Original Article

Cost of Illness of the Obstetrical Diseases in Japan: a Time-trend and Future Projection Analysis

Eijiro Hayata[1)] Kunichika Matsumoto[2)] Takefumi Kitazawa[2)]
Kanako Seto[2)] Mineto Morita[1)] and Tomonori Hasegawa[2)*]

[1)]Department of Obstetrics and Gynecology, Toho University Omori Medical Center
[2)]Department of Social Medicine, Toho University School of Medicine

ABSTRACT

Background: Many problems associated with pregnancy and childbirth are associated with public health policies and require the attention of society as a whole. We chronologically observed the social costs for obstetrical diseases to obtain an overview of the changes and determine future prospects.

Methods: Using the cost-of-illness (COI) method based on official government statistics, we calculated COI for obstetrical diseases (ICD10 Code: O01-99) from 1996 to 2014 and estimated future COI projections, that is, for the period from 2017 to 2029. COI includes both direct and indirect costs (morbidity and mortality costs).

Results: COI increased by 28.5% between 1996 and 2014 mainly because of increased direct costs during this period. COI of a single birth increased by 54.5% between 1996 and 2014.

Our future predictions included an estimation of changes in the constant trends of COI, assuming that current trends of health-related indices would persist (estimated COI in 2029: 250.6-307.0 billion yen, depending on the model used). COI per birth was estimated to increase until 2029 and (331,000-407,000 yen, depending on the model used).

Conclusions: We estimated that COI would remain unchanged in the future, provided current trends of health indices remain constant. Although the number of birth would reduce, the economic burden pertaining to each pregnancy and delivery would increase. Accelerated social participation of women and the promotion of measures to prevent the declining birth rate may lead to future increases in COI.

Toho J Med 4 (2): 58–65, 2018

KEYWORDS: cost of illness, perinatal disease, health economics, health policy

Introduction

Advances in medical science and technology have led to an increase in medical costs across developed nations worldwide. This increase has also been observed in Japan, mainly owing to its rapidly aging population and continued stagnation of economic growth. Therefore, it is important to conduct an economic assessment to determine how to efficiently assign limited medical resources.

Although there are a lot of problems associated with pregnancy and childbirth (e.g., low birth rate and increased number of high-risk deliveries[1)]) that involve public health policies and need to be addressed by society as a whole, there are few reports in Japan focusing on eco-

1) 6–11–1 Omorinishi, Ota, Tokyo 143–8541, Japan
2) 5–21–16 Omorinishi, Ota, Tokyo 143–8540, Japan
*Corresponding Author: tel: +81 3 3762 4151 (Ext. 2415)
e-mail: tommie@med.toho-u.ac.jp

DOI: 10.14994/tohojmed.2017-013
Received Nov. 10, 2017: Accepted Dec. 22, 2017
Toho Journal of Medicine 4 (2), June 1, 2018.
ISSN 2189–1990, CODEN: TJMOA2

nomic assessments required for public policy making.

Thus, the aim of this study was to chronologically observe the social costs of obstetrical diseases (ICD10 code: O01-99, "pregnancy, childbirth, and the puerperium") and form an overview of its changes comprising those pertaining to future prospects to elucidate changes in the burden placed on society.

Materials and Methods

1. Analytical method

In this study, social cost was measured on the basis of the cost of illness (COI), estimated using official government data and the COI method advocated by Dorothy Rice.[2–9] Since the 1960s, this method has been widely used for economic assessment of COI and determination of public policy[10–14]. The COI method includes both direct cost (DC) and indirect cost (IC). IC includes both morbidity cost (MbC) and mortality cost (MtC). COI is calculated using the following equation:

1) $COI=DC+MbC+MtC$

DC includes the medical costs such as treatment, hospitalization, testing, and drug costs that are a direct result of the illness. In this study, we used the Survey of National Medical Care Insurance Services[15] to calculate annual medical costs from medical care fees for obstetrical diseases (ICD-10 code: O01-99, "pregnancy, childbirth, and the puerperium"). In this study, obstetrical diseases (ICD-10 code: 01-99) includes almost all complications of pregnancy (e.g., gestational diabetes, preeclampsia, and placenta previa), abnormal pregnancies (e.g., multiple pregnancy and breech presentation), and disorders around delivery (e.g., postpartum bleeding, fetal distress, and amniotic fluid embolism).

IC includes the cost of opportunities lost because of illness and death. MbC and MtC are calculated using the following equations:

2) $MbC=TOVy\times LVd/2+THD\times LVd$

3) $MtC=NMDy\times LVl$

Where TOVy indicates the "total person-days of outpatient visits," LVd indicates the "1-day labor value per person," THD indicates the "total person-days of hospitalization," NMDy indicates the "number of maternal deaths," and LVl indicates the "lifetime labor value per person."

TOVy and THD were calculated for 5 year age increments using Patient Survey[16] data. Labor values were calculated for 5 year age increments using data from Basic Survey on Wage Structures,[17] Labor Force Survey,[18] and Estimates of Monetary Valuation of Unpaid Work.[19] We calculated MbC with the assumption that hospitalization resulted in loss of one work day and an outpatient visit resulted in the loss of half a work day. MtC was calculated as the loss of human capital in the form of the total amount of income that would have been earned in the future if the patient had not died. NMDy was calculated for 5 year age increments using Vital Statistics[20] data, and this was then used to calculate the LVl with the assumption that the patient had lived from the time of death until the average life expectancy.

LVd and THD were calculated using the equations shown below:

4) $LVd=(Iy+ULVy)/365$

5) $THD=HPy\times ALOS$

Iy indicates the "annual income per person,[17]" ULVy indicates the "annual monetary valuation of unpaid work per person,[19]" HPy indicates the "annual number of hospitalized patients,[16]" and ALOS indicates the "average length of stay.[16]" Future labor value was corrected to the current value using a discount rate of 3%. This value was selected as it was recommended by developed countries that commonly use the COI method, including the United States and Japan.

2. Chronological COI estimates

To assess chronological changes, available past data were used to estimate COI for 3 year intervals from 1996 to 2014.

Thereafter, we calculated COI for 3 year intervals from 2017 to 2029 to estimate future prospects using two methods.

We calculated the health index by fixing the average number of outpatient visits, the average number of hospitalizations, ALOS, and the medical fees per examination at the level observed in the 2014 data and then calculated the estimates assuming that only the population and age distribution of Japan would change (fixed model estimation). Medical fees per examination were obtained from the Survey of National Medical Care Insurance Services.[15] We first calculated the average number of outpatient visits and the average number of hospitalizations for 2014 because this year was used as the base. These figures were then multiplied with the estimated population in 5 year age increments from 2017 to 2029, and the TOVy and THD for each year were calculated. Using data from 2014, ALOS, average life expectancy, and labor value were used to estimate MbC and MtC. DC was determined by multiplying the rate of change in average number of hospital visits and average length of stay for every examined year starting from 2014 based on the outpatient and hospitalization costs for 2014.

The second method involved calculating the estimates assuming that health index trends would also change at the current pace in addition to population and age distribution trends. After calculating approximation curves (logarithmic and linear) for all items using data starting from 1996, we measured the numerical expressions and calculated the values from 2017 to 2029. Using this method, we obtained different estimates of future prospects, depending on the trend followed. Estimates were calculated using the following three patterns: 1) the logarithmic model estimation in which all items were calculated using logarithmic approximations, 2) the linear model estimation in which all items were calculated using linear approximations, and 3) the mixed model estimation in which all calculations were performed using the higher approximation of the coefficient of determination for each item. Logarithmic and linear model estimations would produce different annual trends depending on the item; thus, single estimates are likely to produce overestimated or underestimated values. We therefore compared determination coefficients within the same age group in both the logarithmic and linear approximation curves and performed a mixed model estimation using the curve with the higher coefficient in each age group. We believe that the mixed model produced the most valid estimates in this study. We used the 2014 data for average life expectancy and labor value. We also used the Population Estimates[21] published by the Ministry of Internal Affairs and Communications between 1996 and 2014 and the Population Projections for Japan[22] published by the National Institute of Population and Social Security Research between 2017 and 2029. The number of maternal deaths and the maternal mortality rate should have been included in the health indices, but it was impossible to estimate the annual and by-age annual trends because these figures were extremely low in Japan. In this study, we calculated the number of maternal deaths for 5 year age increments and the cumulative totals for a 10 year period from 2005 to 2014. Thereafter, we calculated the future projected maternal mortality rate by multiplying these figures with the estimated population for each year. Elements using COI future projections are shown in Table 1.

Ethical considerations

This study used only aggregated and published nationwide data that are freely available online. No humans or animals were used. In Japan, no institutional review board approval is required for this type of study.[23]

Results

1. COI estimates from 1996 to 2014

COI was 248.9 billion yen in 1996, 292.7 billion yen in 1999, 279.1 billion yen in 2002, 244.9 billion yen in 2005, 296 billion yen in 2008, 269.1 billion yen in 2011, and 319.8 billion yen in 2014 indicating an increase of 28.5% from 1996 to 2014 (Table 2). Although DC increased by 94.7% (from 102.7 billion yen to 200.0 billion yen), MbC decreased by 15.5% (from 137.9 billion yen to 116.5 billion yen) and MtC decreased by 62.7% (from 8.3 billion yen to 3.1 billion yen). The birth rate for women aged ≥35 years as well as the average maternal age was seen to increase. The number of maternal deaths and the maternal mortality ratio exhibited declining trends. COI per live birth increased by 54.9% from 206,000 yen in 1996 to 319,000 yen in 2014. The costs related to normal delivery were not included in COI because these were paid as a separate fixed amount by health insurance in Japan.

2. COI projections for the period from 2017 to 2029

The COI future projections of all three models are shown in Table 3.

The projected number of live births showed a declining trend, which was consistent with past trends. The average maternal age was projected to remain unchanged, and the live birth rate for pregnant women aged ≥35 years was projected to decline.

Our mixed model estimation remains unchanged in COI, from 302.4 billion yen in 2017 to 307.0 billion yen in 2029. Although DC showed increasing trend, MbC, and MtC exhibited declining trends from 2017. COI per live birth was projected to increase by 21.1% from 336,000 yen in 2017 to 407,000 yen in 2029.

Our linear model estimation showed similar trend to mixed model that COI remained unchanged from 304.6 billion yen in 2017 to 306.4 billion yen in 2029. Although DC showed increasing trend, MbC and MtC exhibited declining trends from 2017. COI per live birth was projected to increase by 21.1% from 336,000 yen in 2017 to 406,000 yen in 2029.

Our logarithmic model estimation showed that COI de-

Table 1 Elements used for calculation of predicted future cost of illness

Model	Item	Elements used for calculation	Fixed or Varied
Fixed model	Number of deaths	Maternal mortality rate	Fixed
		The population estimates	Varied
	Direct cost	The expenses of outpatient visit and hospitalization	Fixed (Calculated using the unit cost in 2014)
		Medical fees per examination	Fixed
		Total person-days of outpatient visit	Varied
		Total person-days of hospitalizations	Varied
	Morbidity cost	Average number of outpatients	Fixed
		Average number of hospitalizations	Fixed
		Average length of stay	Fixed
		The population estimates	Varied
		Labor-value	Fixed
	Mortality cost	Number of maternal deaths	Varied
		Life expectancy	Fixed
		Labor-value	Fixed
		Discount rate: 3%	Fixed
・Linear mode ・Logarithmic model ・Mixed model	Number of deaths	Maternal mortality ratio	Fixed
		The population estimates	Varied
	Direct cost	The expenses of outpatient visit and hospitalization	Fixed (Calculated using the unit cost in 2014)
		Medical fees per examination	Varied
		Total person-days of outpatient visit	Varied
		Total person-days of hospitalization	Varied
	Morbidity cost	Average number of outpatient visits	Varied (Calculated using the trend line formula) (minimum value: the previous value before 0)
		Average number of hospitalizations	Varied (Calculated using the trend line formula) (minimum value: the previous value before 0)
		Average length of stay	Varied (Calculated using the trend line formula)
		The population estimates	Varied
		Labor-value	Fixed
	Mortality cost	Number of maternal deaths	Varied
		Life expectancy	Fixed
		Labor-value	Fixed
		Discount rate: 3%	Fixed

Fixed: The value for 2014 was used. Varied: The values from 2017 to 2029 were calculated on the basis of the trend line.
Source of medical fees per examination: Patient Survey [16].
Source of average length of stay: Patient Survey [16].

clined by 12.4%, from 289.0 billion yen in 2017 to 253.3 billion yen in 2029. DC, MbC, and MtC showed a declining trend starting from 2017. The contribution ratio for COI decline was 45.4% for DC, 51.8% for MbC, and 2.8% for MtC. COI per live birth was projected to increase until 2020 and remain unchanged thereafter.

Our fixed model estimation showed that COI declined by 15.0%, from 294.7 billion yen in 2017 to 250.6 billion yen in 2029. DC, MbC, and MtC exhibited a declining trend. The contribution ratio for COI decline was 54.4% for DC, 43.3% for MbC, and 2.3% for MtC. COI per live birth was projected to remain nearly unchanged thereafter.

Discussion

COI showed an overall increasing trend between 1996 and 2014. When health indices were taken into consideration, the mixed model estimation (considered to have the highest validity) indicated that COI would remain unchanged with increasing trend of DC and declining trends of MbC and MtC.

The rise in COI between 1996 and 2014 was largely driven by the increase in DC because MbC and MtC showed a declining trend. The birth rate for pregnant women aged ≥35 years and the average maternal age both

Table 2 The time trend of cost of illness (COI) of the obstetrical diseases

	1996	1999	2002	2005	2008	2011	2014
Number of live birth (thousand person)	1,206	1,178	1,154	1,063	1,091	1,059	1,003
[% of 35 years or older of maternal age]	9.8%	11.1%	12.8%	16.4%	20.9%	24.7%	27.6%
Average maternal age of delivery (year)	28.7	29.0	29.3	29.9	30.4	30.8	31.2
Number of maternal deaths (person)	72	72	84	62	39	41	33
Maternal mortality rate (per 100 thousands of childbirth)	5.8	5.9	7.1	5.7	3.5	3.8	3.2
Direct cost (billion yen)	102.7	153.8	146.6	131.4	172.8	154.4	200.0
Morbidity cost (billion yen)	137.9	131.0	123.3	106.8	119.1	110.6	116.5
Mortality cost (billion yen)	8.3	7.9	9.2	6.7	4.1	4.1	3.3
COI (billion yen)	248.9	292.7	279.1	244.9	296.0	269.1	319.8
COI per live birth (thousand yen)	206.4	248.5	241.9	230.4	271.3	254.1	318.8

Number of live birth, Average maternal age of delivery, Number of maternal deaths, and Maternal mortality ratio: Vital statistics, Ministry of Health, Labour and Welfare. [20]

Table 3 Future prediction of cost of illness (COI)

model	Item	2017	2020	2023	2026	2029
	Estimated number of live birth (thousand person)	899	836	797	774	755
	[% of 35 years or older of maternal age]	25.2%	24.6%	23.5%	22.6%	22.4%
	Estimated average maternal age of delivery (year)	30.7	30.6	30.4	30.3	30.4
	Estimated number of maternal deaths (person)	49	46	43	41	40
	Estimated maternal mortality rate (per 100 thousands of childbirth)	4.8	4.7	4.4	4.3	4.3
Mixed model	Direct cost (billion yen)	190.1	199.6	201.5	206.0	212.5
	Morbidity cost (billion yen)	106.9	103.0	97.3	93.3	90.1
	Mortality cost (billion yen)	5.4	5.1	4.8	4.6	4.4
	COI (billion yen)	302.4	307.7	303.6	303.9	307.0
	COI per live birth (thousand yen)	336.4	367.9	381.0	392.8	406.5
Linear model	Direct cost (billion yen)	190.7	199.6	201.5	206.0	212.5
	Morbidity cost (billion yen)	108.5	101.3	96.8	92.4	89.5
	Mortality cost (billion yen)	5.4	5.1	4.8	4.6	4.4
	COI (billion yen)	304.6	306.0	303.1	303.0	306.4
	COI per live birth (thousand yen)	338.9	365.9	380.4	391.7	405.7
Logarithmic model	Direct cost (billion yen)	180.0	178.4	171.1	166.5	163.8
	Morbidity cost (billion yen)	103.6	99.1	92.3	88.0	85.1
	Mortality cost (billion yen)	5.4	5.1	4.8	4.6	4.4
	COI (billion yen)	289.0	282.6	268.2	259.1	253.3
	COI per live birth (thousand yen)	321.5	337.9	336.6	334.9	335.4
Fixed model	Direct cost (billion yen)	168.4	159.2	152.9	148.3	144.4
	Morbidity cost (billion yen)	120.9	113.5	108.3	104.6	101.8
	Mortality cost (billion yen)	5.4	5.1	4.8	4.6	4.4
	COI (billion yen)	294.7	277.8	266.0	257.5	250.6
	COI per live birth (thousand yen)	327.9	332.2	333.9	332.9	331.8

increased. This suggests that women were giving birth at an older age, which could be related to increased numbers of high-risk pregnancies and deliveries. However, as the number of maternal deaths and the maternal mortality rate declined, significant advances appear to have been made in the field of obstetrics. COI per live birth increased by 54.5% between 1996 and 2014, and we believe that this was largely owing to improvements in the field of obstetrics in response to the higher number of high-risk pregnancies and childbirths. Improvements in obstetrics may

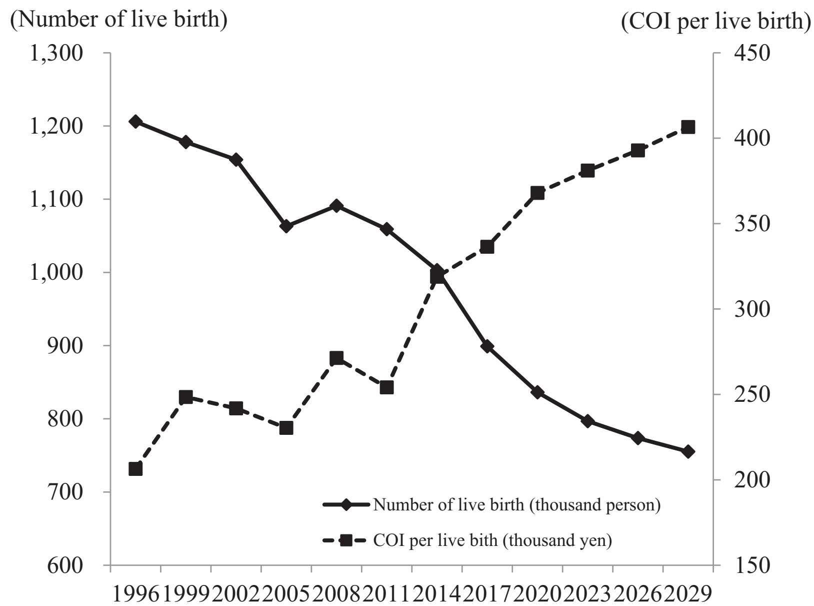

Fig. 1 The number of live births and COI per live birth

have led to increased medical costs (increased DC) and declines in opportunity cost losses owing to illness (decreased MbC).

In the mixed model estimation, COI would remain unchanged. Decrease of MbC was countered by the rise of DCs. Reduction of MbC is thought to be due to the reduction in number of childbirth. In other words, the opportunity loss due to obstetrical diseases is reduced because of decrease of women who engage in pregnancy and delivery. This hypothesis is supported by the similarity of reduction rate of the number of births from 2017 to 2029 (16.0%) and that of MbCs (15.7%). Increase in DCs reflects its strong trend from the past estimates. In the past estimates, the increase of DC is thought to be due to improvements in obstetrics in response to the higher number of high-risk pregnancies and childbirths. This trend can be predicted to continue in the future. The increase of COI per live birth in the future is also thought to be the result of this trend. However, there is a possibility that the higher number of high-risk pregnancies and childbirths would be strongly related factors other than maternal age because the average maternal age was projected to remain unchanged, and the live birth rate for pregnant women aged ≥35 years was projected to decline. Thus, increasing pressure (the improvement in obstetrics and higher risk delivery) and reducing pressure (reduced number of childbirths) would become antagonistic, and economic burden of each pregnancy and childbirth would increase (Fig. 1). COI may exhibit increases if in the future, measures designed to halt declining birth rates are actively implemented and the number of live births increase at nearly the same rate as maternal age distributions.

Because the COI method is specifically designed to calculate costs, one of its advantages is its ability to easily perform the type of economic assessment of the burden of illnesses required for public policy. For this reason, it is widely used in countries such as the United States, Canada, and Australia.[24, 25] Studies calculating the economic burden of illness using the COI method are being conducted in Japan as well, and some of these have been chronological projections for cancer.[26, 27] However, because there are no studies that assess future projections for pregnancy-related illnesses, it is necessary to investigate whether the COI method can be applied to this field. In Japan, 99% of all childbirths take place at hospitals or clinics.[20] Because this means that it is possible to ascertain maternal mortality with near certainty, MtC figures are extremely accurate. In addition, because there is a system of periodic maternal health checkup in Japan covering almost all pregnant women, obstetric-related illnesses are detected at an early stage, enabling early intervention to easily be performed. Therefore, DC figures seem to be accurate. Furthermore, most women who have suffered from an obstetrical disease experience no sequelae or disabilities, thereby quickly returning to their normal lives. In particular, this means that because the period during which the woman is undergoing rehabilitation or home treatment and is "not engaged in social activity even though not in hospital or visiting hospital" is extremely short, MbC figures are extremely accurate. We accordingly believe that our use of the COI method to assess the economic burden of obstetrical diseases is valid.

There are several reports on the economic burden of obstetrical diseases. For example, Kirigia et al.[28] calculated the ICs of maternal mortality in 45 African countries in 2010 using the COI method. This study estimated that there were 147,741 maternal deaths in a single year, representing an economic burden of 45 billion US dollars. This indicated the need for health interventions for young women. Chodkck et al.[29] calculated the DCs of pregnancy in 2006 using the COI method, compared these with the DCs of other chronic diseases (hypertension, diabetes, cancer, and female infertility) and called for the prioritization of public policy intervention in such cases. These studies indicate that the use of the COI method to measure the monetary value of the burden of illnesses facilitates the rational determination of how limited medical resources can be efficiently used. It also provides basic data that can be used to create public policy proposals related to the prevention and management of injury and illness. Therefore, the results of this study can be applied to the determination of future public policies.

This study had a number of limitations. These included the fact that the COI method makes macro estimations of costs alone, without consideration of the quality of medical care or QOL, and cannot be used to examine the cost-effectiveness of treatment techniques at a micro level. Moreover, because future projections were fixed to 2014 levels for annual labor value, the MbC and MtC estimates obtained in this study may be underestimates if women make further social participation resulting in higher income in the future. Furthermore, the opportunity cost losses and cost burden associated with maternal health tests and normal childbirth that are not covered by the national health insurance were not taken into consideration. However, policies designed to compensate women for these social burdens, including public expenditure for maternal health tests, one-time payment childbirth subsidies, and maternity leave, are becoming more widespread including normal pregnancies. Thus, we believe that these factors did not affect the present study, which mainly focused on the economic burden of illness.

In conclusion, the use of government statistics allows the calculation of future projections for the COI of obstetrical diseases. The results of our investigation indicated that COI would be likely to remain unchanged in the future if health indices change along the same trends, and economic burden of each pregnancy and childbirth would increase. COI may increase in the future if the social participation of women increase rapidly and measures designed to halt the decline in the birth rate are further promoted.

Acknowledgements: There are no specific contributors to acknowledge. No funding agency or grant supported this project.

Conflicts of interest: Non declared.

References

1) Matsumoto K, Tanaka M, Maemura T, Hirao T, Hasegawa T, Hasegawa Y. The demand for obstetricians and ob-gyn specialists and their uneven distribution in regional communities. Journal of the Japan Society for Healthcare Administration. 2007; 44: 93-103.
2) Rice DP. Estimating the cost of illness. Am J Public Health Nations Health. 1967; 57: 424-40.
3) Rice DP, Hodgson TA. The value of human life revisited. Am J Public Health. 1982; 72: 536-8.
4) Crum GE, Rice DP, Hodgson TA. The priceless value of human life. Am J Public Health. 1982; 72: 1299-300.
5) Rice DP, Hodgson TA, Kopstein AN. The economic costs of illness: a replication and update. Health Care Financ Rev. 1985; 7: 61-80.
6) Rice DP. Cost-of-illness studies: fact or fiction? Lancet. 1994; 344: 1519-20.
7) Rice DP. Cost of illness studies: what is good about them? Inj Prev. 2000; 6: 177-9.
8) Tarricone R. Cost-of-illness analysis: What room in health economics? Health Policy. 2006; 77: 51-63.
9) Hodgson TA, Meiners MR. Cost-of-illness methodology: a guide to current practices and procedures. Milbank Mem Fund Q Health Soc. 1982; 60: 429-62.
10) Miller LS, Zhang X, Novotny T, Rice DP, Max W. State estimates of Medicaid expenditures attributable to cigarette smoking, fiscal year 1993. Public Health Rep. 1998; 113: 140-51.
11) Warner KE, Hodgson TA, Carroll CE. Medical costs of smoking in the United States: estimates, their validity, and their implications. Tob Control. 1999; 8: 290-300.
12) Kirschstein R. Disease-Specific Estimates of Direct and Indirect Costs of Illness and NIH Support. Washington, DC: National Institutes of Health; 2000.
13) The U.S. Environmental Protection Agency (EPA). Cost of Illness Handbook. [Cited 5 Aug 2015]. Available from: http://www.epa.gov/oppt/coi/pubs/execsum.html
14) Ministry of Health. Report on New Zealand Cost-of-Illness Studies on Long-Term Conditions. Wellington. Ministry of Health. [Cited 5 Aug 2015]. Available from: http://www.moh.govt.nz/moh.nsf/pagesmh/9258/$File/nz-cost-of-illness-jul09.pdf
15) Survey of National Medical Care Insurance Services, Ministry of

Health, Labour and Welfare. [Cited 5 Aug 2015]. Available from: http://www.mhlw.go.jp/toukei/list/26-19.html
16) Patient survey, Ministry of Health, Labour and Welfare. [Cited 5 Aug 2015]. Available from: http://www.mhlw.go.jp/toukei/list/10-20.html
17) Basic survey on wage structure, Ministry of Health, Labour and Welfare. [Cited 5 Aug 2015]. Available from: http://www.mhlw.go.jp/toukei/list/chingin_zenkoku.html
18) Labor force survey, Ministry of Internal Affairs and Communications. [Cited 5 Aug 2015]. Available from: http://www.stat.go.jp/data/roudou/
19) Cabinet Office: System of National Accounts, Satellite Accounts, and Unpaid Work. [Cited 5 Aug 2015]. Available from: http://www.esri.cao.go.jp/jp/sna/sonota/satellite/satellite_top.html
20) Vital statistics, Ministry of Health, Labour and Welfare. [Cited 5 Aug 2015]. Available from: http://www.mhlw.go.jp/english/database/db-hw/vs01.html
21) Population Estimates, Ministry of Internal Affairs and Communications. [Cited 5 Aug 2015]. Available from: http://www.stat.go.jp/data/jinsui/
22) Population Projections for Japan, National Institute of Population and Social Security Research. [Cited 5 Aug 2015]. Available from: http://www.ipss.go.jp/syoushika/tohkei/suikei07/suikei.html#chapt1-1
23) Ethical Guidelines for Epidemiological Research: [Cited 5 Aug 2015]. Available from: http://www.lifescience.mext.go.jp/files/pdf/n796_01.pdf
24) Hjelmgen J, Berggren F, Anderson F. Health economic guidelines-similarities, differences and some implications. Value Health. 2011; 4: 225-50.
25) Tarricone R. Cost-of-illness analysis. What room in health economics? Health Policy. 2006; 77: 51-63.
26) Haga K, Matsumoto K, Kitazawa T, Seto K, Fujita S, Hasegawa T. Cost of illness of the stomach cancer in Japan—a time trend and future projections. BMC Health Serv Res. 2013; 13: 283.
27) Hayata E, Seto K, Haga K, Kitazawa T, Matsumoto K, Morita M, et al. Cost of illness of the cervical cancer of the uterus in Japan—a time trend and future projections. BMC Health Serv Res. 2015; 15: 104.
28) Kirigia JM, Mwabu GM, Orem JN, Muthri RDK. Indirect cost of maternal deaths in WHO African Region in 2010. BMC Pregnancy and Childbirth. 2014; 14: 299.
29) Chodick G, Porath A, Alapi H, et al. The direct cost of cardiovascular diseases, hypertension, diabetes, cancer, pregnancy and female infertility in a large HMO in Israel. Health Policy. 2010; 95: 271-6.