system. We will examine the consequences of the special treatment of the elderly, and we will assert it is difficult to continue to support them. The second weakness is the NHI system. We should remind everyone that the health insurance for the elderly was born out of the huge deficits of the NHI programs and the national government in 1984. Moreover, the national government has been subsidizing 50 percent of the expenses of the municipal NHI programs for over thirty years. This figure signifies that the NHI system has failed to function as an independent insurance system for the working generations. Thus, strengthening the financial base of the NHI as well as improving health insurance for the elderly may improve Japan's medical insurance system.

The remainder of this paper is constructed as follows. In section 4.2, we will show that the burden of medical expense is placed heavily on the employees and the government. In section 4.3, we will explain a set of procedures for simulating the benefits and burdens of medical services, with the household as a unit of analysis. In section 4.4, we will verify the validity of our simulation procedures by comparing the medical expenses and the number of patients derived from our baseline simulation with that of pub-

lished statistics and discuss the results of the simulation. Last, section 4.5 will provide a conclusion and discuss the implications of our work.

4.2 Japan's Medical Care Financing

4.2.1 National Medical Expenditure and Payment Funds

We will first examine the medical expenditures and financial resources of each type of insurance system using the national medical expenditures of fiscal year 1996. For the fiscal year, national medical expenditures were 28.5 trillion yen, of which 1.3 trillion yen was paid directly by the government (as, for example, medical aid to low income families or by other agents). This leaves 27.2 trillion yen of medical expenditures covered by public health insurance. The breakdown of this figure is as follows: 14.5 trillion yen were paid as health insurance benefits for the nonelderly individuals, 9.3 trillion yen as the health insurance benefits for the elderly, and only 3.4 trillion yen were paid by individuals (including the elderly) as their out-of-pocket costs. The government and the health insurance system altogether spent approximately 25 trillion yen. Premiums collected by the insurance programs totaled 16 trillion yen, and subsidies from national and local government totaled 9.7 trillion yen.

We use those figures to calculate the average medical expenditure and insurance premiums per household. First, we divide the total medical expense by the number of households to obtain the average medical expenditure per household: 700,000 yen per year. As shown in table 4.1, the breakdown of the source of payment is as follows: 101,000 yen from the public funds, 516,000 yen from the insurance, and 83,000 yen from the household members themselves. The expense paid by the patients themselves refers to the amount actually paid at the medical institutions—this has an immediate effect on the household budget. The expense paid from public funds and from insurance do not directly strain the household budget but eventually affects it in the form of premiums and taxes. Thus, it is important to illustrate the ways in which the premiums and taxes burden the household.

Table 4.1 shows the results of such analysis. The numbers on the left column represent the amount spent on medical services per household. On the right are their estimated sources, categorized into three groups: premiums, taxes, and budget deficit. First, we obtain the amount of premiums paid per household by dividing the total sum of premiums by the number of households, which equals 392,000 yen.

Next, we estimated how much of the general fiscal revenue from various taxes and public bonds has been allotted to finance medical expenses. The tax revenue allotted is estimated to be 9.1 trillion yen—this figure is obtained by adding all the subsidies provided for the benefits of health insur-

Table 4.1 **Sources and instruments of medical cost (NHCE) payments (in thousands of yen per household)**

	Amount
Sources	
Health insurance programs	516
Government subsidies	101
Out-of-pocket costs	83
All sources	700
Financial instruments	
Insurance premiums	392
All taxes	147
Income tax	57
Corporate tax	40
Consumption tax	18
Other taxes	32
Fiscal deficit	77
Error	1
Out-of-pocket expenses	83
All instruments	700

ance and the charges for the health care for the elderly, paid from the general tax revenue. The estimated figure was computed by the following procedures:

1. The general account revenue from taxes for fiscal year 1996 reached 51.3 trillion yen, while revenue from public bonds was approximately 26 trillion yen. The revenue from taxes will be deemed to have been 49.5 trillion yen (the revenue from the gasoline excise tax, which would be allotted to finance road maintenance, has been subtracted), with the following breakdown: 19 trillion yen as income tax, 13.5 trillion yen as corporate tax, 6 trillion yen as consumption tax, and 8 trillion yen from other taxes.
2. Because the sum of general revenues from taxes and public bonds was 75.5 trillion yen, the public subsidies for health insurance programs amount to approximately 12 percent of these revenues.
3. We multiply this percentage by the revenues from each tax and public bond per household and obtain 57,000 yen as income tax, 40,000 yen as corporate tax, 18,000 yen as consumption tax, and 32,000 yen for other taxes, and 77,000 yen for public bonds. Per household, the subsidies to the health insurance programs were financed with 147,000 yen in taxes and 77,000 yen in bonds, respectively.

Thus, roughly speaking, the 700,000 yen health care costs per household are borne as follows: 392,000 yen as premiums, 147,000 yen as taxes, 77,000 yen as budget deficit and 83,000 yen as out-of-pocket costs. Or, in proportions, the health care cost is financed 56 percent by premiums, 21 percent by taxes, 11 percent by public bonds or budget deficit, and 12 percent from

Table 4.2 **Sources and instruments of medical cost (NHCE) payments (in thousands of yen per household)**

	Amount
Sources	
Health insurance programs	415
Government subsidies	82
Out-of-pocket costs	67
All sources	564
Financial instruments	
Insurance premium	316
All taxes	118
Income tax	46
Corporate tax	32
Consumption tax	14
Other taxes	25
Fiscal deficit	62
Error	1
Out-of-pocket expenses	67
All instruments	564

Notes: Figures exclude cost of dental care. Medical costs equal national medical expenditures minus the costs of dental care and pharmaceuticals dispensed to patients.

out-of-pocket expenses. It must be noted that each year a very significant proportion of health care costs, almost equal to the out-of-pocket costs, is financed with public bonds to be paid by future generations.

In this paper, we conduct various microsimulation[3] analyses of the benefits and burdens of health care costs, using *medical costs,* which equals national medical expenditures minus the costs of dental care and pharmaceuticals dispensed to patients. First, we calculate the expenditures and burdens of medical costs borne by each household as our reference case. According to the national medical expenditures for fiscal year 1996, medical costs accounted for 80 percent of national medical expenditures. Thus, the sources of payments for medical costs were calculated by multiplying this percentage (80 percent) by the numbers listed in table 4.1. As shown in table 4.2, the results are 564,000 yen for medical cost, and the same amount was paid by each household. The breakdown of the cost is as follows: 67,000 yen as out-of-pocket costs, 316,000 yen as premiums, and 118,000 yen as taxes. The tax burden can be further classified into income tax (46,000 yen), corporate tax (32,000 yen), and consumption tax (14,000 yen).

4.2.2 Concentration of Burden on Employees and the National Treasury to Finance the Insurance Scheme for the Elderly

The current insurance scheme for the elderly redistributes most of their medical costs to the government and employees. Take, as an example, the

3. For example, Harding (1996) is a collection paper of microsimulation.

Table 4.3 **Changes in instruments in aged households by switching to Health Insurance for the Aged Health Insurance System in 1996 (in thousands of yen)**

	NHI	HIMA and HIGE	HIMG	HIE	Changes
Insurance premiums	525	1,050	914	759	104
NHI	525	0	0	171	–197
HIMA and HIGE	0	1,050	0	341	236
HIMG	0	0	914	247	64
Government subsidies	525	0	137	666	271
National government subsidy	525	0	137	516	121
Other public subsidy	0	0	0	150	150
Out-of-pocket	450	450	450	75	–375
Total	1,500	1,500	1,500	1,500	0

Notes: HIMG = Health Insurance Managed by Government; HIMA and HIGE = Health Insurance Managed by Association and Health Insurance for Government Employees; NHI = National Health Insurance and other health insurances; HIE = Health Insurance for the Elderly.

hypothetical case of a couple, both sixty-nine years old, who receive a pension as their sole income. They are insured by their municipal national health insurance program and spend 1,500,000 yen in health care costs per year. The cost represents the average health care costs for an elderly couple (hospitalization and outpatient treatments) for fiscal 1995. The figures listed under the column "NHI" in table 4.3 show who bears the burden and by how much. The couple paid 450,000 yen, or 30 percent of the expense, as out-of-pocket payments to providers. The national health insurance and the government split the rest of the expense, worth 1,050,000 yen, each paying 525,000 yen.

Now we compare this with the following year when the couple turns seventy, making them eligible for the health insurance for the elderly. We assume that their medical costs remain at 1,500,000 yen per year. Note that there was not a single, fixed out-of-pocket rate for the elderly. But according to the national medical expenditure for the fiscal 1996, the average medical expense paid by the elderly themselves was around 5 percent, which is the ratio we have used in the table. As shown in the column labeled "HIE" in table 4.3, 30 percent of the cost will be paid by public funds (20 percent from national fund, 5 percent from prefectural fund, and 5 percent from municipal fund). This leaves 65 percent of the medical costs for the elderly couple, which will be charged to HIMA, HIMG, HIGE, and NHIs. Each insurance system contributes an amount equal to its proportion of the total number of participants (HIMA: 30 percent, HIMG and HIGE: 35 percent, and NHI: 35 percent). The HIMG and NHI receive subsidies from the national government for their contributions, equaling 16.4 percent and 50 percent, respectively.

The key factor that determines the changes in the burden of medical costs when the couple turns seventy is the type of insurance program they were enrolled in at age sixty-nine. Table 4.3 takes this into consideration and explores the cases in which the couple subscribes to NHI, HIMG, and HIMA and HIGE. We estimated the possibilities of the couple being subscribed to each insurance system at age sixty-nine as follows: 70 percent for the national health insurance, 20 percent for HIMG, and 10 percent for HIMA and HIGE. The figures in the last column illustrate the expected value of the changes. For every new couple becoming eligible for HIE

1. out-of-pocket costs are reduced by 375,000 yen;
2. the costs to NHI are reduced by 200,000 yen;
3. the costs to the public sector are increased by 270,000 yen; and
4. the costs to HIMA and HIGE will be increased by 240,000 yen, while the costs to HIMA will be increased by 60,000 yen.

As mentioned in section 4.2.1, as a result of the revision to the Health Insurance Law, starting April 2003 the elderly are responsible for 10 percent of their medical expense. Our table 4.4 shows the results of this revision. If an elderly couple were responsible for 10 percent of their own medical expenses, for every new couple becoming eligible for the elderly benefits

1. the reduction in the out-of-pocket costs will be 300,000 yen;
2. the reduction in the national health insurance cost will be 210,000 yen;
3. the increase in the cost of the public sector will be 257,000 yen; and
4. the increase in the costs of HIMA and HIGE will be 210,000 yen and 43,000 yen, respectively.

These changes are not insignificant, given that an average of over 1.3 million people have reached the age of seventy each year during the last few

Table 4.4 **Changes in payment sources for a new elderly health insurance system in 2002**

Sources	NHI	HIMA and HIGE	HIMG	HIE	Changes
Out-of-pocket	450	450	450	150	–3,000
National government subsidy	525	0	137	502	1,070
Other public subsidy	0	0	0	150	1,500
NHI	525	0	0	158	–2,100
HIMA and HIGE	0	1,050	0	315	2,100
HIMG	0	0	914	226	430
Total	1,500	1,500	1,500	1,500	0

Note: See notes to table 4.3 for acronym explanations. The 2002 new health insurance law required 10 percent out-of-pocket costs, raising the copayment rate to 10 percent for the aged (more than sixty-five years).

years. Prior to the reforms implemented in April 2003, this translated into an annual increase of 195 billion yen in medical expenses for the employee health insurance and an annual increase of 178 billion yen for the public sector. On the other hand, the cost imposed on national health insurance decreased by 130 billion yen every year, and the individual payments decreased by over 195 billion yen every year. After April 2003, medical expenses for the employee health insurance will increase annually by 164 billion yen, and the public sector will have to bear an increase of 167 billion yen. The cost imposed on the national health insurance will decrease by 137 billion yen every year, and the individual payments will decrease by 195 billion yen every year. When people shift to the insurance scheme for the elderly, the burden shouldered by the employee health insurance and the public sector will decrease somewhat, and the decrease in individual payments will be kept small.

We must emphasize, moreover, that the shifts in financing burden are not temporary and will last for the rest of the elderly couple's life. If we assume that an individual reaching age seventy has ten more years to live on average, the current insurance system will shift a burden close to 4 trillion yen each year from the national health insurance and the elderly themselves to the employee health insurance and private sector. Even if the elderly were to pay 10 percent of their medical costs, it makes little difference. Given that the aging of the population will continue at least for another twenty years, the size of this transfer will easily double, amplifying the adverse effects on individuals' incentive to work and companies' incentive to hire.

There are grave problems in the current health insurance system. One is the fact that so much of the burden is shifted to the employee health insurance and the national treasury. Another is the fact that the percentage of individual payments drops dramatically after one turns age seventy. Generally speaking, Japanese health care professionals are very critical of any attempt to increase out-of-pocket costs. They are especially opposed to raising those of the elderly, fearing it would prevent poor elderly from receiving necessary medical services. The issue, however, is whether anyone who reaches age seventy should be exempt from paying out-of-pocket costs. Or why should we insist on making someone who is poor and very sick pay 30 percent of his or her medical costs because he or she is young? Younger individuals would also be discouraged from receiving needed medical care. The authors doubt that age alone is a clear guide for solving these issues. It has been shown that the increase in the number of elderly aged seventy years and older increases the burden on employees and the national treasury. In other words, the current insurance scheme may stymie the fair allotment of the burden between the elderly generations and the working generations. If we reform the insurance scheme, to what extent have we increased the fairness in the distribution of benefits and burdens

of medical expenses per household? We used the following simulation to address this question.

4.3 Overview of the Microsimulation Model

In analyzing health care financing issues, it is not sufficient to have accurate information on total health care costs. A good framework for analyzing these issues should include information on the joint distributions of health care costs and such key socioeconomic indicators as age, income, and consumption. Ideally, such information should come directly from individual households in the real world, but because such a perfect household data set is not yet available for Japan, we have decided to construct our own microsimulation model of health care costs. This model consists of a large number of hypothetical households randomly created according to the known marginal distributions of key socioeconomic variables, together with a number of rules regarding their health care service demand functions. The model provides information on the changes in the costs and benefits of health as the parameters of the health care financing system are changed. Health care utilization by individual households can then be aggregated by household types.

First, we have to obtain data on the benefits and costs of medical services at individual household levels. For this purpose, the best public data set available for Japan is the *Comprehensive Survey of the Living Conditions of People on Health and Welfare* (Comprehensive Survey on Health and Welfare [CSHW]; Ministry of Health and Welfare 1997a). Extensive information has been collected in this survey regarding the socioeconomic characteristics of household members. The survey also gathers information on illnesses, symptoms, and treatments among household members. For our purposes, however, there are several serious shortcomings in this survey:

1. The survey respondents tend to underreport the use of medical resources.
2. The survey lacks annual medical expense data.
3. The aggregate totals for socioeconomic variables using the specified scales differ substantially from census data, system of national accounts (SNA) statistics, and social insurance statistics, as the surveyed households have not been randomly selected.

Details on how we addressed the preceding issues appear in the appendix.

Before moving on to the analyses of health care financing reforms, we will examine the quality of the information generated by our microsimulation model. We compare them to those of the national medical expenditures of 1996, using inpatient medical expenses, inpatient medical expenses by disease group, outpatient medical expenses, and total medical expenses.

4.3.1 Inpatient Medical Expenses

As shown in table 4.5, according to our simulation the inpatient expenses in fiscal year 1996 are 10.2 trillion yen. Actual total medical expenses for fiscal 1996 were estimated to be 9.9 trillion yen. Thus, the error is plus 3 percent, which can be considered reasonably accurate. Turning to total medical costs by age and disease for patients over the age of sixty-five, who account for almost half of the inpatient expense, our simulation yields 4.9 trillion yen, which is nearly the same as the figure in the national medical expenditure (5.0 trillion yen). However, some of the results of other groups show some inconsistencies; for example, our results for the patients between the ages of zero and fourteen, and the patients between the ages of forty-five and sixty-four are, respectively, 20 percent and 15 percent greater than the actual expenses.

Table 4.5 **Simulation estimates and estimates according to national health care expenditure (NHCE) for inpatient medical costs (in billions of yen)**

	Our simulation estimate	NHCE
Age		
0–14	513	433
15–44	1,433	1,518
45–64	3,342	2,924
65 and over	4,943	5,048
Disease		
Infectious and parasitic diseases	268	279
Neoplasms	1,706	1,533
Diseases of the blood and blood-forming organs	64	61
Endocrine, nutritional, and metabolic diseases	389	420
Mental disorders	880	1,074
Diseases of the nervous system	331	329
Diseases of the eye and adnexa	293	240
Diseases of the ear and mastoid process	36	33
Diseases of the circulatory system	2,664	2,431
Diseases of the respiratory system	481	492
Diseases of the digestive system	740	847
Diseases of the skin and subcutaneous tissue	46	55
Diseases of the musculoskeletal system and connective tissue	463	551
Diseases of the genitourinary system	410	404
Complications of pregnancy, childbirth, and puerperism	191	146
Congenital anomalies	138	56
Symptoms, signs, and ill-defined conditions	272	63
Injury and poisoning	858	847
Total (inpatient)	10,230	9,862

Source: Ministry of Health and Welfare (1998), *Estimates of National Medical Care Expenditure, 1996.*

4.3.2 Inpatient Medical Expenses by Disease Groups

In most disease groups, our simulated costs for inpatient care are reasonably accurate with moderate errors. For example, our estimate for circulatory diseases, the group that accounts for the largest share of spending, is 10 percent greater than the national medical expenditure figure. Our estimate for neoplasms is similarly overstated. Those two groups alone account for 40 percent of our national inpatient care costs. On the other hand, we substantially overestimate spending for the pregnancy group and for the eye disease group. Conversely, we have underestimated spending by 15 percent and 10 percent for the musculoskeletal and digestive diseases, respectively.

4.3.3 Outpatient Medical Expenses

Table 4.6 compares our simulation results for outpatient medical costs with the actual costs. According to our simulation, the total outpatient cost amounts to 12.0 trillion yen, which is almost equal to the actual value. Among the age classes, there is underestimation in the groups between the ages of zero and fourteen and between the ages of fifteen and forty-four, but there is an overestimation among those sixty-five years and older. While we do not find significant errors in most major diseases, note that we overestimate spending by 30 percent for musculoskeletal diseases and underestimate spending by 40 percent for urino-genital diseases.

4.3.4 Total Medical Expenses

Table 4.7 compares the actual total medical costs and our simulation results by age group. Actual medical costs equal 21.9 trillion yen, while our simulation figures total 22.2 trillion yen (only a 1 percent difference). By age group, the costs for those between zero and fourteen and those between fourteen and forty-four are underestimated, while the costs for those forty-five years old and older are overestimated. In percentage terms, the magnitude of the error is minus 10 percent for the younger generations, but note that their medical costs account for only 25 percent of the total. In contrast, for older patients, who consume around 75 percent of the total, the magnitude of the error is just a few percentage points. We conclude that our simulated spending is relatively accurate.

4.4 Simulation Results under Different Scenarios

In this section, we compare the simulation results for a number of scenarios designed to capture the effects (direction and the magnitude) of alternative policies. One alternative we consider is the combination of increased out-of-pocket costs and an additional consumption tax to finance all public health care costs. For the price elasticity of medical services, we consider only the demand side and set it at –0.3 for inpatient care and at

Table 4.6 **Simulation estimates and estimates according to national health care expenditure (NHCE) for outpatient medical costs (in billions of yen)**

	Our simulation estimate	NHCE
Age		
Total	11,953	11,945
0–14	729	958
15–44	1,886	2,201
45–64	3,758	3,947
65 and over	5,581	4,840
Disease		
Infectious and parasitic diseases	413	374
Neoplasms	881	790
Diseases of the blood and blood-forming organs	41	77
Endocrine, nutritional, and metabolic diseases	980	945
Mental disorders	297	297
Diseases of the nervous system	265	194
Diseases of the eye and adnexa	515	565
Diseases of the ear and mastoid process	176	152
Diseases of the circulatory system	2,664	2,626
Diseases of the respiratory system	1,302	1,326
Diseases of the digestive system	1,149	1,199
Diseases of the skin and subcutaneous tissue	350	372
Diseases of the musculoskeletal system and connective tissue	1,544	1,211
Diseases of the genitourinary system	647	1,063
Complications of pregnancy, childbirth, and puerperium	30	58
Certain conditions originating in the perinatal period	1	5
Congenital anomalies	15	16
Symptoms, signs, and ill-defined conditions	153	115
Injury and poisoning	529	532
Medical expenditures for outpatients	11,953	11,916

Source: Ministry of Health and Welfare (1998), *Estimates of National Medical Care Expenditure, 1996.*

–0.15 for outpatient care (except in Scenario 5 as described in the following). For convenience, we assume zero income elasticity of demand for health care.

The details of the five scenarios are as follows:

Scenario 1: Maintain the current health insurance system (premiums and out-of-pocket costs) as of fiscal 1996.

Scenario 2: Maintain out-of-pocket costs as of fiscal year 1996, but impose 10 percent out-of-pocket costs for the elderly. The source of revenue will remain the same as of fiscal year 1996. The price elasticity of health care demand with respect to out-of-pocket costs will be set at –0.3 for inpatient care and –0.15 for outpatient care.

Table 4.7 **Simulation estimates and estimates by national health care expenditure (NHCE) for medical costs (in billions of yen)**

Age	Our simulation estimate	NHCE
Total	22,184	21,868
0–14	1,241	1,391
15–44	3,318	3,719
45–64	7,100	6,871
65 and over	10,523	9,888

Scenario 3: Maintain out-of-pocket costs as of fiscal 1996, but impose 10 percent out-of-pocket costs for the elderly. To pay for all the health care costs, an additional consumption tax set at 9 percent will be imposed. The price elasticity of health care demand with respect to out-of-pocket costs will be set at –0.3 for inpatient care and –0.15 for outpatient care.

Scenario 4: Out-of-pocket costs will be set at 20 percent for all patients, and an additional consumption tax set at 8 percent will be imposed. The price elasticity of health care demand with respect to out-of-pocket costs will be set at –0.3 for inpatient care and –0.15 for outpatient care.

Scenario 5: Out-of-pocket costs will be set at 20 percent for all patients, and an additional consumption tax set at 8 percent will be imposed. The elasticity will be set at –0.6 for inpatient care and –0.3 for outpatient care.

4.4.1 Characteristics and Results of Each Scenario

On one hand, we have Scenario 1, which was the status quo as of 1996, the year on which our microsimulation model is based. Scenario 2 is a simplified version of the new status quo since October 2002.[4] On the other, we have Scenarios 4 and 5 with uniform 20 percent out-of-pocket costs and an additional 8 percent consumption tax to finance health insurance benefits. Compared with the preferential out-of-pocket rates offered to the elderly and the weak financing mechanism in Scenarios 1 and 2, Scenario 4 offers an alternative that is both simple and stable. For this reason, we are particularly interested in finding out what changes would be involved in the transition to Scenario 4.[5]

The out-of-pocket costs in Scenarios 2 and 3 may be considered transitional steps between the 1996 system and a uniform rate of 20 percent. The

4. To be precise, since April 2003 an elderly couple with more than 1.24 million yen in taxable income or 6.37 million yen in pretax income is responsible for 20 percent of their health care costs.

5. We will emphasize the results of Scenario 4, but this should not be taken as support for the unification of all public medical insurances, a position strongly advocated by the Japan Medical Association. Our version of Scenario 4 is a system in which public insurance programs, sharing consumption-tax revenue with appropriate risk adjustments, compete to attract individuals by offering superior benefits. Unification of the out-of-pocket costs and the source of revenues would, we believe, be a first step to such a quasi-market mechanism.

rate was increased to 10 percent for the elderly in October 2002, but the rate for others remained the same at 20 percent. Moreover, because the out-of-pocket rates are the same in Scenario 2 and 3, the expected medical expenses for each household will be the same[6] and hence the differences between the two scenarios are solely on the revenue side.

The financing mechanism in Scenario 2 remains the same as in Scenario 1, so the difference between the two is due to the out-of-pocket rates for the elderly. A higher out-of-pocket rate in Scenario 2 will reduce the medical costs of the elderly, which will reduce the required contributions of each insurance program and lessen the burden on the government. This will reduce the financial burden for each household in Scenario 2. Scenario 3 is the same as Scenario 2, but with a consumption tax as the source of revenue.

In Scenarios 4 and 5, the out-of-pocket costs are set at 20 percent, and all health insurance benefits are funded by an additional consumption tax of 8 percent. In Scenario 5, however, individuals are assumed to be twice as responsive to the increased out-of-pocket costs as in Scenario 4, which will result in a fiscal surplus to be refunded to households. Setting the elasticity of inpatient care with respect to out-of-pocket costs at –0.3 means that as the cost increases by 1 percent, hospitalizations will decrease by 0.3 percent, resulting in a 0.3 percent decrease in inpatient medical costs. Setting the elasticity of outpatient care with respect to out-of-pocket cost at –0.15 means that as the rate increases by 1 percent, the outpatient visitation rate will decrease by 0.15 percent, resulting in a decrease in the number of outpatients and their medical costs.

4.4.2 Simulation Results

In this section, for each scenario we show total expenditures and expenditures aggregated by household age groups and by insurance programs. To calculate the total individual burden, we have to consider the government subsidy and the surplus or deficit of the medical insurance programs as well. All our simulations produced surpluses in every insurance program (see table 4.8),[7] and, hence, we estimated the household burden assuming that the surpluses would be returned to the households in equal amounts.

Household Payments by the Age of Householders

Our table 4.9 shows the mean costs of medical care consumed and the payments for medical care per household, by age group of the household head. To compare the scenarios, figure 4.1 shows mean payments as a fraction of mean medical costs by age group of the household head (100 per-

6. Recall that the income elasticity of demand for medical care is assumed to be zero.

7. In the case of Scenarios 2 through 5, there is a surplus ranging from 1.2 trillion to 2 trillion yen (table 4.8). In other words, financial resources are sufficient in each of our scenarios.

Table 4.8 **Medical costs and burden simulated by scenario and by age of head of household (in billions of yen)**

	15–39	40–64	65 and over	Total
	A. Scenario 1			
Medical costs	2,144	11,109	8,917	22,170
Out-of-pocket costs	324	1,114	555	1,993
Burden of premium	2,567	7,885	1,752	12,204
Tax incidence and public subsidy	1,453	5,278	1,241	7,973
Sum of household burden	4,345	14,277	3,548	22,170
	B. Scenario 2			
Medical costs	2,042	10,367	8,002	20,411
Out-of-pocket costs	344	1,371	895	2,610
Burden of premium	2,567	7,885	1,752	12,204
Tax incidence and public subsidy	1,097	3,587	913	5,597
Sum of household burden	4,008	12,842	3,560	20,411
	C. Scenario 3			
Medical costs	2,042	10,367	8,02	20,411
Out-of-pocket costs	344	1,371	895	2,610
Burden of consumption tax (9%)	3,953	11,805	3,941	19,698
Health insurance surplus	–284	–1,351	–262	–1,897
Sum of household burden	4,012	11,825	4,573	20,411
	D. Scenario 4			
Medical costs	1,993	10,354	8,304	20,651
Out-of-pocket costs	399	2,071	1,661	4,130
Burden of consumption tax (8%)	3,546	10,591	3,535	17,672
Health insurance surplus	–172	–820	–159	–1,151
Sum of household burden	3,772	11,842	5,037	20,651
	E. Scenario 5			
Medical costs	1,934	10,112	7,923	19,968
Out-of-pocket costs	387	2,022	1,585	3,994
Burden of consumption tax (8%)	3,546	10,591	3,535	17,672
Health insurance surplus	–254	–1,208	–235	–1,697
Sum of household burden	3,679	11,405	4,85	19,968

cent would indicate that the household financial burden equals the cost of medical care consumed).

Under Scenario 1, or the 1996 system, the households headed by individuals age sixty-five or older bear only 39.8 percent of their medical costs on the average. In contrast, the households whose heads are in the prime of life and support their children (ages forty to sixty-four) bear about 128.5 percent of their medical costs on the average, and the households whose heads are between fifteen and thirty-nine bear over 200 percent of their medical costs.

Under Scenarios 4 and 5 (8 percent consumption tax, 20 percent individual payment rate), the households headed by individuals sixty-five and older will bear slightly over 60 percent of their mean medical costs. On the

Table 4.9 **The means for medical costs and burden simulated by scenario (per household) and by age of head of household (in thousands of yen)**

	15–39	40–64	65 and over	Total
	A. Scenario 1			
Medical costs	185	465	741	487
Out-of-pocket costs	29	47	52	44
Burden of premium	233	330	165	268
Tax incidence and public subsidy	132	221	117	175
Sum of household burden	395	598	335	487
	B. Scenario 2			
Medical costs	185	434	754	449
Out-of-pocket costs	31	57	84	57
Burden of premium	233	330	165	268
Tax incidence and public subsidy	100	150	86	123
Sum of household burden	364	538	336	449
	C. Scenario 3			
Medical costs	185	434	754	449
Out-of-pocket costs	31	57	84	57
Burden of consumption tax (9%)	359	495	372	433
Health insurance surplus	–26	–57	–25	–42
Sum of household burden	364	495	431	449
	D. Scenario 4			
Medical costs	181	434	783	454
Out-of-pocket costs	36	87	157	91
Burden of consumption tax (8%)	322	444	333	388
Health insurance surplus	–16	–34	–15	–25
Sum of household burden	343	496	475	454
	E. Scenario 5			
Medical costs	176	424	747	439
Out-of-pocket costs	35	85	149	88
Burden of consumption tax (8%)	322	444	333	388
Health insurance surplus	–23	–51	–22	–37
Sum of household burden	334	478	461	439

other hand, the burden on households headed by individuals between forty and sixty-four will be reduced to less than 115 percent. Households with heads between the ages of fifteen and thirty-nine will bear around 190 percent of their medical costs, slightly lower than in Scenario 1. Under Scenario 3, the households with heads sixty-five or older will bear 57.2 percent of their costs, a little bit lower than Scenario 4, but considerably higher than the current rate.

Analysis of Individual Payment Per Household by the Age of the Householder

We now examine the components of the total payments for medical care. Namely, in Scenarios 1 and 2, the payments consist of out-of-pocket costs,

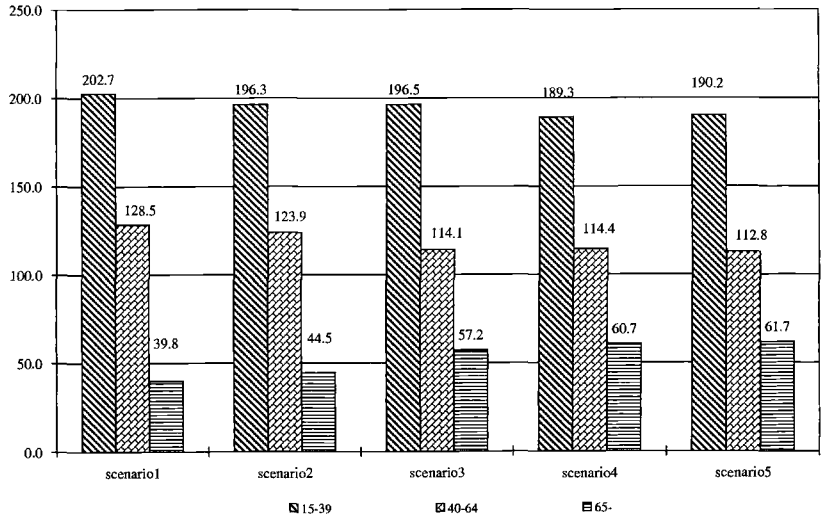

Fig. 4.1 The ratios of medical burden to cost per household by age class for household head (percentage)

insurance premiums and the imputed taxes, while in scenarios 3 through 5, the insurance premiums and imputed taxes and deficits are replaced by the consumption taxes. To facilitate comparison between these two groups of scenarios, the sum of all payments other than out-of-pocket costs (i.e., the premiums, imputed tax and surplus payments, and consumption tax)[8] will be referred to simply as "premiums and taxes."

Now we examine how the out-of-pocket costs and premiums and taxes shift as we move away from Scenario 1. Figure 4.2 illustrates two particularly interesting comparisons, namely Scenarios 3 and 4, relative to Scenario 1. The results are shown separately by age group of the household head.

If Scenario 4 is put into effect, the total payments of households headed by individuals age fifteen to thirty-nine and individuals forty to sixty-four, will decrease by 13 percent and 17 percent, respectively. Note that out-of-pocket costs contribute +1.7 percent and +6.7 percent, respectively, but premiums and taxes contribute –14.9 percent and –23.8 percent, respectively. We observe similar results for Scenario 3.

On the other hand, households headed by individuals sixty-five or older experience a 42 percent increase in total payments in Scenario 4. Specifically, out-of-pocket costs contribute +31 percent, and premiums and taxes contribute +11 percent. Thus, three-quarters of the change are due to the

8. The "deficit" and "surplus transfer" items refer to the average value of the deficit or the surplus, equally redistributed among the same age groups.

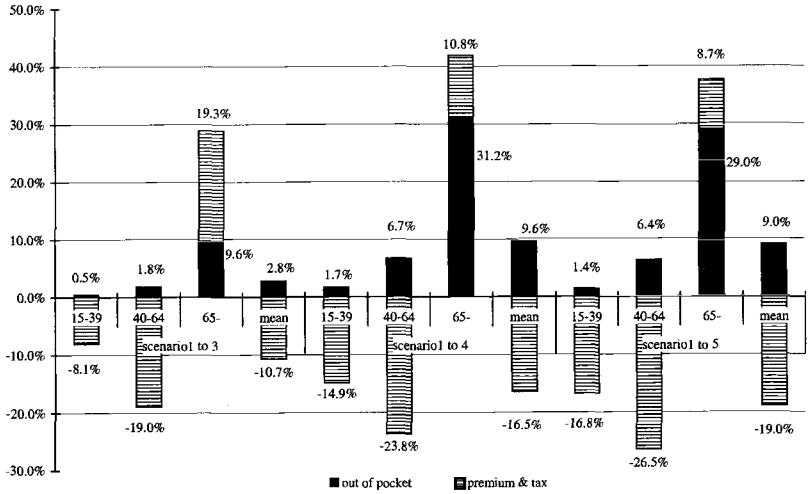

Fig. 4.2 Household medical burden changes by shifting Scenario 1 to other scenarios (by age class for household head)

increase in the out-of-pocket costs. In case of Scenario 3, the total payments will increase by 29 percent, with the out-of-pocket costs accounting for +10 percent, and premiums and taxes accounting for +19 percent. Because the out-of-pocket rate for Scenario 3 is only one-half of Scenario 4, the medical costs of the elderly will be larger, resulting in a higher consumption tax rate. Particularly for the elderly, if we lower the out-of-pocket costs, we should expect premiums and taxes to move in the opposite direction.

Comparing the Contributions across Insurance Types

Table 4.10 illustrates mean medical costs and financial burdens per household by type of insurance. We note that the insurance scheme for the elderly is not a primary medical insurance, but is more a reinsurance. As primary insurance programs in 1996, HIMA insured 940,000 elderly individuals, HIMG insured just over 2 million, and NHIs insured nearly 9 million.

Mean payments as a fraction of mean medical costs are shown in figure 4.3 for each type of insurance and for each scenario. Households insured by national health insurance programs only contribute around 60 percent of their total medical costs under the 1996 health insurance system. Households insured by HIMA and HIGE, on the other hand, contribute over 170 percent of their own medical costs. For households insured by HIMG, their contribution amounts to just under 115 percent of their medical costs. Scenario 2 is similar in these respects to Scenario 1.

In the case of Scenarios 3 through 5, in which consumption tax is used

Table 4.10 **The means for medical costs and burden simulated by scenario (per household and in thousands of yen)**

	NHI	HIMG	HIMA and HIGE	Mean
	A. Scenario 1			
Medical costs	587	439	383	487
Out-of-pocket costs	53	38	35	44
Burden of premium	172	256	410	268
Tax incidence and public subsidy	126	210	219	175
Sum of household burden	351	504	665	487
	B. Scenario 2			
Medical costs	534	412	356	449
Out-of-pocket costs	58	62	54	57
Burden of premium	172	256	410	268
Tax incidence and public subsidy	02	155	144	123
Sum of household burden	322	473	608	449
	C. Scenario 3			
Medical costs	534	412	356	449
Out-of-pocket costs	58	62	54	57
Burden of consumption tax (9%)	396	438	481	433
Health insurance surplus	–27	–44	-60	–42
Sum of household burden	427	456	474	449
	D. Scenario 4			
Medical costs	548	408	356	454
Out-of-pocket costs	110	82	71	91
Burden of consumption tax (8%)	356	393	431	388
Health insurance surplus	–16	–27	–37	–25
Sum of household burden	449	448	466	454
	E. Scenario 5			
Medical costs	525	399	347	439
Out-of-pocket costs	105	80	69	88
Burden of consumption tax (8%)	356	393	431	388
Health insurance surplus	–24	–39	–54	–37
Sum of household burden	436	433	447	439

Note: See table 4.3 for acronym explanations.

to finance health insurance benefits, households with national health insurance contribute around 80 percent, households with HIMA or HIGE contribute around 130 percent, and households with HIMG contribute around 110 percent. Clearly, even when the consumption tax is used to finance the medical insurance benefits, the total contribution varies widely across different types of insurances. Because the average health care costs of the elderly are several times of those of the rest of the population, and because they contribute substantially less than their full costs, the insurance programs with larger-than-average percentages of the elderly, such as NHIs, will have contribution-to-cost ratios of less than 1. These ratios, however, will move in the same direction as the contribution-to-cost ratio

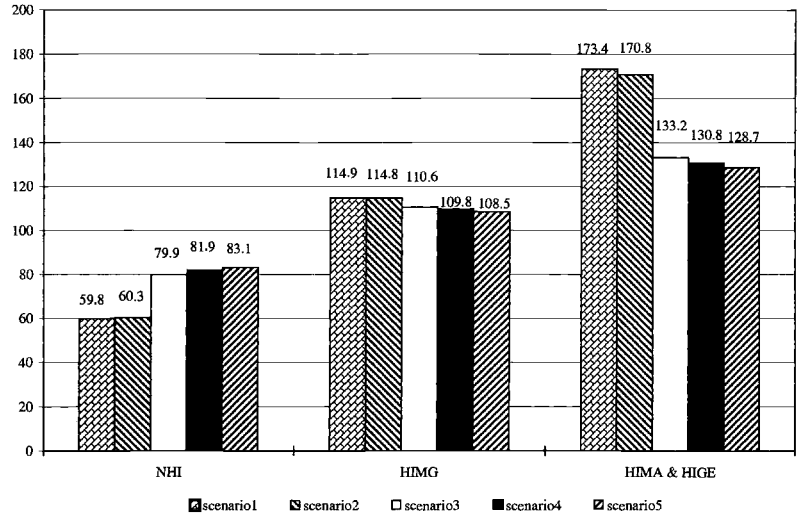

Fig. 4.3 The ratios of medical burden to cost per household by branch of health insurance (percentage)

of the elderly: for example, a consumption tax raises the contribution-to-cost ratio of the elderly and NHIs as well.

4.4.3 Implications for Different Types of Insurance and Age Groups

Table 4.11 shows mean contributions as a fraction of mean medical costs, by type of insurance and age group of the head of household, for each scenario. For a given age group, the fractions under Scenarios 3 through 5 are far less dispersed than under Scenario 1. This implies that these systems are more horizontally equitable than the 1996 system. Comparing the contribution-to-cost ratios within the given insurance types (i.e., vertically), or across different insurance types (i.e., diagonally), we observe that the ratios narrow considerably under any of these three scenarios. This implies that these systems are far more equitable between the generations than the 1996 system.

Now we examine how the total contribution-to-cost ratio changes for households whose heads are between the ages of fifteen and thirty-nine under each scenario. It should be noted that even under the 1996 system, the younger households with NHIs contribute 125.0 percent of their total costs. Although this figure is lower than those of HIMG households (191.0 percent) or of HIMA or HIGE households (252.7 percent), the ratios of other age-groups in NHIs are below 100 percent. In Scenario 2, the figures are similar to those in Scenario 1.

If all the health insurance benefits are financed by a consumption tax, as in Scenario 4, younger households in NHIs contribute 197.6 percent,

Table 4.11 **The means for ratios of medical burden to cost simulated by scenario (per household) and by age and branch of insurance for the head of household**

Age	NHI	HIMG	HIMA and HIGE	Mean
		A. Scenario 1		
15–39	125.0	191.0	252.7	202.7
40–64	90.9	119.7	173.7	128.5
65 and over	37.3	52.8	48.7	39.8
Mean	59.8	114.9	173.4	100.0
		B. Scenario 2		
15–39	116.3	182.5	249.1	196.3
40–64	82.9	119.0	171.1	123.9
65 and over	42.1	56.1	52.3	44.5
Mean	60.3	114.8	170.8	100.0
		C. Scenario 3		
15–39	201.3	188.0	199.5	196.5
40–64	102.6	110.1	129.2	114.1
65 and over	56.7	59.6	58.6	57.2
Mean	79.9	110.6	133.2	100.0
		D. Scenario 4		
15–39	197.6	181.9	189.7	189.3
40–64	104.9	109.8	127.6	114.4
65 and over	60.3	62.4	61.6	60.7
Mean	81.9	109.8	130.8	100.0
		E. Scenario 5		
15–39	200.2	187.4	186.9	190.2
40–64	105.2	107.2	124.8	112.8
65 and over	61.6	61.5	62.2	61.7
Mean	83.1	108.5	128.7	100.0

Note: See table 4.3 for acronym explanations.

households in HIMG contribute 181.9 percent, and households in HIMA or HIGE contribute 189.7 percent of their own health care costs. In other words, households with NHIs contribute greater proportions than households with employee health insurance, primarily due to their lower medical costs. Similar results were obtained in Scenarios 3 and 5.

For households with heads age forty to sixty-four, in Scenario 1 the contribution-to-cost ratios are as follows: 90.9 percent for those in NHIs, 119.7 percent for those in HIMG, and 173.7 percent for those in HIMA or HIGE. If all the insurance benefits are financed by consumption tax, as in the case of Scenario 4, the contribution-to-cost ratios are 104.9 percent for households in NHIs, 109.8 percent for HIMG households, and 127.6 percent for HIMA or HIGE households. Thus, by switching to a consumption tax, the ratio increases for NHI and HIMG households and drops for HIMA/HIGE households, bringing the ratios to converge around 110 percent. In other words, a switch to a consumption tax is a reform that brings

the burdens of households who are raising families more or less in line with their medical costs.

Last, in the 1996 system, for households with heads age sixty-five or older, the contribution-to-cost ratios show substantial variations; they are 37.3 percent for national health insurance, 52.8 percent for HIMG, and 48.7 percent for HIMA or HIGE, respectively. The low ratio for NHIs reflects the preferential treatments in out-of-pocket costs, premium assessment, and income tax. The higher rates for HIMG and HIMA or HIGE probably reflect the insurance premium payments by the heads who are still employed by firms.

It must be noted that by switching to a consumption tax to finance health insurance benefits, the contributions of this older age group will be increased for all types of insurance. For example, in Scenario 4 such households would be responsible for around 61 percent of their medical costs, regardless of insurance type. The disincentive for the working elderly can be solved by switching to a consumption tax. The fact that the elderly would be responsible for 60 percent of their costs needs to be scrutinized more closely, but there are clear advantages to the use of a consumption tax to finance benefits.

4.4.4 Income Distribution and Contribution-to-Medical-Costs Ratios

Table 4.12 is the average figures of medical costs and total contributions of households by quartiles of household income. The bottom figures in each scenario stand for the contribution-to-medical-costs ratios. In our baseline Scenario 1, the bottom income quartile households pay 54.2 percent of their health care costs, while the top income quartile households pay 131.8 percent. In each of our scenarios, we observe a positive relationship between the household income and contribution-to-medical-costs ratios, and, in each of our scenarios, the top income quartile pays more than 100 percent. However, as we move from Scenario 3 to 5, the bottom quartile's contribution-to-medical-costs ratios increase from 71.6 percent to 82.1 percent. Particularly in Scenarios 4 and 5, there is a tendency for the contribution-to-medical-costs ratios to move toward 1, regardless of income quartiles, which reflects the fact that, proportionally speaking, consumption tax tends to take more bite out of the income of the poorer households.

Nevertheless, it is clear that the rich are paying more than they consume under the present system and under any reform plan. Technically, this result is a trivial one because our simulation started from our (estimated) household demand functions for medical services with zero income elasticity. We should note, however, more recent studies by other authors more or less confirmed that income elasticity for medical services is either very small or even negative. This result seems to contradict the widely held belief that health care services are luxury goods. An economically sensible

Table 4.12 **The means of medical burden to cost simulated by scenario (per household) and by percentile for household income (in thousands of yen)**

	Below 25th percentile	25th through 50th percentile	50th through 75th percentile	75th percentile and above	Total
		A. Scenario 1			
Medical costs	449	468	460	570	487
Out-of-pocket costs	32	44	48	52	44
Burden of premium	71	190	320	494	268
Tax incidence and public subsidy	141	167	188	205	175
Sum of household burden	243	400	556	751	487
Contribution to medical costs	54.20	85.49	120.79	131.80	100.00
		B. Scenario 2			
Medical costs	408	430	428	528	448
Out-of-pocket costs	40	57	62	71	57
Burden of premium	144	237	305	388	268
Tax incidence and public subsidy	101	118	132	140	123
Sum of household burden	286	412	498	600	448
Contribution to medical costs	70.08	95.67	116.55	113.59	100.00
		C. Scenario 3			
Medical costs	408	430	428	528	448
Out-of-pocket costs	46	53	59	72	57
Burden of consumption tax (9%)	278	390	466	599	433
Health insurance surplus	–32	–39	–45	–51	–42
Sum of household burden	292	404	480	619	448
Contribution to medical costs	71.68	93.91	112.19	117.28	100.00
		D. Scenario 4			
Medical costs	419	436	429	531	454
Out-of-pocket costs	79	84	88	112	91
Burden of consumption tax (9%)	249	350	418	537	388
Health insurance surplus	–19	–23	–27	–31	–25
Sum of household burden	309	410	479	618	454
Contribution to medical costs	73.78	94.04	111.67	116.47	100.00
		E. Scenario 5			
Medical costs	401	421	416	516	439
Out-of-pocket costs	59	85	94	114	88
Burden of consumption tax (9%)	299	363	411	482	388
Health insurance surplus	–28	–35	–40	–46	–37
Sum of household burden	329	413	464	549	439
Contribution to medical costs	82.10	98.01	111.44	106.54	100.00

answer to this apparent contradiction is that under the Japanese public health insurance schemes, by and large, medical services are rationed goods, whose quantities or qualities consumers have relatively little to say.

There are some clear exceptions; first, some categories of illnesses are not covered by public health insurance, e.g., pregnancies, car accidents, or

injuries incurred in fights. They constitute only a few percentage points of the national medical services market. Second, there is potentially a very large market for services not approved by public health insurance programs, including many high-tech medical services or unapproved drugs. Up to now, providers have been obligated to separate the medical services covered by the public health insurance and the medical services not covered by the public health insurance, and mixed billing have been strictly prohibited.

4.5 Conclusion

In this paper, we showed that in the 1996 health insurance system an imbalance of the benefits and burden of medical services was created across generations and that the imbalance was growing rapidly due to the aging of the population. The working generations are forced to bear an increasingly large load while their benefits are reduced. The view that the current medical insurance system is not sustainable in the long run is spreading very fast and eroding the credibility of the government, which has been stressing the system's equality. The Health Insurance Reform in April of 2003, which retained most of the privileges of the elderly, seems to have been another stopgap measure that failed to restore public confidence.

In order to defuse an approaching crisis, we consider a system that is simple, fair, and self-sustaining at the same time. We have constructed a microsimulation model as a tool for judging the properties of a given health insurance system. This simulation model consists of a large number of individual households that collectively represent the economic and health statistics of our economy. We conducted several simulations to explore policy alternatives and analyzed the resulting incidence of medical costs and benefits.

The purpose of this simulation was to find a scenario in which an employee in his or her working prime (i.e., a household head age forty to sixty-four), who may be supporting children, would have a financial burden appropriate to the benefits he or she receives.

One scenario that would satisfy these two conditions is Scenario 3, which relies on a consumption tax as the sole financial tool to pay for insurance benefits, raises to 10 percent the out-of-pocket costs for the elderly, and maintains the current out-of-pocket costs for other consumers. Another is Scenario 4, which uses the consumption tax as the sole financial tool to pay for the insurance benefits and raises everyone's out-of-pocket costs to 20 percent. These scenarios call for 8 percent (Scenario 3) or 9 percent (Scenario 4) consumption tax rates.

These two scenarios would make the elderly responsible for far more than the 40 percent they are paying for now, but not for more than 60 percent (Scenario 4). In Scenarios 3 and 4, the contribution-to-costs ratios are

far less dispersed across different types of insurance for a given age group, compared to the current system (Scenario 1 or 2). In terms of horizontal equity, the overall allocation of health insurance costs and benefits are far better in Scenarios 3 and 4. The current system consists of very different premiums, subsidies, and reinsurances. By replacing it with the consumption tax to finance health insurance benefits, it is also possible to reduce the huge disparity in the contribution-to-costs ratios across different age groups and improve the vertical equity of the medical insurance system.

Last, we would like to address the limitations of our analysis. First of all, the microsimulation model is a static model. It would have been better if we could have explicitly incorporated health capital as a determinant of medical costs and income. We also do not take savings into consideration. If we introduced savings into our model, it would be possible to examine the effects of increasing the burden on the elderly that would result from changes in the medical insurance system (changes in out-of-pocket costs of the patients, the use of consumption tax, etc.) on household assets. We also did not consider population dynamics in our model, fixing the population structure to year 1995. Thus, our simulation results depend on the given year's population structure. On the other hand, we did take into account the annual budget deficit of the national government as one component of household financial burden, but not the enormous stock of public bonds. We should also remind our readers that we have assumed zero income elasticity in the demand for medical services in our model. It is not difficult to incorporate this element, but we decided against doing so to simplify comparisons across scenarios.

Appendix

Calibration of our Microsimulation Model

Creation of Standard Households and the Fixing of Scaling Factor

First, we created 100,000 probabilistic virtual households based on the CSHW data on the distribution of household and individual attributes. These virtual households will hereafter be called *standard households.* The standard households are categorized in the same manner as the census using the age of householder, sex, marital status, the number of members, and so on. Next, we fixed the weights for the standard households so that the number of each type of household in each prefecture would conform to the number in the most recent census. We then adjusted the weights so that the aggregate employment income, consumption expenditure, and social insurance premiums of all the households would be reasonably close to

the SNA statistics. Finally, we adjusted to the weights again so that the distribution of employment income from the survey would be reasonably close to the known distribution of household monthly compensation.

Estimating The Number of Patients

Next, we constructed a stochastic model that can be used to reproduce the medical utilization patterns recorded in the Patient Survey 1996 (Ministry of Health and Welfare 1997b). We use the Patient Survey 1996—rather than the CSHW—because it is the most extensive and most accurate survey on the utilization of medical institutions by individual patients. The utilization information provided in the CSHW is plagued by serious downward bias. Thus, we assigned various illnesses to members of the standard households randomly, using the statistics on major illnesses in sex and age groups of Patient Survey 1996. The place of treatment, nature of treatment, and the length of the treatment time are determined accordingly.

Estimating the Number of Outpatients

We calculated the probability that a patient would come for his or her first visit and for follow-up visits for each illness based on sex and age from the Patient Survey 1996 (Ministry of Health and Welfare 1997b). We then generated a random number every other day starting from January 1, and calculated the probability of a sick person going for a checkup. Once the date for the first checkup is fixed, the date for the follow-up visit and the span of the treatment is determined by a stochastic process.[9] By repeating this process every day for one year,[10] we were able to determine whether a member of a simulated household would visit a particular medical institution for a checkup and determine the beginning and end date of treatment in addition to the frequency of the treatment.[11]

Estimating the Number of Inpatients

The simulation of hospital care was conducted in the following manner. From the Patient Survey 1996 we estimated the daily probability of a new patient being admitted to a hospital or clinics based on sex and age group. For the number of days hospitalized, we estimated a single Weibull survival function, using the same survey and sex, age-group, and disease dummies

9. The number of first outpatient visits and return visits for each sex and age group was calculated from the Patient Survey 1996 (Ministry of Health and Welfare 1997b). We also extracted total population data for sex and age groups from the national census of 1995. For a given sex and age group, the probability of an outpatient visit is the sum of the first-visit probability and the return-visit probability.

10. 240 days will be regarded as one year.

11. Some simulated individuals never visit a hospital in a given year.

(table 4.5). We used the estimated distribution function in our stochastic decision making.

The date of hospitalization for each household member was determined in the same way as the date of outpatient checkup. We drew a random number every other day starting from January 1 for each member of a household and determined if he or she is to be hospitalized on that day, given his or her age group. Once admitted, we draw another random number to determine if he or she is discharged on that day, based on the estimated Weibull distribution. By continuing this process until December 31, we were able to determine when each household member was in or out of the hospital.

The Distribution of Medical Costs Based on the Survey of Medical Care Activities in Public Health Insurance (SMCA)

Because there are no medical costs data in our Patient Survey 1996 we have to gather medical cost information from the Survey of Medical Care Activities in Public Health Insurance (SMCA; Ministry of Health and Welfare 1997c).[12] While the latter survey provides information on disease groups, type of hospitals, and the patient's sex and age, it does not provide any information on his or her household characteristics. Here we assume that the medical cost per day is a random variable that follows the empirical distribution of SMCA medical costs for a given patient and hospital attributes in the SMCA. In order to improve the concordance between the simulation results and aggregated medical costs, small adjustments were made to the empirical SMCA distributions to remove the bias in its samples.[13] A random number was generated for every practicing day, and the medical expenditure for each household member was obtained.

Repeating the process for all members of the standard households, we obtained the number of inpatient and outpatient visits and the total costs of outpatient care and of inpatient care for the year, as well as the annual insurance premium borne by households.

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12. This survey is also known as the Survey of Socialized Medicine; we use the official English name and acronym (SMCA).

13. From SMCA, for each combination of sex, age group, disease, and type of medical institution, we first calculated the 5 percent, 15 percent, 30 percent, 50 percent, 70 percent, 85 percent, 91 percent, 93 percent, 95 percent, 97 percent, and 99 percent values of medical costs. The partitions for calculating these cost figures are set at the following percentiles: 10th, 20th, 40th, 60th, 80th, 90th, 92nd, 94th, 96th and 98th. We then reduced these medical costs uniformly by nearly 10 percent.

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