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Original Article

The ecology of medical care in Taiwan

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Abstract

Background: In regular administrative statistics for medical services, utilization data are usually presented as aggregate data and lack an individual perspective. The aim of this study was to provide an overview of medical care utilization in Taiwan using a long-established analytical framework, the so-called ecology model.

Methods: Claims data for a cohort of one million people from the National Health Insurance (NHI) Research Database were used to estimate the yearly and monthly prevalence of health care utilization in Taiwan in 2005. Analyses were extended to different types of healthcare settings and were stratified by age and sex. Results are presented per 1000 of the population.

Results: Per 1000 people, 74 did not utilize any NHI services during the year. In a month, 503 people on average utilized at least once NHI service of any kind, 329 visited a physician's clinic (Western medicine), 152 visited a hospital-based outpatient clinic, 19 visited an emergency department, 10 were hospitalized and 3 were hospitalized in an academic medical center. Women were more likely to utilize NHI services than men (274/504 vs. 229/496 in a month). In a month on average, 40.3% (146/362) of young people, 52.2% (166/318) of middle-aged people, 53.3% (121/227) of children and 75.0% (70/93) of elderly people utilized NHI services. Over the whole year, 22.0% (21/93) of elderly people were hospitalized and nearly one-third of them were hospitalized in academic medical centers.

Conclusion: People in Taiwan utilized NHI services frequently and tended to seek medical help in hospitals. Although these features might reflect the higher availability and accessibility of medical care within the NHI in Taiwan, the possibility of overuse deserves further attention. Copyright © 2011 Elsevier Taiwan LLC and the Chinese Medical Association. All rights reserved.

Keywords: ecology; medical care; national health insurance; utilization

1. Introduction

In regular administrative statistics for medical services, utilization data are usually presented as aggregate data and lack an individual perspective. In 1961, White et al proposed a new model in which the number of people among the total population who had utilized medical services in a given period of time is calculated.¹ During the past five decades, this

patient-centered and population-based model, also known as the ecology of medical care, has gained popularity in academic circles worldwide.^{2–4} Repeated surveys have been performed in the United States,⁵ and similar studies have been conducted in other countries.^{6,7} Furthermore, the analysis framework has been extensively applied to medical services for smaller patient groups, such as pediatric care,⁸ asthma patient care,⁹ and mental health care.^{10,11} Many studies of the ecology model may have suffered from bias, in that questionnaires for only a small sample size were used and the results were weighted to represent the total population.^{6–8} These drawbacks could be overcome by using large-scale health insurance claims databases.¹² Since 2000, the National

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Health Insurance Research Database (NHIRD) in Taiwan has provided extensive data sets to domestic researchers and has facilitated hundreds of academic publications.¹³ However, a long-due ecology model of general medical care in Taiwan is still lacking.

In the current study, we used NHIRD cohort data sets for 1,000,000 people to illustrate the ecology of medical care in Taiwan over a period of 1 year. Utilization data for ambulatory care, emergency services and hospitalization within the NHI were analyzed according to White's ecology model. Our results, which are applicable for international comparison, will be of importance in health policy-making.

2. Methods

2.1. Data sources

We used the NHIRD (<http://www.nhri.org.tw/nhird/>) to obtain cohort data sets for 1,000,000 people (Longitudinal Health Insurance Database 2005, LHID2005). These data sets contain original claims data for 1,000,000 people randomly sampled from all NHI beneficiaries in 2005. According to the NHIRD, no significant differences in age or sex distributions exist between beneficiaries in the LHID2005 and those in the original NHIRD.¹⁴

In the current study, we analyzed the ambulatory care (CD) and hospitalization (DD) data sets of LHID2005. The registry for contracted medical facilities in 2005 (HOSB2005) was also used to identify the type of hospital. We chose the 2005 cohort because this was the latest sampled cohort and thus no adjustment or weighting was required for computation. In the future, the 2005 cohort could be used for direct comparisons when cohorts for 2010 and 2015 become available.

2.2. Study design

Based on the ecology model proposed by White,¹ we estimated the proportion of the population in Taiwan who utilized medical services within the NHI in 2005. The analysis was extended to different settings. According to White's ecology model and for international comparison, the following estimates, both yearly and monthly, were computed:

- 1) NHI services utilization: the number of people who utilized an NHI service at least once.
- 2) Visit to a Western medicine (WM) clinic: the number of people who visited either a physician's clinic or a hospital outpatient clinic.
- 3) Visit to a physician's clinic (WM): the number of people who visited a physician's clinic.
- 4) Visit to a hospital outpatient clinic (WM): the number of people who visited an outpatient clinic in any hospital. Hospitals were classified as district hospitals, regional hospitals, and academic medical centers (AMCs). Estimates were generated for each type of hospital.
- 5) Visit to a dental clinic: the number of people who visited a dentist, either in a dentist's clinic or at an outpatient clinic.
- 6) Visit to a traditional Chinese medicine (TCM) clinic: the number of people who visited a TCM physician, either in a TCM physician's clinic or at an outpatient clinic.
- 7) Visit to an emergency department: the number of people who visited an emergency department.
- 8) Admission to a ward in the hospital: the number of people who were admitted to a ward in any hospital and specifically in an academic medical center.
- 9) Homecare: the number of people who received homecare services.
- 10) The demographic variables included age and sex. Age was categorized as 0–17 years (children), 18–39 years (young), 40–64 years (middle-aged) and ≥ 65 years (elderly).

2.3. Statistical analysis

Computation was performed using the scripting software Perl, version 5.12.1.¹⁵ Only descriptive analyses are presented. Monthly estimates were calculated as the mean of 12 estimates, one for each month in 2005.

3. Results

In 2005, the total cohort of 1,000,000 (495,816 women and 504,184 men) included 226,000 persons aged 1–17 years, 361,530 aged 18–39 years, 318,432 aged 40–64 years and 93,438 aged ≥ 65 years (Table 1). During the year, 73,733 people (7.4%) did not utilize any NHI service.

Utilization data were then normalized per 1000 people. In a month on average, 503 people utilized an NHI service of any kind at least once, 329 visited a physician's clinic, 152 visited a hospital-based outpatient clinic, 19 visited an emergency department, 10 were hospitalized and 3 were hospitalized in an academic medical center (Fig. 1). Over the whole year, 926 utilized an NHI service at least once, 823 visited a physician's clinic, 486 visited a hospital-based outpatient clinic, 169 visited an emergency department, 80 were hospitalized and 27 were hospitalized in an academic medical center (Fig. 2).

Women were more likely to utilize NHI services than men (274/504 vs. 229/496 in a month). While a higher proportion of women visited WM physicians' clinics, hospital outpatient clinics, dental clinics, and TCM clinics, a higher proportion of men received emergency services and were hospitalized in AMCs and other hospitals (Tables 1 and 2). For home care, both sexes had a similar utilization rate (0.7/504 vs. 0.7/496 in a month).

In a month on average, 40.3% (146/362) of young people, 52.2% of middle-aged people, 53.3% of children and 75.0% of elderly people utilized NHI services (Table 1). The likelihood of visiting a hospital outpatient clinic increased with age, from 8.9% (18/227) in children to 42.2% (39/93) in elderly people.

Over the whole year, 22.0% (21/93) of elderly people were hospitalized and nearly one-third of admissions were to AMCs (Table 2). The likelihood of hospitalization for elderly people was almost four times as high as that for children and three times that for young and middle-aged people.

Table 1
Monthly utilization estimates for the ecology of medical care in Taiwan in terms of type of care according to age and sex^a

Category	n	NHI	WM	PC	Hospital outpatient clinic (WM)			Dental	TCM	ED	Hospitalized		Home	
		service	clinic	(WM)	Any	LCH	MH	AMC	service	service	visit	Any	AMC	care
Overall	1000	502.9	420.0	329.1	151.6	60.1	59.0	45.0	64.4	67.4	18.9	9.9	3.0	1.4
Age														
<18 y	226.6	120.9	105.8	96.9	18.2	7.4	6.6	5.0	17.3	10.6	4.8	1.3	0.4	0
18–39 y	361.5	145.6	113.8	91.8	33.6	14.0	12.6	8.8	21.4	25.1	6.2	2.5	0.6	0.1
40–64 y	318.4	166.3	137.2	99.7	60.4	23.2	23.7	18.4	20.5	25.5	4.9	3.2	1.1	0.3
≥65 y	93.4	70.1	63.2	40.6	39.4	15.5	16.1	12.8	52	6.2	3.0	3.0	0.9	0.9
Sex														
Male	495.8	228.6	191.1	146.5	70.9	27.6	27.8	21.5	29.5	26.9	9.8	5.1	1.6	0.7
Female	504.2	274.3	228.9	182.6	80.6	32.5	31.2	23.5	34.9	40.6	9.0	4.8	1.4	0.7

^a Data are for individuals who utilized any type of NHI service at least once in a 1-month period and are expressed as number per 1000 population. Abbreviations: AMC = academic medical center; ED = emergency department; LCH = local hospital; MH = metropolitan hospital; NHI = National Health Insurance; PC = physician’s clinic; TCM = traditional Chinese medicine; WM = Western medicine.

4. Discussion

According to our study results, people in Taiwan utilized NHI services frequently in 2005. On average, 420 out of 1000 people in Taiwan paid an ambulatory WM visit in a month, in contrast to only 217 in the USA.⁵ The difference in hospitalization rate between Taiwan and the USA is far less striking: 10 versus 8 persons per 1000 population were hospitalized in a month. While ambulatory visits are initiated by patients, hospitalizations are mainly determined by medical professionals according to disease severity.^{16,17} Population health might not differ greatly between Taiwan and the USA. The high utilization of ambulatory visits in Taiwan could be attributed to easy access to clinics in the densely populated country and low co-payment within the NHI.^{16–21} Among Asian countries, utilization of ambulatory visits in Hong Kong and Japan (372 and 307 per 1000 people in a month) lies between the rates for Taiwan and the USA.^{5–7}

Another feature of the medical care ecology in Taiwan is that people tended to seek medical help at hospitals. The proportion of people who visited a hospital outpatient clinic in Taiwan (152 per 1000 people in a month) was much greater than that in Japan (88) and the USA (21).^{5,6} In addition, people in Taiwan were more likely to be admitted to an AMC (3 per 1000 people in a month) than those in Hong Kong (1), Japan

(1) and the USA (<1).^{5–7} This does not necessarily mean that people in Taiwan had more serious medical problems. On the contrary, it might reflect the easy and free access to all public and private healthcare facilities in Taiwan without referral.^{12,21} Other reasons may be that the definition of an AMC and the proportion of AMC beds in all hospital beds vary from country to country.

The use of TCM was more popular in Taiwan than in other countries. On average, 67 per 1000 people in Taiwan visited a TCM clinic in a month, in contrast to 49 in Japan and 54 in Hong Kong.^{6,7} The NHI reimbursement scheme might play an important role.²² In the USA, as many as 65 per 1000 people received complementary and alternative medicine (CAM) treatment in a month, but the CAM spectrum is much broader than that of TCM.²³ Within the NHI, the popularity of TCM has seemed to remain constant in recent years. A previous study reported that 28.4% of people in Taiwan visited a TCM clinic in 2001.²⁴ Furthermore, because most NHI beneficiaries utilized WM, we can deduce that most TCM users did not exclude WM for treatment. Similar findings were reported in another study.²⁵

In the current study, male and female NHI beneficiaries differed in their utilization of medical help. Women were possibly more health-conscious²⁶ or had lower employment rates²⁷ and thus had more time to visit physicians during office hours. However, it has been reported that men usually seek

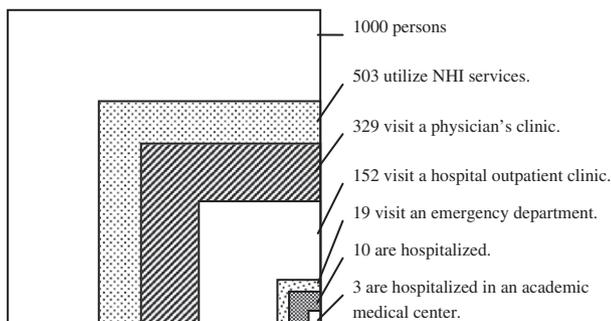


Fig. 1. Monthly prevalence estimates of healthcare utilization in Taiwan in 2005. Each box does not necessarily represent a subgroup of the larger box (i.e. some values overlap). Values are based on 1000 individuals.

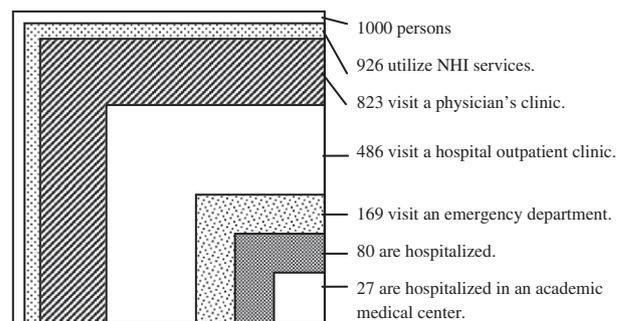


Fig. 2. Yearly prevalence estimates of healthcare utilization in Taiwan in 2005.

Table 2
Yearly utilization estimates for the ecology of medical care in Taiwan in terms of type of care according to age and sex^a

Category	n	NHI	WM	PC	Hospital outpatient clinic (WM)				Dental	TCM	ED	Hospitalized		Home
		service	clinic	(WM)	Any	LCH	MH	AMC	service	service	visit	Any	AMC	care
Overall	1000	926.3	886.3	822.7	485.7	245.8	222.1	161.2	388.4	283.5	168.6	80.3	26.6	2.5
Age														
<18 y	226.6	218.4	213.9	208.9	84.6	40.1	35.1	25.2	98.1	47.9	42.9	12.7	4.1	0
18–39 y	361.5	324.9	305.9	284.0	155.4	79.6	67.7	45.1	139.7	112.9	57.9	22.8	6.1	0.2
40–64 y	318.4	292.6	277.7	251.6	173.1	87.0	81.7	61.7	121.3	99.6	44.4	24.2	9.0	0.6
≥65 y	93.4	90.4	88.8	78.1	72.5	39.1	37.6	29.2	29.4	23.2	23.4	20.5	7.4	1.7
Sex														
Male	495.8	447.5	423.4	386.0	226.4	112.5	102.5	73.8	180.2	119.3	87.6	39.2	13.7	1.3
Female	504.2	478.8	462.9	436.7	259.3	133.3	119.6	87.4	208.2	164.2	81.0	41.1	12.9	1.3

^a Data are for individuals who utilized any type of NHI service at least once in 2005 and are expressed as number per 1000 population. Abbreviations are as in Table 1.

medical help at a later stage of illness.²⁸ Such a delay might lead to a higher proportion of men with visits to the emergency department or hospitalization, as revealed in the current study.

Elderly people utilized more NHI resources in all medical services settings than other age groups. Although the person-based ecology model does not reveal the intensity and frequency of medical care utilization, a previous study revealed that elderly people typically have a high visit frequency.¹² There are some possible reasons. First, a higher proportion of elderly people have chronic diseases,²⁹ which might require regular follow-ups. Second, chronic diseases are often accompanied by multiple co-morbidities,²⁹ which might increase the likelihood of ambulatory care visits, emergency services use, or hospitalization.³⁰ Third, because elderly people usually have more free time and the NHI does not have high co-payment,¹⁸ the threshold for seeking medical care is relatively low for this age group. A greater number of ambulatory care visits is usually associated with “doctor shopping”,¹² polypharmacy, and a higher risk of receiving potentially inappropriate medication.³¹ These geriatric issues deserve further attention.

Our study has some limitations. First, our analysis was based solely on NHI claims data sets. The results thus do not reflect the utilization of medical services not reimbursed by the NHI. Second, our study did not stratify the cohort by geographic region because the NHIRD does not include residence data for beneficiaries. Third, the ecology model is only one of the methods available for assessing the utilization of medical services. This model does not include the intensity of service use, the continuity of care, and illness severity, and misuse, abuse, and underuse of medical services are not calculated. Fourth, the financial aspect, an essential part of healthcare delivery, was not analyzed in our study. Fifth, *p* values or confidence intervals were not shown in the analysis. The *p* value, if applicable in the analysis, would be less than 0.05 for nearly all tests, and the confidence interval would be extremely narrow because the sample size of the cohort was quite large.

In conclusion, people in Taiwan utilized NHI services frequently and tended to seek medical help at hospitals in 2005. Although these features might reflect the higher

availability and accessibility of medical care within the NHI in Taiwan, the possibility of misuse deserves further attention. Elderly people had a far higher utilization rate of ambulatory care visits and hospitalization than younger people. In a rapidly aging society such as Taiwan, the geriatric issue in medical care gives serious cause for concern.

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