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Analysis of Healthcare Expenditure In Taiwan: A HLM Model Construction

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ABSTRACT The current National health insurance in Taiwan is a system widely praised by other countries, but the rising healthcare expenditure has been a serious financial issue in recent years. Many scholars have adopted the National Health Insurance Research Database (NHIRD) for all sorts of research studies. However, few have conducted research from the perspective of multiple-level stakeholders, which remains to be a worth exploring research direction. This research addressed the above issue by constructing a Hierarchical linear modeling (HLM) based on the available data in NHIRD in order to identify key factors influencing health spending. A future work is to conduct an empirical study to validate the HLM model, which can be also good reference for future insightful research on multiple-stakeholder perspective.

KEYWORDS : National Health Insurance Research Database National Health Insurance Hierarchical Linear Modeling (HLM) Healthcare Expenditure

INTRODUCTION

It is the responsibility of a government to establish an effective and affordable health insurance scheme for all its population. In Taiwan, National Health Insurance (NHI), characterized by universal coverage, payroll tax financing, comprehensive benefits, national global budget, and public single payer, was launched on 1 March 1995[1]. During this period of time, the scheme has closed the gap of access to health care between the rich and the poor, and protected many families from falling into poverty trap.

Although NHI had achieved broad coverage, low cost, easy accessibility and satisfaction successfully from then on, there were problems behind the scheme. Easy accessibility induces waste of medical resource. Aging needs more funding to fulfill a global coverage. Both easy accessibility and aging result in the rising of healthcare expenditure. Furthermore, fragmented care overuse of prescribed medication, and increasing size of hospitals also have made healthcare expenditure increases significantly [2]. Shortage of resource and funding is the ultimate challenge to National Health Insurance scheme of Taiwan government. The next wave of health care reforms should focus on values and attitudes of medical care system toward medical practice [2]. Clinicians are key-roles of medical care system. Medical practice of clinicians is an important factor for values and attitudes of medical care system toward medical practice, and it can be presented by healthcare expe nditure.

Furthermore, most the above-mentioned health insurance research studies addressed only single-perspective stakeholder, such as patient, doctor, or hospital. However, not all patients are the same since there maybe doctor-level or hospital-level factors influence patient behavior, which may be buried in the average patient statistics. Therefore, this research in interested to explore the multiple-level perspective by adopting the Hierarchical linear modeling (HLM) approach. A brief background literature is given next, followed by an initial attempt of HLM modeling of the healthcare expenditure issue.

BACKGROUND LITERATURE

Aging of population [3, 4], increment of per capita income [5], and development of health-related technology [6, 7] will increase health care expenditure year by year. Deficit of the national health insurance scheme of Taiwan occurred in 1998. Increasing the insurance premiums may aggravate the burden of citizens; on the other hand, changing payment system of hospital of physician may sacrifice the quality of medical services clinicians or medical institutions should provide originally. Medical institutions are platforms, and clinicians are executors. Clinicians' practice, operates the health care system, is a pivotal position in the process of medical care expenditure generation.

The impaction of clinicians' practice on health care expenditure can be present in two aspects: Drug prescription and examination arrangement. As per capita income rising, people ask more and more about health care quality and quantity to maintain happiness of life [5]. On the other hand, as the antagonistic relationship between clinicians and patients increasing, clinicians will use any resource available, including drugs, laboratory tests or examinations, to prevent themselves from medical malpractice, this is the so-called "defensive medicine" [8]. In 2012, the percentage of healthcare expenditure accounted for expense on drugs was ranked second, both in outpatient or inpatient areas. Data from OECD (Organization for Economic Co-operation and Development) also showed that there was a rising trend in the proportion of GDP accounted for expense on drugs in last three decades [9, 10, 11]. Expense on drugs is related to medical practice of clinicians [12], and potentially inappropriate medication use will also increase healthcare expenditure indirectly [13]. High price examinations, such as CT or MRI, also contribute to the rise in healthcare expenditure. A lot of evidences showed that most medical practice of clinicians are related to "dement inducement" [14, 15].

HLM MODELING

HLM is an indispensable statistical method to cope with multi-level data, thus advancing our understanding of organizations. At present, the method has been applied to a lot of fields, such as education, management, economics, and election survey. Organizational science often necessarily involves hierarchically ordered entities. Each of these entities is "nested" within a group. Members of each group share some similarities, and these similarities can't be shared to other groups. Researchers relied on traditional linear regression not only are incapable of capturing potentially meaningful relationship in multi-level data, but also run a higher risk of committing a Type I error, which results from inaccurate estimation of standard error. Data aggregation and disaggregation also result in ecological fallacy and atomistic fallacy, respectively. By using HLM as an analysis method, multi-level data can be evaluated through the use of interdependent regression equations simultaneously.

Frequently used basic models are listed in Table 1. Null model involves no predictor in both levels, while means as outcome involves predictor in level-2 and random coefficient model involves predictor in level-1. When predictors appear in both levels, it is the intercepts and slops as outcome model.

Table 1. HLM Model

Model	Level 1	Level 2
Null Model	$Yij = \beta 0j + \varepsilon ij$	$\beta 0j = \gamma 00 + \mu 0j$
Means as Outcome	$Yij = \beta 0j + \varepsilon ij$	$\beta 0j = \gamma 00 + \gamma 01Zj + \mu 0j$

Random Coefficient	Yij = β0j + β1jXij + εij	β0j = γ00 + μ0j β1j = γ10 + μ1j
Intercepts and Slopes as Outcome	Yij = β0j + β1jXij + εij	β0j = γ00 + γ01Zj + μ0j β1j = γ10 + γ11Zj + μ1j

METHODOLOGY

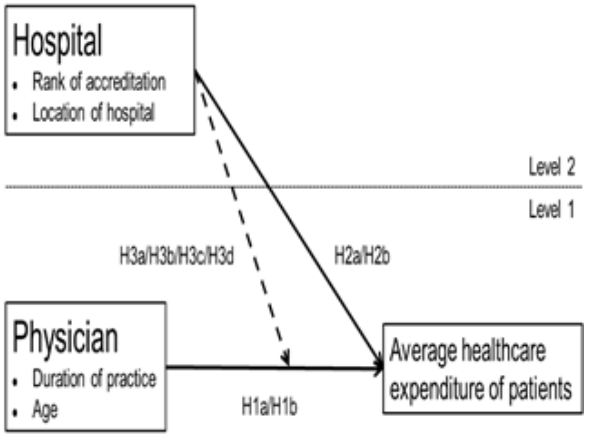
This study utilized data available National Health Insurance Research Database, in which large computerized de-identified databases can be derived by the National Health Insurance Administration, Ministry of Health and Welfare, Taiwan, and maintained by the National Health Research Institutes, Taiwan.

Data are extracted from: (1) Registration files, including Registry for contracted beds, specialty services, medical facilities and registry for board-certified specialists; (2) Original claim data, including ambulatory care expenditures by visits, details of ambulatory care orders, inpatient expenditures by admissions, details of inpatient orders. Usually, the extracted data are then analyzed using IBM SPSS Statistics 20 and HLM 7.0 for multiple-level model as this research.

PATTERN ESTABLISHMENT

As an initial attempt to model the multiple-level model between the physician and hospital, we identified a set of key hospital and physician factors, which impacts healthcare expenditure. Figure 1 depicts the theoretical framework of the study. In general, the relationships presented in Figure 1 are related to the individual-level physician and average healthcare expenditure of patients, and the group-level of hospital. In fact, the outcome variable, average healthcare expenditure of patients may be also treated as a hidden level of patients belong to the physicians, which is not included to complicate this initial modeling research.

Figure 1. Theoretical framework



Accordingly, the following hypotheses are proposed:

H1a: Physician's duration of practice positively influences average healthcare expenditure of patients.

H1b: Physician's age positively influences average healthcare expenditure of patients.

H2a: Hospital's rank of accreditation positively influences average healthcare expenditure of patients.

H2b: Hospital's location positively influences average healthcare expenditure of patients.

H3a: Hospital's rank of accreditation reinforces the positive influence of physician's duration of practice on average healthcare expenditure of patients.

H3b: Hospital's rank of accreditation reinforces the positive influence of physician's age on average healthcare expenditure of patients.

H3c: Hospital's location reinforces the positive influence of physician's duration of practice on average healthcare expenditure of patients.

H3d: Hospital's location reinforces the positive influence of physician's age on average healthcare expenditure of patients.

CONCLUSION

In Taiwan, National Health Insurance has been implemented for about 2 decades. The system is facing some trouble because of its financial problem. This research uses HLM as a new tool to analysis multi-level data from National Health Insurance Research Database for trying to identify key factors influence healthcare expenditure. With this new tool and approach, we hope our proposals will be helpful in providing some new research outcomes for resolving this financial problem of this widely praised national healthcare insurance system in Taiwan.

An immediate future work is to conduct an empirical study on the proposed HLM model with the NHI databased, which should provide a basis for future multiple-perspective research agenda on NHI related issues.

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