# Investigation on Taiwan's medical system and a proposal

**I-Chun Chen***

Department of Economics, State University of New York

## Abstract

As the co-payment rate is almost homogenous across all regions in Taiwan in spite of the hospital size and because patients are impressed that a large hospital would offer a higher quality of medical care and thus prefer to wait in a large hospital, the denial of service in large hospitals and capacity inefficiency in small hospitals as a consequence take places. Indigenous communities located in remote areas, in contrast, face more difficulty in accessing medical services and thus people claim that the equality criteria (or objectives) for medical services may be sacrificed especially in those isolated remote regions even though BNHI (Bureau of National Health Insurance) emphasize to practice health insurance reforms in aiming at (1) More Fairness in Financial Contribution, (2) Better Quality in Medical Services, and (3) More Efficiency in Operations (BNHI, 2006).

In this paper we propose a 'new' medical system that consists of two parts: (1) the flexible co-payment rates including zero copayment rate for impatient cares and full rate for ambulatory cares, and (2) an incentive to medical providers based on residents' health status improvements. The proposed incentive to medical providers based on the health status of a specified and contracted community may encourage the creation of a better health and supportive environment. The implementation of the suggested medical system can reach social optima, mitigate capacity inefficiency, reduce social inequity, and improve medical care quality.

Keywords: medical care, service capacity; co-payment rate, health-status

*Corresponding author: I-Chun Chen
Email：ichen4@buffalo.edu

## 1. Introduction

The Bureau of National Health Insurance (BNHI), the sole agent of Taiwan's government, is the only payer for medical services by contracting with 17,259 medical institutions that provide services at the end of 2003 (page 43, BNHI, 2004). The public may receive comprehensive medical care such as health prevention, clinical care, hospitalization, resident care, and social rehabilitation through risk pooling by a compulsory insurance system. Patients are treated equally by paying the same co-payment rate in spite of their incomes, but are dependent on the ranking of hospitals which are classified into four categories: regional hospitals, medical centers, district hospitals, and clinic (please see Table 1). The current medical system works for all income groups to improve and protect people's health based on the health policy, characterized by (1) an equally low co-payment rate for ambulatory care, despite income which indigenous communities pay is the same co-payment rate for ambulatory care with a relatively higher amount of transportation cost from their home to hospitals, (2) a high co-payment rate for impatient care, and (3) different medical services for impatient care depending on an extra-copayment rate.

Table 1. Co-payment rates for ambulatory care (NT Dollars)

| **Level of Service Provide** | **Outpatient Care** | **Dentistry** | **Chinese Medicine** | **Emergency** |
|---|---|---|---|---|
| Clinic | 50 | 50 | 50 | 150 |
| District Hospital | 50 | 50 | 50 | 150 |
| Regional Hospital | 140 | 50 | 50 | 210 |
| Academic Hospital | 210 | 50 | 50 | 420 |

Source: BNHI (2004).

The improvements in living standards and the development in medicine technology, especially in the area of acute diseases and health care provision, have extended the average life

expectancy of citizens and thus Taiwan's society has become over-aging. In general, the aged needs more medical cares, but pays less for a social health insurance system since they belong to low income groups or unemployed groups. As a result, BNHI has gradually faced a pressure of financial losses due to the increased cost of health care with flattening revenue. The average growth rate of the premium receivable in Taiwan is 4.1% while the average growth rate of medical expenditures is 6.5% during 1995-2003 (BNHI, 2006). After 1999, the insurance cost (medical expenditures) was going beyond the insurance revenue (please see Figure 11 Revenues and expenditures of the Bureau of National Health Insurance Accrual Basis 1995-2003, BNHI, 2004).

BNHI discloses that the basic medical system currently implemented in Taiwan has covered over 99 percent of Taiwan's population and more than 80% people show their satisfaction by 2004 (BNHI, 2006). Even though, BNHI is still keep going on the medical reforms and starts to implement some new measures such as a global budget system and a family doctor referral system to ensure reasonable distribution of medical resources. In fact, the program of National Health Insurance is categorized into social insurance based on the interpretation of Grand Justice, and thus it is also aiming at safeguarding the right of the weak to have access to medical care.

How to avoid an over-consumption of medical care and improve the distribution of medical cares may be worthwhile for BNHI to solve. In recent years a great number of studies have focused on the issues of medical care (e.g. Mechanic, 1997; Bernard, 2000; Glazer and Rothenberg, 1999; Glazer and McGuire, 2002) and some focus on market-oriented reforms for the improvement of medial care systems (Hakansson, 1994; Harrison and Calltorp, 2000) that emphasize the changes in provisions of services, shifts the responsibility of medical care, and increases the co-payment rate for visits to hospitals. However, many authors criticize the effectiveness of the market-oriented system (Manning, et al., 1987; Lillard, et al., 1999; Propper, et al., 2004).

Mechanic (1997) focuses on the rationing problems and makes a distinction between explicit and implicit rationing involving equity and imperfect information. Glazer and Rothenberg (1999) discuss the provision of medical care with the existence of the demand for medical insurance and the moral hazard problems. They argue that an increase in capacity is seen as an increase in capital so that an incentive system results in a decrease in the time required to serve a customer since rationing is costly and denial of service is difficult. They conclude that a reduction in capacity may increase social welfare. Cockx and Brasseur (2003) analyze the effect of co-payment increases on medical demand and show the price effects to be decomposed into income effects and substitution effects. Their results show that the elasticity of demand is relatively small (0.13 for men and 0.03 for women), but substitution effects are large. In addition, many studies also confirm that the increase in co-payment will lead to a reduction in the average health care expenditures (Manning et al., 1987; Newhouse, 1993).

Other authors focus on the medical policy issues involving the prevention of adverse selection when public medicare serves as the only payer to contract with providers in order to enlist more participation (Frank et al., 2000; Glazer and McGuire, 2002; Newhouse, 2002; van de Ven and Ellis, 2000), or how to provide incentives for good quality of services (Glied and Zivin, 2002; McNeil. 2001). Janssen (2002) evaluates the organization and financing of the Danish health care system, evaluated within a framework of a SWOT analysis, by five experts with a background in health economics. The major results of this qualitative analysis show that the efficiency can be improved through the cooperation among the subsystems, and a greater input into health education programs can improve the health status.

Considering the existence of these problems occurred in Taiwan, we intend to examine whether the currently operated health reforms coincide with the stated objectives through the analysis of some theoretical models. We also propose a 'new' medical system to mitigate the capacity inefficiency and to serve as a policy reform for BNHI's reference.

## 2. The current problems occurring in Taiwan's medical care

2.1 overconsumption of medical services

Based on the data listed in Table 53 NHI Medical Claims (BNHI, 2004), we compare the relationship of medical expenditure and ambulatory care expenditure with GDP and find a significantly strong relationship with coefficient 0.976 and 0.972 respectively (please see Table 2 where AMBUEXP represents medical expenditures for ambulatory cares, and MEDICEXP is total medical expenditures). This result implies that an increase in GDP may stimulate the rising of medical expenditures. As total medical expenditures = total cases per person X costs per case X total population, the causes of the rising medical expenditures may attribute to three factors (1) the increase in total cases per person, reflecting the reduction in public average health status, (2) the rise in costs per case, representing the continuous up of medical costs, and (3) the increase in population. In fact total population does not significantly change during 1995-2003, increasing from 21,391,000 in 1995 to 22,535,000 in 2003.

Table 2. Relationship among medical expenditure for ambulatory cares, total medical expenditures, and GDP

| | | AMBUEXP | MEDICEXP | GDP |
|---|---|---|---|---|
| AMBUEXP | Pearson 相關<br>顯著性 (雙尾)<br>個數 | | | |
| MEDICEXP | Pearson 相關<br>顯著性 (雙尾)<br>個數 | .998**<br>.000<br>9 | | |
| GDP | Pearson 相關<br>顯著性 (雙尾)<br>個數 | .972**<br>.000<br>9 | .976**<br>.000<br>9 | |

**. 在顯著水準爲0.01時 (雙尾)，相關顯著。

To investigate what causes the continuous rising-up of medical expenditure, a further investigation are made on cases per capita and medical costs per case for ambulatory cares and

impatient cares shown in Table 53 NHI Medical Claims (BNHI, 2004) respectively. The results find that (1) cases per capita for ambulatory cares $z_a$ are a decreasing function of per capita GDP $y$, i.e. $q_a$ = -141.046 + 745.257 $y$ – 892.256 $y^2$ (please see Table 3) with $R^2$ = 0.957. (2) medical costs per case $c_b$ for ambulatory cares is an increasing function of per capita GDP $y$, i.e. $c_b$ = 2.89-13.507 $y$ + 19.361 $y^2$ (please see Table 4) with $R^2$ = 0.922, and (3) cases per capita and medical costs per case for impatient cares are a linear function of per capita GDP.

Table 3. Coeficient for Regression model of per capita cases for ambulatory cares [a]

| 模式 | | 未標準化係數 | | 標準化係數 | t | 顯著性 |
|---|---|---|---|---|---|---|
| | | B 之估計值 | 標準誤 | Beta 分配 | | |
| 1 | (常數) | -141.046 | 20.119 | | -7.011 | .000 |
| | GDP | 745.257 | 101.650 | 16.519 | 7.332 | .000 |
| | GDP*2 | -892.256 | 127.637 | -15.751 | -6.991 | .000 |

a. dependent variable: per capita cases for ambulatory cares

Table 4. Coefficient for regression model of costs per case for ambulatory cares [a]

| 模式 | | 未標準化係數 | | 標準化係數 | t | 顯著性 |
|---|---|---|---|---|---|---|
| | | B 之估計值 | 標準誤 | Beta 分配 | | |
| 1 | (常數) | 2.890 | 1.246 | | 2.320 | .059 |
| | GDP | -13.507 | 6.295 | -6.524 | -2.145 | .076 |
| | GDP*2 | 19.361 | 7.905 | 7.448 | 2.449 | .050 |

a. dependent variable: costs per case for ambulatory cares

These results demonstrate that the demand for ambulatory cares is increasing with GDP, but blocked to a limit. As the decisions to see the doctors (the case per capita) is determined by patiens, the regression model for ambulatory shown in Table 3 reflects the actual demand for ambulatory cares. In contrast, the linear relationship between cases per capita for impatient capita and per capita GDP implies that the demand for impatient cares is proportional to the growth of GDP. However, impatient cares should depend on the status of disease which are generally determined by the physicians and thus the actual medical services represent the needs of the patients as well as the medical providers.

On the other side, the medical costs per case for ambulatory care is a convex function of per capita GDP (please see Table 4) and the medical costs per case for impatient care is linearly proportional to per capita GDP. This result reflects that BNHI has lost control of medical costs or at least cannot attain an optimal contract with medical providers through an effective negotiation. We conclude that the adjustment of co-payment rate proposed by BNHI cannot really solve the problem of financial deficit (the unbalance of medical revenues and medical expenditures) since medical costs and the actual cases (occurrences) of impatient cares are fully dominated by medical providers. The current overconsumption of medical service cannot be solved unless BNHI has a fully understanding about the cost structure of medical expenditure and take strong negotiation power and force the medical providers to improve efficiency.

2.2 equity of medical service

Based on the results obtained in Section 2.1, we assume the demand for medical services $q$ is a function of per capita GDP, $I$ , and co-payment paid by the patients $P_c$, i.e. $q = f(P_c, I)$ with properties of $\frac{\partial f}{\partial P_c} < 0$, and $\frac{\partial f}{\partial I} > 0$. As the copayment rate is homogenous across income levels, the quantity demanded by the lower income group is less than the higher, determined by the currently operated system (please see Figure 1). However, the lower income group in actuality requires more demands for medical cares. Low economic status leads to low social status. As low socioeconomic groups, for example, indigenous communities behave as if they are socially isolated, have higher addictions to alcohol, and thus have a worse health status (e.g. shorter life expectancy, low health status, etc.). Based on the population statistics in 2001 (Minister of Internal Department, 2004), the mortality rate is 0.758 % in indigenous communities - higher than 0.571% in Taiwan's general population. The mortality rates of

infants (less than 1 year old) and new-born children are 1.2% and 0.644% in indigenous communities, almost double Taiwan's general population's 0.6% and 0.332%, respectively. The life expectancy is 65.72 in indigenous communities in 2003, shorter than 76.14 in Taiwan's general population. The causes of shorter life in indigenous communities can be attributed to poor health habits and medical infrastructure.

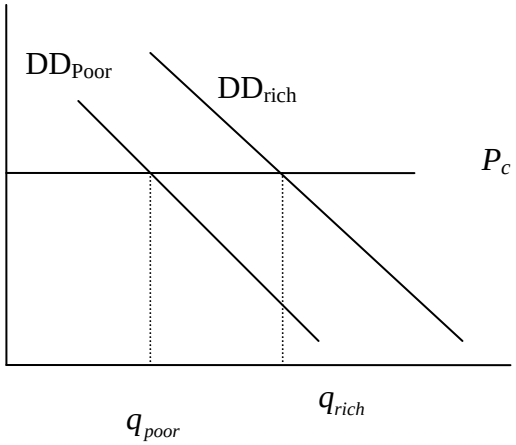



Figure 1 the comparison of medical quantity demanded across income groups

There are many rural and slum communities in Taiwan where the basic infrastructure cannot keep pace with the urban areas. This is especially so for an indigenous community which receives less public services from the government. Most indigenous communities are located in isolated mountain regions where the scenery is beautiful and there is far less air pollution, but the land is over-developed for high priced agriculture products, resulting in a degraded environment, poorly-designed buildings, and the rivers are polluted by illegal dumping of wastes and exposure to toxic chemicals. Most of the residents are poor, powerless, and economic insecure with a higher unemployment rate and lower income level (please see Table 5). The unemployment rate of Taiwan's indigenous people is 15%, much higher than 4.8% for general households in 2002, because the low education level of indigenous people

cannot catch up with labor market requirements driven by quick changes of technological progress. The education level beyond college/university that indigenous community residents received was about 11% in 2001 (please see Table 5) while more than 26% of the civilian population in Taiwan in 2002 graduated from college or above (Taiwan Statistical Bureau, http://www.dgbas.gov.tw). An indigenous household income averaged NT$200,000 in 2001 while a general household's income reached NT$875,919 in 2002 and NT$891,000 in 2004.

Table 5. Monthly income distribution and education level distribution in Taiwan's indigenous households in 2001

| (Currency in NT$) | Male | Female |
|---|---|---|
| No fixed income | 21.7% | 39.3% |
| Below 10,000 | 15.4% | 19.6% |
| 10,000-20,000 | 15.1% | 18.5% |
| 20,000-30,000 | 18.6% | 14.7% |
| 30,000-40,000 | 15.0% | 4.4% |
| 40,000-50,000 | 7.2% | 1.9% |
| 50,000-60,000 | 3.9% | 1.1% |
| Over 60,000 | 3.1% | 0.6% |
| Below primary school | 28.4% | 40.5% |
| Junior high school | 23.2% | 18.6% |
| Senior high school | 37.6% | 28.7% |
| College | 6.8% | 8.2% |
| University | 4.0% | 4.1% |

Source: Council of Indigenous People (2004).

Hospitals (medical providers) are rarely, in practice, caring about the health consequences of poverty, unsafe and unhealthy environments, bad housing or the many other conditions that determine health status in their community and pay less attention to the insufficient ability to access medical services of the low income groups. Thus, the governments are required to intervene with medical managements for social welfare and social equity since medical cares are seen as one kind of public goods with information asymmetries between patients and hospitals. The government needs to develop public

medical policy to determine appropriate inputs in providing healthy environments and reduce the impacts upon the health status of the community. Hospitals need to have a clear information releases system to inform the patients the facts of illness and to advance their management system to protect the interests of the community as a whole. From our analysis, it is always exists a gap between social optimum and market equilibrium under the current system. For this reason, hospitals must integrate together and seen as a unit for provision of medical services and to seek to affect public policy in areas of significance for health status, and should avoid seeking to dominate or take over such coalitions.

2.3 Efficiency of medical facilities

As many authors assume or verify a positive relationship between hospital capacity and cost and quality performance (Berwick et al., 1991; Flood and Scott, 1987; Li and Benton, 1996; Lowery and Martin, 1992) through the analysis of mathematical modeling or empirical studies, we assume that the marginal cost $c(q, K)$ of providing medical care is an increasing function of demanded quantity $q$ and medical service capacity $K$. The marginal revenue of medical providers (hospitals) is identical to average revenue at a given rate $P_t$ that is determined through a detailed calculation of medical costs based on historical data by BNHI and contracted by medical providers and BNHI. In general, the average revenue $P_t$ is composed of two parts: co-payment $P_c$ paid by the patients and the remaining parts $P_b$ paid by BNHI, i.e. $P_t = P_c + P_b$.

As larger hospitals in general are equipped with better physicians and high-value medical equipments and are believed to be able to offer a better quality of medical care, we thus assume that the market demand for medical service is expressed as $q = q(p, K)$. This implies that the quantity demanded $q$ decreases with the price $p$, but increases with medical capacity $K$. To simplify our analysis, we assume there are two sizes of hospitals, the large and the small with capacity $K_L$ and $K_S$, respectively, where $K_L$ is much greater than $K_S$. Patients will prefer to

buy medical care from large hospitals at the same price, i.e. market demand $DD_L = q(P, K_L) >> q(P, K_S) = DD_S$, where $DD_L$ and $DD_S$ represent the curves of market demand for medical care in large hospitals and small hospitals, respectively. In this paper we assume that the severity of disease does not affect an individual's demand for medical care since he in general cannot make a self-examination.

Large hospitals determine their willingness to provide medical care at $q_L^p$, where the marginal costs $c(q, K_L)$ intersect with marginal revenues $P_t$ and small hospitals at $q_S^p$ where the marginal costs $c(q, K_S)$ intersect with marginal revenues $P_t$ (please see Figure 2). On the demand side, the quantity demanded would be $q_L^d$ and $q_S^d$ for large hospitals and small hospitals, respectively, where the marginal private benefit $DD_L$ (demand for medical care in large hospitals) and $DD_S$ (demand for medical care in small hospitals) equal the co-payment rate $P_c$. In Figure 2 the service capacity provided by the small hospital $q_S^p$ is much higher than the quantity demanded $q_S^d$ and thus the capacity is not used up. On the contrary, an excessive demand ($q_L^d - q_L^p$) exists in large hospitals which represent the number of patients who are denied service.

The current system has led to an unnecessary utilization of medical capacities, because there lacks incentives or penalties to reduce the insured to access medical care. There is also a lack of incentives to encourage the physicians to avoid unnecessary referrals of patients to advanced medical care so that a high number of hospital beds are occupied by patients whose illnesses are not so serious or urgent for treatment, because most hospitals aim at maximizing profits and revenue. What the hospital management really do is to encourage more patients for medical services to retain hospital capacity operating without caring the demand of real patients.

To avoid confusions on the symbols presented in this paper, we provide a notation list in

Appendix 1.

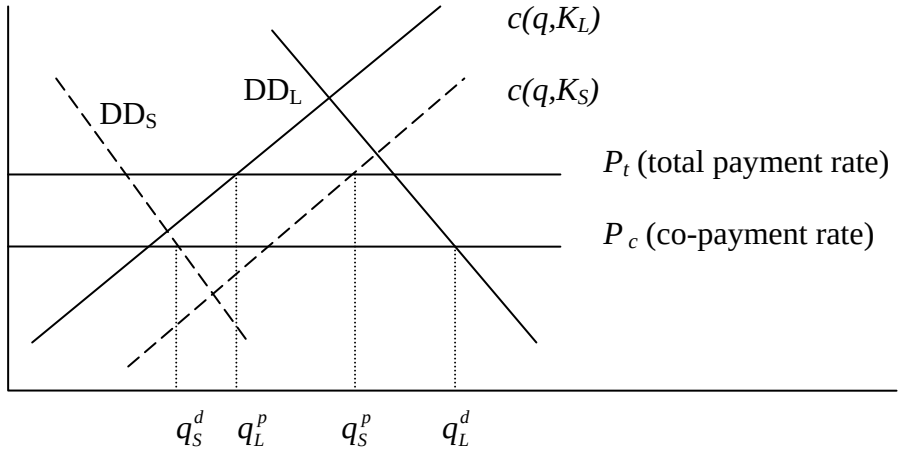



Figure 2. Provision and demand determined by patients and hospitals

**3. The current remedy strategies practiced by BNHI**

The above analysis shows that low co-payment rates in large hospitals may encourage patients to visit more frequently and extend their stays for medical service and consume a great number of service capacities. To solve the over-consumption of medical services, BNHI has adopted the strategy that the co-payment rate is increased for large hospitals from $P_c$ to $P_c^f$ (please see Figure 3) but it is reduced in small hospitals (please see Figure 4).

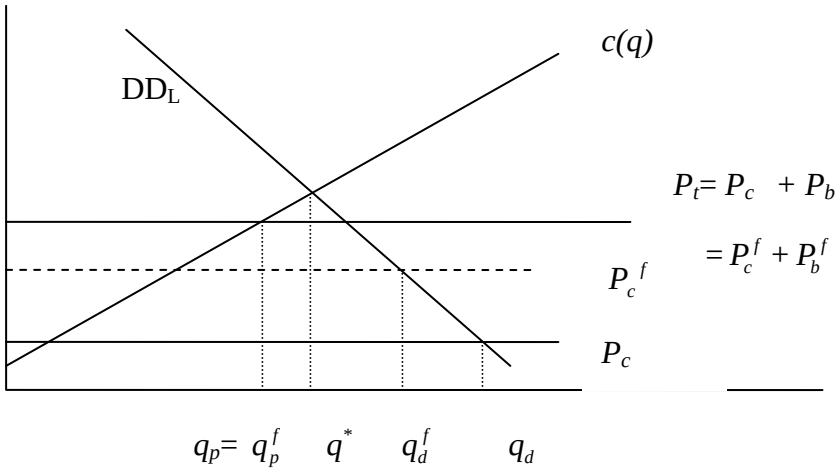



Figure 3. Provision and demanded quantity in large hospitals

This strategy of increasing the co-payment rate in large hospitals may bring about the reduction in demanded quantity from $q_d$ to $q_d^f$ (in Figure 3) and consequently can reduce partially the problem of the over-consumption of medical services without affecting the use of other medical services.[1] However, Manning, et al. (1987) and Lillard, et al. (1999) argue that an increase in the co-payment rate in large hospitals will result in costs rising for medical care and the patients are unable to purchase the medical service. Propper, et al., (2004) use data on hospital level death rates as a major indicator for the quality of care and find that payer-driven competition may reduce the quality of care. Supply sides (the providers' efforts) play an important role in controlling medical care costs and medical quality through the adjustment of patients' selections in response to patients' consumption behavior of medical care. A patient who is incapable of paying for the care, but 'need' the service may be denied that in large hospitals.[2]

[1] Motheral and Fairman (2001) find that the increases in the co-payment rate do not substantially affect the total quantity of drugs purchased and suggest that the use of a 3-tier prescription drug co-payment system can gain significant savings without the sacrifice of other medical services. The experimental study of Fairman, et al., (2003) finds that the implementation of a 3-tier prescription drug co-payment system can yield a significant savings of medical costs without affecting the use of other medical services.

[2] The empirical study of Burstrom (2002) finds that an inverse income relationship between income and utilization of medical care exists. This result shows that it is disadvantageous to lower income groups in the utilization of health services.
Gerdtham (1997) also finds evidence to support that the access to medical care is affected by a great number of socioeconomic factors such as income and occupational status. In general, lower income groups have higher

The effect of a reduction in the co-payment rate in small hospitals may lead to an increase in quantity demanded from $q_d$ to $q_d^f$ and improve capacity operating efficiency, but the demanded quantity is still lower than the provided quantity (the real operating capacity in the hospital).

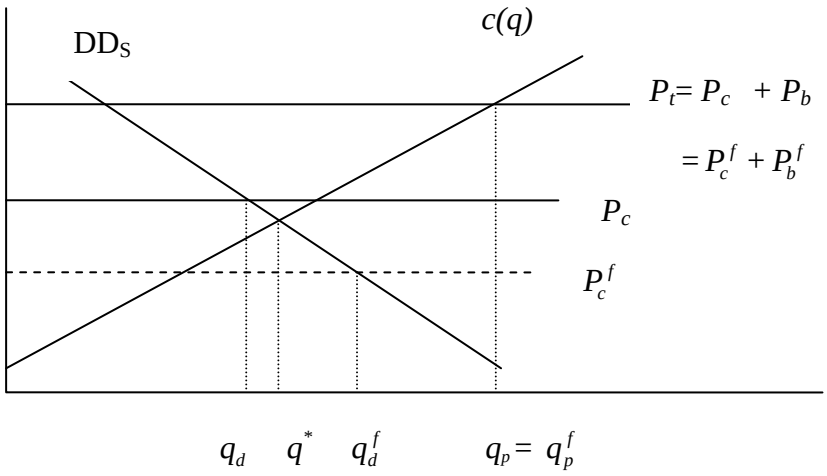



Figure 4. Provision and demanded quantity in small hospitals

The social optima $q^*$ in Figure 3 and Figure 4 are still apart from the real operating capacity $q_p$. This means that the remedy strategy of increasing the gap of co-payment rates between large hospitals and small hospitals does not mitigate the social inefficiency. Some authors also consider a quantity rationing strategy and increased capacity strategy except for the adjustment of the co-payment rate. However, these two strategies have been proven to be inappropriate for implementation. The reasons are listed below:

(1) Quantity rationing may lead to a misallocation of services — The people who mostly demand the service may lose the opportunity for the service. This result means that market inefficiency exists. For example, the treatment of a chronic illness requires highly-qualified physicians and medical equipments that are in general provided for in large hospitals. Patients with a chronic illness who are denied service due to quantity rationing may feel a large

rates of morbidity and mortality than higher income groups, and thus they really need more medical service.

psychological loss (Glazer and Rothenberg 1999).

(2) As to increased capacity, Glazer and Rothenberg (1999) present a theoretical model by assuming that increased capacity does not increase demand and does not increase the marginal cost of service. The results of their analysis show that an increase in service capacity will reduce social welfare and thus "rational voters may favor a reduction in capacity, even when realizing that they may thereby be denied care. One reason is that the lower service thereby induces reduced costs and so reduces taxes or premiums for medical insurance. The other reason is that for any level of service rationing costs decline (Glazer and Rothenberg 1999, p. 675). An increase in capacity is seen as an increase in capital and as a technological change, or as improved incentives.

## 4. The proposed medical system

Even though BNHI aims to create an era of "Universal coverage, Excellent quality of care, Care to disadvantaged groups and Financial stability" (BNHI, 2006, http://www.nhi.gov.tw/english/index.asp), the findings in the previous sections have shown the failure of BNHI's health policy since the disadvantage groups were treated unfair to access health care services. Under such a circumstance, the current medical system should be reformed and re-considered in order to be more efficient and equitable to improve the current health policy and to recover the problems that BNHI faces. However, the strategy of pricing on demand by increasing the co-payment difference between large hospitals and small hospitals to reduce capacity inefficiency has been adopted by BNHI and proven to be not an efficient solution, because it may induce social inequity. The discussions in previous sections also reveal the relative disadvantages of quantity rationing that is costly and increases the patient's waiting time and that of the strategy of increased service capacity that may reduce social welfare.

In this paper we present a framework of a medical system which consists of two parts

(please see Figure 7): (1) the co-payment rate depends on the severity of illness, and (2) an incentive system is based on the health status of residents (the insured) in a community. The suggested co-payment system (please see Section 5.1) can improve capacity inefficiency and reach a social optimum, and the incentive system based on the health status in communities may reduce social inequality for medical care. The details are discussed as follows.

4.1 Co-payment rates depend on the severity of illness

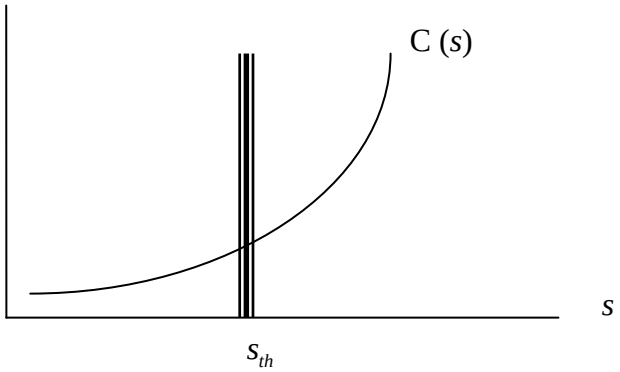



Figure 5. Determination of co-payment rate

It is intuitively true that the cost for a patient's medical care depends on the severity of illness and is expressed as a convex function (please see Figure 5) where *s* denotes the severity of illness, $s_{th}$ is the critical severity of illness, and C(*s*) are the medical costs. In a practical world a great number of diseases that people experience do not require medical care and only require simple self-care or they are not so urgent to see a doctor immediately if the family or the community can take the primary action to avoid an expansion of the illness. Only an illness beyond the threshing point $s_{th}$ for ambulatory care requires to be treated by impatient care with the support of highly-skilled physicians and equipments. In other words, we separate the total demand of medical services into two cases: (1) ambulatory care that can be given by regular medical personnel or with drugs and supplies that are comparatively easy to receive, and (2) inpatient care requires a physician's diagnosis and treatments through the support of highly

expensive medical equipments in a hospital immediately and occurs in a random manner[3] when patients have a severity of illness $s > s_{th}$.[4]

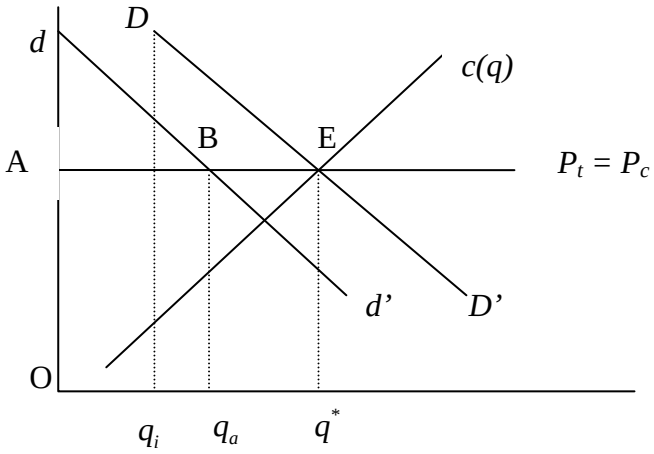



Figure 6. Total payment and co-payment level designed to achieve the social optimum

In the social perspective, the demand function for medial service of impatient care is a vertical line $Dq_i$ in Figure 6, representing that the demand elasticity is zero. In contrast, the demand for ambulatory care[5] will be determined by individuals' psychological factors and represented by $q = q(P_c)$, represented by the curve dd' in Figure 6. The total demand of medical services *DD'* represents the summation of demand for ambulatory care $q = q(P_c)$ and impatient care $Dq_i$.

For impatient care, it is not appropriate to apply the co-payment system due to its

[3] In this paper we assume that the patients are homogenous in incurring such a disease, independent of incomes or other demographical characteristics and need to be sent for impatient treatments.

[4] The point or the regions of $s_{th}$ can be decided through a technical analysis, but many symptoms experienced by individuals are difficult to categorize so that medical care is varied and contested (Heyman, 1995; McCance, et al., 1997). Thus, $s_{th}$ is in practice determined by physicians with subjective judgments and may fall within a range of values.

[5] Some authors based on European countries' historical data to examine the relationship between co-payment rates and medical consumptions (e.g. Nolan, 1993; Chiappori, et al., 1998; Van de Voorde, et al. 2001) and find the price elasticity of the demand for ambulatory care is higher, ranging from 0.17 to 0.31 than that of general medical care services.

inelasticity of demand.[6] Thus, we suggest that the payment for the impatient care is born by the insurer (BNHI) completely, i.e. the co-payment rate is zero. As to ambulatory care, the payment is totally paid by patients at a price of $P_t$ (please see Figure 6), i.e. the co-payment rate for ambulatory care is $P_t$.

Through an economic analysis, the social optimum for all medical care (consisting of ambulatory care and inpatient care) is achieved at the point ($q^*$, $P_t$ ) where the demand *DD'* intersects with marginal costs *c(q)* at the price of $P_t$. In other words, patients for ambulatory care will purchase the medical services at a quantity of $q_a$ that equals to ($q^* - q_i$) (please see Figure 6) at a co-payment rate of $P_c$ that equals to the total payment of $P_t$, and the quantity demanded for inpatient care remains unchanged at $q_i$ and the total payment rate is determined at $P_t$ with a zero co-payment rate. In other words, the patients should pay OAB$q_a$ and the revenue for medical providers is OAE$q^*$. The balance amount of medical services $q_a$BE$q^*$ should be paid by BNHI.

This co-payment system focuses on the elasticity market demand of ambulatory care and sets up the appropriate co-payment rate to guide the patients to behave for self-profits so as to reduce demand for services and to pressure the service providers to improve medical quality and reduce costs. Chernew et al. (2000) suggest that patients can choose the low-cost treatment options for medical care so that it can reduce the over- consumption of medical cares. This system can guide both the patients and the providers' behaviors to coincide with the social optimum without sacrificing capacity efficiency since the quantity of medical demanded coincides with the provision of medical services so that the welfare loss due to low operating efficiency in small hospitals is improved. In other words, the implementation of this system can increase the total social welfare with the achievement of social optima.

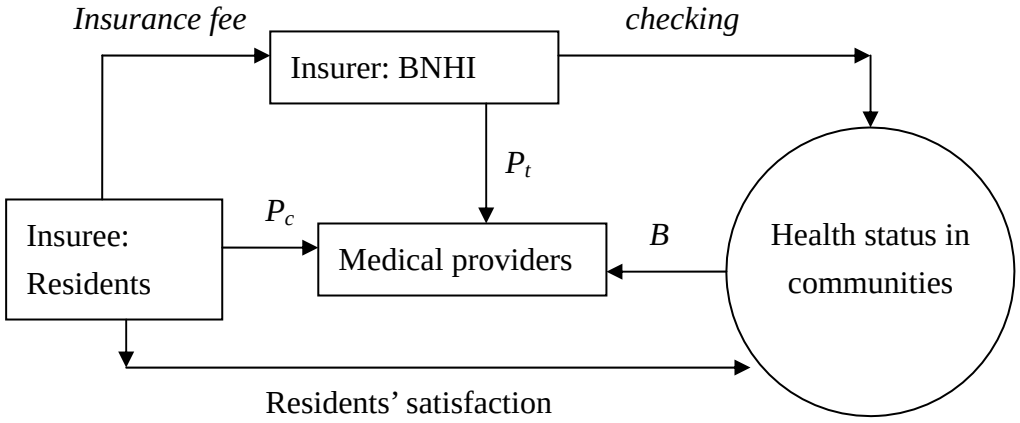
[6] Whether patients require impatient care or not is determined by physicians, and thus patients are only forced to accept physicians' decisions.

4.2 The reform of the payment system

The objectives of the medical policy are to improve health, based not only on the cost consideration and social equity, but also disease prevention. In this section we incorporate the objectives of patients and the hospitals into the framework to find out a solution in which the two parties benefit and the social objectives are easier to achieve. We suggest that BNHI (policy maker as well as insurer) may offer an incentive for medical providers based on the improvement of the health status for a certain community that has signed a contract with medical providers in addition to the total payment rate and co-payment rate determined by Section 5. In other words, the health status of a contracted community and the incentives are correlated in a positive way and determined through a negotiation process between the interested provider and BNHI or through an open tender.

In this 'new' medical system (please see Figure 7), the measurement of the health status should be defined and specified in the medical contract through the design of a health indicator. There are several health indicators used in the world to reflect the performance of medical care. Kaltenthaler, et al., (2004) make a systematic review on a large amount of literature pertaining to the development and use of health indicators. The study of Starfield and Shi (2002) mention that an average ranking for 16 health indicators including low birth weight; neonatal mortality; post neonatal mortality; total infant mortality; life expectancy at ages 1, 15, 40, 65, and 80 for males and females separately; and years of potential life lost from all but external causes for males and females separately (p. 206). We suggest that the criteria for an indicator for health status in the community should positively reflect the resident's opportunity to access to medical care and to receive the care from medical specialists in addition to medical performance. Based on the designed indicator, the health status in each county can be obtained and compared through statistical analysis and put into

the contract as a benchmark for the medical providers to follow.




$P_c$ : co-payment rate paid for ambulatory care
$P_t$ : total payment paid for inpatient care (full rate) and the balance of the co-payment rate for ambulatory care
$B$ : incentives (extra pays) for improvements of the health status in communities

Figure 7. Framework of medical care system

The revenues for medical providers include the co-payment paid by patients for ambulatory care, total payments from BNHI for inpatient care, and incentives from BNHI based on the overall assessment of the health status in the community in which residents' satisfaction with medical providers is also incorporated into the framework. In this case, the contracted medical providers needs to establish a health information management system[7], networked by integrating comprehensive electronic patient records, modern health information system architectures, architectures for medical knowledge centers, specific data processing methods, etc., so as to enhance the trust between patients and physicians and to create appropriate health activities for

[7] Due to rapid progress in digital technology, the management system in our society has been influenced significantly in the past years and the health care management system has also been affected and profited greatly by this development in technology (Haux et al., 2002). They argue that there are three factors, including the development of the population, medical advances, and advances in informatics, that shall greatly influence the further development of information processing in health care within the near future.

improvements of health care services through the mutual cooperation between medical providers and residents. This health information management system also can release the service quality of providers (hospitals) to the public to decrease redundancy and patient transportation and waiting time, which should imply an improvement in medical quality.

As the contracted medical provider's incentives are based on residents' health status, it will be encouraged to create environments supportive of health by investing on better medical equipments and provide more health education with more concern for preventive care at sources that can increase residents' skill in self-care. Considering the economic revenue, the medical provider will choose effective medical methods for curing diseases at minimum costs to increase operating efficiency, and thus medical providers will prefer to create more home-like settings which are beneficial to patients, which tend to help residents identify and address environmental threats to health, and then tracks these factors that affect health in communities in order to ensure that all aspects of community life contribute to the creation of physical and social environments' support for health. This system can produce appropriate incentives for medical providers to maintain medical care quality with the enhancement of efficiency as well as achievements of the objectives for patient satisfaction inherited from the current health care system. It also allows the existence of a competitive market among medical providers so that the implementation of this 'new' medical payment system can increase operational efficiency of the investment provided by the hospitals.

## 5. Conclusions

One of the medical policies is to assure the achievement of a more equitable society and to guarantee medical equality[8] for people with different incomes so that the level of health does not

[8] It is difficult or unavailable to get the objective data for the measurement of medical equality and thus some authors apply the traditional objective of income inequality measurement to assess health inequality (see, for example, Muurinen and Le Grand, 1985, or Culyer and Wagstaff, 1993). To be more objective and practical in

need to depend on one's social or economic status. This system can assure that patients with real demand for inpatient care or emergency care can receive the service without any costs so that the low income groups can be treated more equitably than the current system. Through the implementation of this payment system, patients start for ambulatory care first. If they are identified with the mark of a severe illness, they can be referred or transported for inpatient care or emergency care. This system suggests small hospitals serve as a detector at the front counter to identify whether patients need to be sent for inpatient care. In this case, it does not sacrifice the low income groups to access medical care and provides benefits to reduce medical expenditures, as many authors emphasize that co-payments can reduce costs to the insurer and continue to be beneficial to patients (Leibowitz et al., 1985; Feldstein, 1999). The implementation of this system can help to control the growth of the medical expenditures and increase the service efficiency through the cost-controlling mechanism as more efforts in primary care will result in lower medical costs (Starfield and Shi, 2002).

Our suggested 'new' medical payment system is completely different from the system adopted by Western countries in which the relation between health expenditure and health status is insignificant. Starfield and Shi (2002) argue that medical care with fewer investments on the creation of physical and social environments supportive of health has a relative poorer performance on citizen's health status. We propose that the incentive is increased with the health level of community residents and thus the community and medical provider focus not only on medical care, but also living styles and social environments surrounding the community. Legemaate (2002, p. 101) argues that "health law is intended to create an environment in which the promotion of health goes hand in hand with the protection of individual rights and the general

application, many authors suggest to use self-reported health status (SRHS) data to measure medical inequality (e.g. Kunst et al. 1995 ; Van Doorslaer et al. 1997; Deaton and Paxson, 1998; Kennedy et al. 1998). Mackenbach and Kunst (1997) and Wagstaff and Van Doorslaer (2000) make an overview about the issues of health inequality in a great number of literature.

principles of quality and justice." Our suggested 'new' medical payment system can create a more equitable society in which low income residents enjoy the same opportunity to access medical care.

In addition, this may drive the medical providers to create a health supportive environment through an appropriate education system and encourage the medical providers to identify and work with the low income groups within their community, since these groups are likely to have both the worst health status and the least control over their health and their health care services. Health education on the resident can help people to develop skills so that they can increase control over and improve their health, as residents are generally worried about their health status and thus residents' desire to know more about health is one incentive to implement health education. If a community is educated to prevent sickness penetration and take appropriate action in collaboration with medical providers, then it will be beneficial to both the community and medical providers. From the point of view of promoting a population's health status, health education is a more important way than medical care to be involved with a resident who has become sick.

**Reference**

1. Bureau of National Health Insurance (BNHI), 2004. http://www.nhi.gov.tw/.
2. Berwick, D.M., Godfrey, A.B., Roessner, J., 1991. Curing Health Care. Jossey-Bass Publishers, San Francisco, CA.
3. BNHI, 2006. http://www.nhi.gov.tw/english/reform.asp
4. BBHI, 2006. National Health Insurance Annual Statistical Report (Year 2003), Taipei, BNHI.
5. Campbell, S.M., Roland, M.O., Buetow, S.A., (2000). Defining quality of care . Social Science & Medicine 51, 1611-1625.
6. Chernew, M.E., Encinosa, W.E., Hirth, R.A., 2000. Optimal health insurance: the case of

observable, severe illness. Journal of Health Economics 19, 585–609.

7. Chiappori, P.A., Durand, F., Geoffard, P.Y., 1998. Moral hazard and the demand for physician services: first lessons from a French natural experiment. European Economic Review 42, 499–511.
8. Chinitz D, Preker A, Wasem J. 1998, Balancing competition and solidarity in health care financing. In: Saltman RB, Figueras J, Sakellarides C, editors. Critical Challenges for Health Care Reform in Europe. Buckingham: Open University Press, 55–77.
9. Cockx., B., and Brasseur, C., (2003). The demand for physician services: Evidence from a natural experiment. Journal of Health Economics 22, 881–913.
10. Culyer, A.J., Wagstaff, A., 1993. Equity and equality in health and health care. Journal of Health Economics 12, 431–457.
11. Deaton, A., Paxson, C., 1998. Aging and inequality in income and health. American Economic Review 88 (2), 248–253.
12. Evandrou, M., Falkingham, J., Le Grand, J., & Winter, D. (1992). Equity in health and social care. J. Soc. Pol., 21, 489-523.
13. Fairman, K.A., Motheral, B.R. and Henderson, R.R., 2003, Retrospective, Long-Term Follow-Up Study of the Effect of a Three-Tier Prescription Drug Copayment System on Pharmaceutical and Other Medical Utilization and Costs, Clinical Therapeutics 25, 12, 3147-3161.
14. Feldstein, P.J., 1999. Health Care Economics. 5th ed. Albany, NY: Delmar Publishers.
15. Flood, A.B., Scott, W.R., 1987. Hospital Structure and Performance. The Johns Hopkins University Press, Baltimore, MD.
16. Frank, R., Glazer, J., McGuire, T., 2000. Measuring adverse selection in managed health care. Journal of Health Economics (19:6), 829-854.
17. Gerdtham UG. 1997. Equity in health care utilization: further tests based on hurdle models

and Swedish micro data. Health Economics 6, 303–19.

18. Glazer, J., McGuire, T.G., 2002. Setting health plan premiums to ensure efficient quality in health care: minimum variance optimal risk adjustment. Journal of Public Economics 84, 153–173.
19. Glazer, A., and Rothenberg, L.S., 1999. Increased capacity may exacerbate rationing problems: with applications to medical care. Journal of Health Economics 18, 671–680.
20. Glied, S., Zivin, J.G., 2002. How do doctors behave when some (but not all) of their patients are in managed care? Journal of Health Economics 21 (2), 337–354.
21. Hakansson, S. 1994. New ways of financing and organizing health care in Sweden. International Journal of Health Planning and Management 9, 103–24.
22. Harrison, M.I., Calltorp, J., 2000.The reorientation of market-oriented reforms in Swedish health care. Health Policy 50, 219–40.
23. Haux, R., Ammenwerth, E., Herzog, W., Knaup, P., (2002). Health care in the information society. A prognosis for the year 2013. International Journal of Medical Informatics 66, 3-21.
24. Heyman, B. (1995). Researching user perspectives on community health care. London: Chapman & Hall.
25. Janssen, R., (2002). Evaluation of the organization and financing of the Danish health care system. Health Policy 59, 145–159.
26. Kaltenthaler, E., Maheswaran, R., Beverley, C., (2004). Population-based health indexes: a systematic review. Health Policy 68, 245–255.
27. Kennedy, B.P., Kawachi, I., Glass, R., Prothrow-Stith, D., 1998. Income distribution, socioeconomic status, and self rated health in the United States: multilevel analysis. British Medical Journal 317, 917–921.
28. Kunst, A., Geurts, J., van den Berg, J., 1995. International variation in socioeconomic

inequalities in self-reported health. Journal of Epidemiology and Community Health 49, 117–123.

29. Legemaate, J., (2002). Integrating health law and health policy: a European perspective. Health Policy 60, 101–110.
30. Leibowitz, A, Manning, W, Newhouse, J., 1985. The demand for prescription drugs as a function of cost sharing. *Soc Sci Med.* 21:1063-1069.
31. Li, L.X., Benton, W.C., 1996. Performance measurement criteria in health care organizations. The European Journal of Operational Research 93, 449–468.
32. Lillard LA, Rogowski J, Kington R. 1999. Insurance coverage for prescription drugs: Effects on use and expenditures in the Medicare population. *Med Care*. 37, 926–936.
33. Lowery, J.C., Martin, J.B., 1992. Design and validation of methodologies for determining critical care simulation model. Journal of the Society for Health Systems 3 (3), 15–36.
34. Mackenbach, J.P., Kunst, A.E., 1997. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. Social Science and Medicine 44 (6), 757–771.
35. Macintyre, S., McIver, S., & Sooman, A. (1993). Area, class and health: should we be focusing on class or people? J. Soc. Pol., 22, 213±234.
36. Manning WG, Newhouse JP, Duan N, 1987. Health insurance and the demand for medical care: Evidence from a randomized experiment. *Am Econ Rev*. 77, 251–277.
37. Martin, S., Smith, P.C., 1999. Rationing by waiting lists: an empirical investigation. Journal of Public Economics 71, 141–164.
38. McCance, T. V., McKenna, H. P., & Boore, R. P. (1997). Caring: dealing with a concept. Int. J. Nurs. Stud., 34, 241-248.
39. McNeil, B.J., 2001. Hidden barriers to improvement in the quality of care. The New England Journal of Medicine 22 (345), 1612–1620.

40. Mechanic, D., 1997. Muddling through elegantly: finding the proper balance in rationing. Health Affairs, Septemberr-October, 83–92.
41. Motheral B, Fairman K.A. 2001. Effect of a three-tier prescription copay on pharmaceutical and other medical utilization. *Med Care*. 39, 1293–1304.
42. Neal, R. D., Heywood, P. L., Morley, S., Clayden, A. D., & Dowell, A. C. (1998). Frequency of patients' consulting in general practice and workload generated by frequent attenders: comparisons between practices. British Journal of Gen. Pract., 48, 895-898.
43. Newhouse, J.P., 1993. Free for all? Lessons from the Rand Health Insurance Experiment, Harvard University Press, Cambridge and London.
44. Newhouse, J., 2002. Pricing the Priceless: A Health Care Conundrum. MIT Press, Cambridge.
45. Nolan, B., 1993. Economic incentives, health status and health services utilisation. Journal of Health Economics 12, 151–169.
46. Oakley, A. (1994). Who cares for health? J. Epidemiol. Community Health, 48, 427-434.
47. Propper, C., Burgess, S., Green, K., (2004) Does competition between hospitals improve the quality of care? Hospital death rates and the NHS internal market. Journal of Public Economics 88, 1247– 1272.
48. Robinson, J., & Granfield, A. J. (1986). The frequent consulter in primary medical care. J. Psychosom. Res., 30, 589-600.
49. Rogers, A., Hassell, K., & Nicholaas, G. (1999). Demanding patients? Analysing the use of primary care. Oxford: Oxford University Press.
50. Starfield, B., Shi, L., (2002). Policy relevant determinants of health: an international perspective. Health Policy 60, 201–218.
51. Van der Kar, A., Knottnerus, A., Meertens, R., Dubois, V., & Kog, G. (1992). Why do patients consult the general practitioner? Determinants of their decision. Br. J. Gen. Pract., 42,

313-16.

52. Van Doorslaer, E., Wagstaff, A., Bleichrodt, H., Calonge, S., Gerdtham, U.-G., Gerfin, M., Geurts, J., Gross, L., Hakkinen, U., Leu, R.E., O'Donnell, O., Propper, C., Puffer, F., Rodriquez, M., Sundberg, G.,Winkelhake, O., 1997. Income-related inequalities in health: some international comparisons. Journal of Health Economics 16, 93–112.
53. van de Ven, W.P.M.M., Ellis, R.P., 2000. Risk adjustment in competitive health plan markets. In: Culyer, A.J., Newhouse, J.P. (Eds.), Handbook of Health Economics. North-Holland, Amsterdam.
54. Van de Voorde, C., van Doorslaer, E., Schokkaert, E., 2001. Effects of cost sharing on physician utilisation under favourable conditions for supplier-induced demand. Health Economics 10, 457–471.
55. Wagstaff, A., Van Doorslaer, E., 1994. Measuring inequalities in health in the presence of multiple-category morbidity indicators. Health Economics 3, 281–291.
56. Wagstaff A, van Doorslaer E, Calonge S, 1992. Equity in the finance of health care: some international comparisons. Journal of Health Econmics 11, 361–87.
57. Whitehead, M., Evandrou, M., Haglund, B., and Diderichsen, F., 1997. As the health divide widens in Sweden and Britain, what's happening to access to care? British Medical Journal 315, 1006–1009.

Appendix 1: Notation Lists

| | |
|---|---|
| $c(q, K)$ | marginal cost of providing medical care |
| $q$ | the quantity demanded for medical service |
| $K$ | medical service capacity of a hospital |
| $K_L$ | medical service capacity of a large hospital |
| $K_S$ | medical service capacity of a small hospital |
| $DD_L$ | market demand for medical care in large hospitals |

$DD_S$ market demand for medical care in small hospitals

$q_L^d$ the quantity demanded for large hospitals

$q_S^d$ the quantity demanded for small hospitals

$q_L^p$ the quantity provided by large hospitals

$q_S^p$ the quantity provided by small hospitals

$P_t$ total payment to medical providers (hospitals), equal to marginal revenue

$P_c$ co-payment paid by the patients

$P_c^f$ co-payment after adjustment

$P_b$ the remaining parts of total payment, paid by BNHI

$c_b$ the payment per case paid by BNHI

$P_b^f$ the remaining parts of total payment after the adjustment of copayment

$q_p$ provided quantity (real operating capacity)

$q_p^f$ provided quantity after the adjustment of copayment

$q_d$ quantity demanded for medical service

$q_d^f$ quantity demanded for medical service after the adjustment of coapyment

$q^*$ social optima

$s$ the severity of illness,

$s_{th}$ the critical severity of illness

$Dq_i$ market demand for impatient care

dd' market demand for ambulatory care

$q_a$ quantity demanded for ambulatory care

$q_i$ quantity demanded for impatient care