

Economic loss of chronic kidney disease in Chun district, Phayao province

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ABSTRACT

This study is an analysis of the economic loss and loss of income, and a holistic approach of life expectancy of outpatient who has chronic kidney disease in Chun district, Phayao province. The sample is an outpatient with chronic kidney disease and admitted to the Chun hospital, Chun district, Phayao, for 300 people in a total. The cost of hospital data is used for analysis the cost of providing care for patients with chronic kidney disease, and allocated by using simultaneous equation method the descriptive statistics, percentage and average are used in the analysis of economic loss. The holistic health of the population measurement model (Disability-Adjusted Life Years-DALYs) is used to find the economic loss throughout a holistic life expectancy. The results found that the total economic loss cost was 14,624.98 baht per person in annual. The cost of providing care for patients showed a maximum value for 47.24 percent. The total economic loss throughout a holistic life expectancy was 368,605.38 baht per person, which in terms of the opportunity cost of premature death showed a maximum value of 97.79 percent. Obviously, the economic loss in terms of the opportunity cost of premature death was the highest cost. Therefore, if a patient was likely to increase or death with chronic kidney disease, this would result in economic loss up.

Keywords: chronic kidney disease, simultaneous equation method, disability-adjusted life years, economic loss, hospital cost

JEL Classification: I15, C87, C88

1. Introduction

In the past fiscal year 2011, the Office of Public Health, Phayao sorted a priority of public health problem by using the rates of sickness and mortality in analysis. It showed that renal disease was a problem affecting the health status in rank 2nd and if it found by the district, mortality from renal disease in the second most common was Chun district, Phayao (ranked second from Phu kamyao district) and if it considered the rate of patient with chronic kidney disease per, it found that Chun district had the rate of patient with chronic kidney disease in the second rank, as can be seen that chronic kidney disease is a problem that affects the health status of patient.

Health service is an important in part of reducing or preventing chronic kidney disease, especially for a community hospital because of their proximity to the public. If they release the health information or the patient knows information or details about chronic kidney disease, it is possible to prevent loss and the early treatment can be improved.

Chun hospital is a community hospital under the Office of Public Health, Phayao, responsible for a population of 50,984 people with 766 chronic kidney disease patients who are in charge of the hospital. Based on information obtained from a patient with chronic kidney disease who received treatment in hospital, it found that the most patients with chronic kidney disease were farmers. Most of these groups would use the right of health insurance coverage among the elderly people and low income for the services in hospital effecting to an increasing of government expenditures or budget used in the treatment and care of patient with chronic kidney disease. In addition, chronic kidney disease affects a wide area in the patient, family, health services, and economic loss.

2. Literature review

2.1 Hospital cost

Sukanya Khongsawat (1991) studied the unit cost of outpatient service, Department of internal medicine, Chulalongkorn hospital. This costing studied in the provider's view, and divided into three cost centers; non - revenue producing cost center (NRPCC), patient service area (PS), and revenue producing cost center (RPCC). The full cost calculation was used an allocation model with simultaneous equation method to solve the problem of allocating cost among departments. Dherasak Wongyai (2007) applied the same model or simultaneous equation method to allocated cost. This method is the most accurate of the other methods for allocating costs, because it solves reciprocal costs among cost centers (Meeting DT, 1978 referred to Walaiporn Patcharanarumol, Kanjana Tisayathikom, and Viroj Tangchroensathien, 2001, p. 25-26).

Unchalee Permsuwan, Yongyuth Ruanta, and Kanchana Hattasin (2005) studied the comparison unit cost of before and after services of universal health coverage scheme. The objective was to compare the unit cost of service before and after the universal health coverage scheme, and double allocation method was used in this study. That was different method from Sukanya Khongsawat (1991) and Dherasak Wongyai (2007) studies. Moreover, the difference allocation methods referred to a slightly results (Foyle,

1978 referred to Walaiporn Patcharanarumol, Kanjana Tisayathikom, and Viroj Tangchroensathien, 2001).

2.2 Disability adjusted life years or DALYs

International Health Policy Program Thailand, Ministry of Public Health (2004) showed the study of years of life lost due to disability from cardiovascular disease, Thailand 2004. This study would explore only a years of life lost due to disability (YLD) and used DISMOD model to estimate the values and consistency of data. This study is used disability weight or DW from global burden of disease and Dutch weights. The results revealed that the years of life lost due to disability (YLD) in 2004, the Thai population had YLD 1.4 hundred thousand years or 225 years per 100,000 people.

Nafar, and others (2008) studied the Burden of Chronic Kidney Disease in Iran: A Screening Program was of essential need for the purpose of the burden of chronic kidney disease in Iran in 2004. The study calculated Disability adjusted life years or DALYs of chronic kidney disease which was split into five levels of severity. Nafar, and others (2008) applied the same model or DISMOD model in estimation and consistency of data. This study is used questionnaire to define the disability weight or DW of chronic kidney disease. A result showed that the value of all DALYs severity of the disease was equal to 1,145,645 years.

3. Methodology

The analysis in this section is divided into two major parts. The first part presents the analysis of the situation of chronic kidney disease, and economic loss of out-patients with chronic kidney disease in Chun district, Phayao province. Second part presents the cost analysis of income loss thoughtout a holistic life expectancy in terms of the opportunity cost during in sickness and opportunity cost of premature death.

Part 1 An analysis of the chronic kidney disease's situation, and economic loss of out-patients with chronic kidney disease in Chun district, Phayao province

An analysis in this part was calculated direct cost and indirect cost. Direct costs were including hospital cost of providing care for patients with chronic kidney disease, patient's medical expense, and cost of traveling. Indirect costs were including any opportunity cost of both out-patient and relative. The calculated steps are listed in below.

3.1 Direct costs

3.1.1 Calculate the hospital cost of providing care for patients with chronic kidney disease in Chun district, Phayao province (Figure 1)

Step 1 Identify Chun hospital's cost centers and grouping

Cost center can be classify into 4 groups, which are non - revenue producing cost center (NRPCC), revenue producing cost center (RPCC), patient service area (PS), and non - patient service area (NPS). In other words, cost center can be classify into 2 major groups; 1) transient cost center (TCCs) or non - revenue producing cost center

(NRPCC), and 2) absorbing cost center (ACCs), which are revenue producing cost center (RPCC), patient service area (PS), and non - patient service area (NPS).

Step 2 Calculate the total direct cost for each cost center including labor cost (LC), material cost (MC), and capital cost (CC)

The following formula was used to calculate the total direct cost:

$$\text{Total direct cost} = \text{Labor cost} + \text{Material cost} + \text{Capital cost}$$

$$\text{TDC} = \text{LC} + \text{MC} + \text{CC}$$

Step 3 Allocation of all costs to absorbing cost center (ACCs)

This step is to allocate costs from transient cost center or NRPCC to the absorbing cost center (ACCs) in term of indirect cost by using simultaneous equation method or the linear algebraic equation.

Step 4 Calculate full cost for each cost center

This step is to calculate full cost for each cost center including total direct cost (TDC) and indirect cost or following formula:

$$\text{Full cost} = \text{Total direct cost} + \text{Indirect cost}$$

Step 5 Calculate the cost of providing care for patients with chronic kidney disease (per person per year)

The cost of providing care for patients with chronic kidney disease can be calculated from full cost of the special clinics (diabetes, high blood pressure, chronic kidney disease) divided by the number of chronic kidney disease patient in Chun hospital.

The following formula was used to calculate the cost of providing care for patients with chronic kidney disease (per person per year):

$$\text{The cost of providing care} = \frac{\text{Full cost of the special clinics}}{\text{Number of chronic kidney disease patient}}$$

3.1.2 Calculate patient's medical expense

A patient's medical expense is equal to the sum of hospital's medicine cost in a year.

3.1.3 Cost of traveling

Cost of traveling for both out-patient and relative can be calculate from cost of traveling multiply by number of out-patient service in Chun hospital.

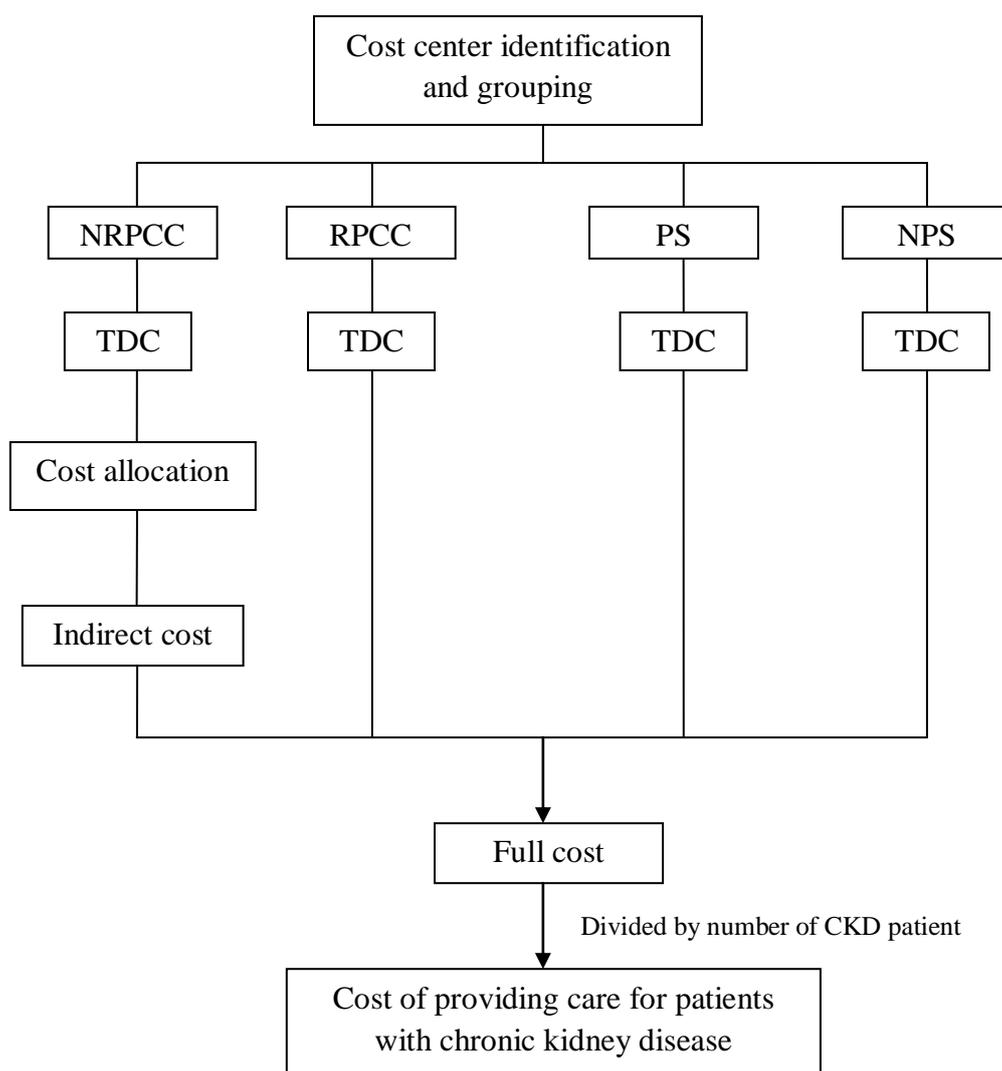


Figure 1. Steps to calculate the cost of providing care for patients

3.2 Indirect costs

Indirect costs were including any opportunity cost of both out-patient and relative. There are time cost for travel, time cost of waiting for medical examination of both patient and relative, income loss of patient due to sickness, and income loss of patients' relative to care for patient.

- 1) Time cost for travel can be calculated from income per hour multiply by travel time to get medical care in hospital (hour).
- 2) Time cost of waiting for medical examination can be calculated from income per hour multiply by waiting time for medical examination (hour).
- 3) Income loss of patient due to sickness can be calculated from number of day that cannot go to work in a year multiply by income per day.

- 4) Income loss of patients' relative to care for patient can be calculated from number of day that provides patient care in a year multiplies by income per day.

Part 2 An analysis of economic loss thoughtout a holistic life expectancy in terms of the opportunity cost during in sickness and opportunity cost of premature death.

3.3 An opportunity cost during in sickness can be calculated in 3 steps.

Step 1 Calculate the total of years of life lost due to disability (YLD) with discounting health with time and age weights

The total of years of life lost due to disability (YLD) with discounting health time and age weights can be calculated from several variables. There are disability incidence-I, disability duration-L, disability weight-DW, age of death-a, discount rate-r, age-weighting constant-C, parameter from age weighting function- β , and age weighting modulation parameter-K. These variables can be estimated by DISMOD model.

The total of the years of life lost due to disability (YLD) was calculated by this formula:

$$\text{Total YLD} = I \times DW \left\{ \frac{KCe^{ra}}{(r - \beta)^2} \left[e^{-r(r+\beta)(L+a)} [-(r + \beta)(L + a) - 1] - e^{-(r+\beta)a} [-(r + \beta)a - 1] \right] + \frac{1 - K}{r} (1 - e^{-rL}) \right\}$$

Where:

- a = age of death (years).
- r = discount rate (usually 3%).
- C = age-weighting constant (standard value is 0.1658).
- β = parameter from age weighting function (standard value is 0.04).
- K = age weighting modulation constant (full age weight is 1).
- L = duration of disability (years).
- DW = disability weight (value is 0.2167).
- I = disability incidence

Step 2 Calculate the YLD per person by calculating the total YLD divided by the number of patient with chronic kidney disease in a total of 766 people.

Step 3 Calculate the opportunity cost during in sickness could be calculated from this equation.

Opportunity cost during in sickness = Years of life lost due to disability (YLD) per person x Per capita income of population in Chun District, Phayao province

3.4 An opportunity cost of premature death can be calculated in 3 steps.

Step 1 Calculate the total of years of life lost (YLL) with discounting health with time and age weights

The total of years of life lost (YLL) with discounting health time and age weights can be calculated from several variables. There are number of deaths- N, age of death-a, discount rate-r, age-weighting constant-C, parameter from age weighting function-β, age weighting modulation parameter-K, and standard life expectancy at age of death-S. These variables can be estimated by DISMOD model and standard life expectancy at age of death estimated from West level 26.

The total of the years of life lost (YLL) was calculated by this formula:

$$\text{Total YLL} = N \times \left\{ \frac{KCe^{ra}}{(r - \beta)^2} \left[e^{-r(r+\beta)(S+a)} [-(r + \beta)(S + a) - 1] - e^{-(r+\beta)a} [-(r + \beta)a - 1] \right] + \frac{1 - K}{r} (1 - e^{-rS}) \right\}$$

Where:

- a = age of death (years).
- r = discount rate (usually 3%).
- C = age-weighting constant (standard value is 0.1658).
- β = parameter from age weighting function (standard value is 0.04).
- K = age weighting modulation constant (full age weight is 1).
- S = standard life expectancy at age of death (years).
- N = number of deaths.

Step 2 Calculate the YLL per person by calculating the total YLL divided by number of death due to chronic kidney disease in a total of 17 people (Chun Hospital, Chun District, Phayao, 2011).

Step 3 Calculate the opportunity cost of premature death could be calculated from this equation.

Opportunity cost of premature death = Years of life lost (YLL) per person x per capital income of population in Chun District, Phayao province

4. Data

This study used a questionnaire to gather data from a sample and used the calculation technique of Taro Yamane at a confidence level of 95% to find a sample size of outpatients with chronic kidney disease who were treated at Chun hospital for 766 people in 2011 (Chun Hospital, Chun District, Phayao, 2011). A sample size was approximately 300 samples. There was a multi-stage random method to calculate the number of samples in each career group and select a sample by a chance random from inpatient in each career group who was admitted to special clinic for diabetes, high blood pressure, and chronic kidney disease at Chun Hospital, Chun District, Phayao, during in March-May 2012.

The researcher gathered the data for this study as follows.

4.1 The primary data was collected by questionnaires from patients with chronic kidney disease and their relatives in Chun district. The questionnaire was a series of question for general information, information about the treatment of patient, expense information, and the opportunity cost of patients and their relatives.

4.2 The secondary data was divided into two parts.

- 1) The following data were used to analyze economic loss of out-patients with chronic kidney disease in Chun district, Phayao province.

TABLE 1. Data for analyzing economic loss of out-patients with chronic kidney disease in Chun district, Phayao province

No.	Data	Source of data
1	Number of patient with chronic kidney disease in 2011	Chun hospital, Chun district, Phayao in 2011
2	Labor cost in 2011	Chun hospital, Chun district, Phayao in 2011
3	Material cost in 2011	Chun hospital, Chun district, Phayao in 2011
4	Capital cost in 2011	Chun hospital, Chun district, Phayao in 2011
5	Medicine cost in 2011	Chun hospital, Chun district, Phayao in 2011

- 2) The following data were used to analyze economic loss throughout a holistic life expectancy with chronic kidney disease in Chun district, Phayao province.

TABLE 2. Data for analyzing economic loss throughout a holistic life expectancy with chronic kidney disease in Chun district, Phayao province

No.	Data	Source of data
1	Number of patient with chronic kidney disease in 2011	Chun hospital, Chun district, Phayao in 2011
2	Income per capita of population in Chun district, Phayao in 2011	The Phayao provincial office of the comptroller general in 2011
3	Standard life expectancy at age of death-West level 26	World Health Organization
4	Population data categorized by age and sex in 2011	Chun hospital, Chun district, Phayao in 2011
5	Total number of deaths from chronic kidney disease in Chun district, Phayao, in 2011	Chun hospital, Chun district, Phayao in 2011
6	Average disability weights for chronic kidney disease	1. Global burden of disease study or GBD 2004 from World Health Organization 2. Disability weights for diseases in the Netherlands or Dutch weights 3. Victorian Burden of Disease Study or Victorian weights 4. Burden of Chronic Kidney Disease in Iran

5. Results

A result of the economic loss of chronic kidney disease was divided into two parts: the first part was the chronic kidney disease's situation and economic loss of out-patients with chronic kidney disease in Chun district, Phayao province (per person per year), which were direct and indirect costs, and the second part was the economic loss throughout a holistic life expectancy in Chun district, Phayao province (per person), which were the opportunity cost during in the sickness and premature death.

Part 1 The chronic kidney disease's situation and economic loss of out-patients with chronic kidney disease in Chun district, Phayao province (per person per year)

The chronic kidney disease's situation in Chun district, Phayao province was more severely for chronic kidney disease's patient, because Chun district had the rate of patient with chronic kidney disease in the second rank, as can be seen that chronic kidney disease is a problem that affects the health status of patient.

The result found that the total cost was equal to 14,624.98 baht per person per year. The highest valuable cost of this part was 47.24 percent of hospital cost of providing care for chronic kidney disease patient, followed by 21.75 percent of the medicine cost, 8.20 percent of income loss of patients' relative to care for patient, 7.88 percent of the travel cost, 4.92 percent of the relatives' time waiting for their patient's medical examination, 4.10 percent of the patients' income loss due to sickness, 4.08 percent of the patients' time waiting for medical examination, 0.98 percent of the relative's time cost for traveling, and 0.84 percent of the patient's time cost for traveling respectively (See table 3).

Part 2 The cost of economic loss throughout a holistic life expectancy in terms of the opportunity cost during in sickness and opportunity cost of premature death (per person)

The result found that it was 368,605.23 baht per person. The highest valuable cost was 97.79 percent of the opportunity cost of premature death, followed by 2.21 percent of the opportunity cost during in sickness respectively (See table 3).

TABLE 3. The calculation of the Economic loss of Chronic Kidney Disease in Chun district, Phayao province

Types of cost	Amount	Percentage of total cost
Economic loss of chronic kidney disease		
1. Direct costs		
(1) Hospital cost of providing care	6,908.75 baht/person/year	47.24
(2) Medicine cost	3,181.38 baht/person/year	21.75
(3) Cost of traveling	1,152.89 baht/person/year	7.88
Total direct cost	11,243.02 baht/person/year	76.88
2. Indirect costs		
(1) Time cost for travel		
- Patients'	122.63 baht/person/year	0.84
- Relatives'	143.43 baht/person/year	0.98
(2) Time cost of waiting for medical examination		
- Patients'	596.29 baht/person/year	4.08
- Relatives'	719.83 baht/person/year	4.92
(3) Income loss of patient	599.99 baht/person/year	4.10
(4) Income loss of patient's relative	1,199.79 baht/person/year	8.20
Total indirect cost	3,381.96 baht/person/year	23.12
Total cost of economic loss of chronic kidney disease	14,654.98 baht/person/year	100
Economic loss cost throughout a holistic life expectancy		
1. The opportunity cost during in the sickness	8,148.00 baht/person	2.21
2. the opportunity cost of premature death	360,457.23 baht/person	97.79
Total cost of economic loss throughout a holistic life expectancy	368,605.23 baht/person	100

Source: From a calculation

6. Discussions

In the study, the hospital cost of providing care for out-patients with chronic kidney disease (per person per year) was different from unit cost of out-patient service (per service). The hospital cost of providing care for out-patients aims to find out medical cost or expense that the hospital was paid for a patient's service, more than determines an amount of costs involved in out-patients with chronic kidney disease services.

The data was used to estimate the prevalence of chronic kidney disease in Chun district, Phayao province. It was from the patient who admitted in 2011. Disability weights are defined from other studies, because Thailand's burden of disease was not studied in disability weights for chronic kidney disease in Thai's population.

7. Concluding remarks

In the present study, the result showed that the total economic loss of out-patients with chronic kidney disease (per person per year) were equal to 14,624.98 baht per person per year. The hospital cost of providing care for chronic kidney disease patient showed the highest cost for 47.24 percent. Obviously, this cost was the result to government or related agencies to bear the high cost of medical care services. And if a chronic kidney disease patient was likely to increased, this would result in economic loss up too. The total economic loss throughout a holistic life expectancy was 368,605.38 baht per person, which in terms of the opportunity cost of premature death showed the highest cost for 97.79 percent. Therefore, this economic loss was affected directly and indirectly to patient, family, social, and overall economy. With this situation, the public sector or the related agencies should take measures to reduce or prevent the disease. It makes people aware and involved in self-care and prevention of chronic kidney disease or reduces the probability of the disease. Since there is no medicine to cure chronic kidney disease, therefore the cost of treatment is expensive. Therefore, the prevention of chronic kidney disease in the early phase is very important (Chagriya Kitiyakara, 2004) to reduce the economic loss that will occur in the future.

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