Willingness-to-Pay per Quality-Adjusted Life Year in Thais:

Discrete Choice Experiment Study

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I hereby certify that this work has not been accepted in substance for any degree, and is not being currently submitted in candidature for any degree.

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ชื่อวิทยานิพนธ์ ความเต็มใจจ่ายต่อปีสุขภาวะของชาวไทยโดยวิธี Discrete Choice Experiment

ผู้เขียน นายคชาพล นิ่มเดช

สาขาวิชา เภสัชศาสตร์สังคมและการบริหาร

ปีการศึกษา 2558

บทคัดย่อ

ค่าเพดานความคุ้มค่าต้นทุน-ประสิทธิผลเป็นเครื่องมือที่สำคัญสำหรับการประเมินความคุ้มค่าทางเศรษฐศาสตร์ของเทคโนโลยีทางการแพทย์ในด้านการส่งเสริมสุขภาพ การป้องกันโรค และการรักษาโรค การวิจัยนี้มีวัตถุประสงค์เพื่อหาค่าความเต็มใจจ่ายต่อปีสุขภาวะในประเทศไทยสำหรับกำหนดเป็นค่าเพดานความคุ้มค่าโดยใช้วิธี discrete choice experiment ผู้วิจัยได้ออกแบบชุดตัวเลือกด้วย orthogonal design โดยใช้ระดับและมิติสุขภาพของ EQ-5D-3L รวมทั้งค่าใช้จ่ายเป็นระดับและคุณลักษณะของ discrete choice experiment จากการออกแบบชุดตัวเลือกทำให้ได้ชุดตัวเลือกทั้งสิ้น 36 ชุดตัวเลือก กลุ่มตัวอย่างได้มาจากการสุ่มแบบบังเอิญจำนวนจากประชากรในจังหวัดสุราษฎร์ธานี สงขลา และยะลา และทำการวิเคราะห์ผลด้วย multinomial logit model โดยใช้ตัวแปร effect coding

ผู้ตอบคำถาม 459 คน จาก 485 คน (94.63%) สามารถจินตนาการและตอบคำถามตามสถานการณ์สมมุติที่กำหนดให้ได้ ค่าความเต็มใจจ่ายในการรักษาชีวิตมีค่าระหว่าง 1,994 ถึง 633,940 บาท ซึ่งขึ้นอยู่ผลการรักษาและปีภาวะสุขภาพที่ได้รับ และค่าเฉลี่ยความเต็มใจจ่ายต่อปีสุขภาวะในการรักษาชีวิตเท่ากับ 671,888 บาทต่อปีสุขภาวะหรือประมาณ 4.00 เท่าของค่าผลิตภัณฑ์มวลรวมในประเทศต่อหัวประชากรในปี พ.ศ. 2556 ค่าความเต็มใจจ่ายของภาวะสุขภาพ 243 ภาวะสุขภาพเพื่อให้มีสุขภาพสมบูรณ์มีค่าระหว่าง 10,494 - 1,523,457 บาท และค่าเฉลี่ยความเต็มใจจ่ายต่อปีสุขภาวะของภาวะสุขภาพระดับต่ำ กลาง และสูง มีค่าเท่ากับ 399,252 (2.38) 785,146 (4.68) และ 1,035,267 (6.17) บาทต่อปีสุขภาวะ (เท่าของค่าผลิตภัณฑ์มวลรวมในประเทศต่อหัวประชากร)

ค่าความเต็มใจจ่ายได้สะท้อนถึงความคิดเห็นของชาวไทยในการดูแลรักษาสุขภาพและจากผลการศึกษาแสดงให้เห็นว่าค่าเพดานความคุ้มค่าเพื่อใช้ในการคัดเลือกเทคโนโลยีทางการแพทย์นั้นไม่ควรเป็นค่าเดียวแต่ควรขึ้นอยู่กับระดับความรุนแรงของโรคเป็นสำคัญ อีกทั้งค่าเพดานความคุ้มค่าในปัจจุบันของไทยซึ่งกำหนดไว้ที่ 160,000 บาทต่อปีสุขภาวะนั้นอาจจะต่ำเกินไปเมื่อเทียบกับความคิดเห็นของประชาชนโดยเฉพาะอย่างยิ่งสำหรับการรักษาชีวิต

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ABSTRACT

Cost-effectiveness threshold is important tool for decision making in economic evaluation of health interventions e.g. drugs, vaccines, and health programs. The objective of study was to examine willingness-to-pay per quality-adjusted life year in Thailand using discrete choice experiment for setting cost-effectiveness threshold. Total 36 choice sets were selected by orthogonal design Attributes and levels were based on dimensions and levels of EQ-5D-3L. Four hundred and eighty five respondents staying in Suratthani, Songkla, and Yala were convenience sampled. Data were analyzed by multinomial logit model, and effect coding.

Four hundred and fifty nine respondents (approximately 94% of all respondents) could imagine, and answer the question following the hypothetical scenario. Ten variables from eleven variables were significantly influencing factors of preference and WTP. WTP for life saving treatment varied 1,994 to 633,940 Baht which depended on treatment outcome and additional QALYs. Its average WTP per QALY was 671,888 Baht/QALY (4.00 times of GDP per capita in 2013). WTP of 243 health states for moving to perfect health state varied from 10,494 to 1,523,457 Baht, and their average WTP per QALY of mild, moderate and severe health states were 399,252 (2.38), 785,146 (4.68) and 1,035,267 (6.17) Baht/QALY (times of GDP per capita).

WTP derived from this study reflected the opinions of Thai population in health care treatment. These WTP per QALY supported that CE threshold should be set as flexible CE thresholds following the severity of disease, and current CE threshold of Thailand as 160,000 Baht/QALY seem not cover CE threshold derived from public opinion, especially, for life saving treatment.

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Chapter I

Introduction

1.1 Background

Increasing health expenditures around the world has been an important problem. World Health Organization (WHO) reported that, globally, total health expenditures (THE) as a percentage of gross domestic product (GDP) in 2008 was 8.5% and varied across regions e.g. 6% in African region, 12.6% in the region of North America, 8.5% in European region, 4.2% in Eastern Mediterranean region, 5.8% in Western Pacific region and 3.8% in South-East Asia region (1). In addition, Organization for Economic Co-operation and Development (OECD) showed that annual average percentage growths in health expenditure per capita were more than annual average percentage growths in GDP per capita in almost every country (2). In Thailand, THE was 367,767.4 million Baht in 2008, which increased from 127,655 million Baht (2.9 times) in 1994. It was about 4.0% of Thailand GDP. THE per capita in 2008 was 5,802 Baht, which increased from 2,160 Baht (2.7 times) in 1994 (3). Previously, Thai government supported nearly 70% of the THE and the remainders were paid by others including patients. National Health Insurance Law in Thailand started in 2002. It was based on the country's constitutional law. Since then, Thailand had three major health insurance schemes, which were the Universal Coverage Scheme (UC), the Social Security Scheme (SSS), and the Civil Servant Medical Benefit Scheme (CSMBS). The UC covers about 75% of the country's population, while the CSMBS and SSS together cover approximately 22%. Consequently, Thai government has been responsible for almost all THE (4). Undoubtedly, Thai government needs health policies to efficiently allocate resources (5, 6).

Generally, any government cannot support all innovative drugs because they usually are expensive. Policy makers need to carefully assess because some of them can be breakthrough technologies. Health technology assessment (HTA) has therefore been adopted worldwide. In Thailand, Health Intervention and Technology Assessment Program (HITAP), a non-profit research organization, was established to take responsibility for providing the best

evidence of efficient health technologies, programs, and interventions for Thai government (7). HITAP recommended cost-effectiveness analysis (CEA) and cost-utility analysis (CUA) as two main types of economic evaluation in Thai health technology assessment guideline and EQ-5D-3L as a measurement in valuing quality of life. In addition, cost-effectiveness threshold (CE threshold) was recommended for decision-making process or for drugs being listed in National Essential List of Medicines (NELM) (8, 9).

It is widely known that using CE threshold as a cut-off for deciding whether an intervention is cost-effectiveness is not uncommon (10). Despite a controversy whether the threshold should be set, the CE threshold has been used implicitly or stated explicitly in various countries (11, 12). For example, US has been use 50,000 US$ per QALY since 1982 (13), Canada set as 20,000 - 100,000 CAN$ per QALY (14), and National Institute for Clinical Excellence (NICE) in UK indicated CE threshold as 20,000-30,000 € per QALY (15). In Thailand, previous CE threshold was based on WHO guideline. To be cost-effective, incremental cost-effectiveness ratio (ICER) should be lower than one GDP per capita per Quality-adjusted life year (QALY) (10, 11). GDP per capita of Thailand varies from year to year e.g. 164,472.53 Baht for 2011(16). However, in practice, only less than the level of 100,000 Baht per QALY were be considered cost-effective. Currently, Thai Health technologies assessment (HTA) recommends the CE threshold be less than 1.2 times of GNI per capita (160,000 baht) (17). Therefore, not many recently launched drugs, including anti-cancer agents and biological products, could pass this threshold e.g. carboplatin plus paclitaxel (375,958 Baht/QALY) (18), recombinant human erythropoietin (2.7 million Baht/QALY) (19), and Human Papilloma Virus (HPV) vaccine (181,000 Baht/QALY) (20). Even though, the CE threshold is only a tool for decision makers, it is very crucial and should be appropriately determined. Otherwise, it would lead to inappropriate decision and affect patient access to new necessary technologies

Several methods, such as expert opinion, human capital, WTP, and WHO recommendation, were used to estimate quality-adjusted life year (QALY) values (11, 21, 22). However, how to derive appropriate cut-offs is still inconclusive. CE threshold is defined as the maximum value of money per health outcome that a jurisdiction decides to pay for adopting a technology or an intervention (11, 21, 22). Various jurisdictions refer to World Health

Organization (WHO) recommendation for their CE thresholds, which were based on one to three times the gross domestic product (GDP) per capita per disability–adjusted life years (DALYs) as a cut-off (11, 23). However, in the practice, the CE threshold unit was usually cost per QALY and most of CE threshold studies were based on QALY (24-27). WTP per QALY, which stems from the maximum amount ones would be willing to pay in order to gain an additional QALY, is another economic concept that has been used to justify CE thresholds (22, 26, 28-30).

In 2009, HITAP examined societal value of CE threshold in Thailand by willingness-to-pay (WTP) approach. Contingent valuation (CV) with bidding game technique was used in that study. There were three scenarios including blindness, paralysis and allergy. Results showed that WTP for treatment was more than for prevention. The study revealed that the highest WTP was for lateral blindness treatment (mean = 258,331$\pm$ 487,817 Baht, and median = 111,576 Baht). However, there were various limitations in this study, such as low number of respondents and hypothetical situations might lead to high variation of WTP values(31). Later, HITAP had re-examined the CE threshold and the CV method was still used (32). CV, a stated preference approach, is generally used to determine CE threshold in many countries but it suffers from various limitations (20, 31-45). Discrete choice experiment (DCE) is another stated preference approach as same as CV is and it has been applied in healthcare research area since early 1990s, especially used for evaluating health benefits (24-30). It can compensate various drawbacks of the CV. First, when the attributes change, CV cannot value WTP because it designs to value WTP for fixed and whole attributes. CV can estimate WTP for all attribute levels by designing the questionnaires to estimate specific WTP for each attribute level. But, DCE requires the sample size less than CV. Second, the cost is usually included as one of attributes in DCE, according to utility theory, therefore, we can compare the effect of cost and other attributes with marginal utility. Third, respondents usually understand DCE questionnaire. Choosing an alternative is easier than some techniques of CV since respondents likely feel difficult to indicate their maximum WTP when they are asked by using opened-ended question. Some respondents answer as ‘yea-saying’ when they are asked by using dichotomous choice technique. On the other hand, DCE faces respondents with a much easier problem, e.g. do I prefer A, B or neither? Fourth, DCE can limit the multicollinearity problem, which ultimately can lead to misinterpretation, between

attribute levels by using orthogonally design to generate choice sets. Fifth, questions in CV method, such as what are you willingness to pay?, are subject to cognitive problems. DCE does not explicitly ask about money values and it makes people more comfortable to respond. Finally, DCE offers a more 'efficient' means of sampling than CV since, typically, more responses can be obtained from each individual with DCE than with CV (30, 46, 47).

Therefore, this study used DCE to examine WTP per QALY. Attributes and levels in the DCE were adopted from dimensions and levels of EQ-5D-3L since it is recommended in the Thai health technology assessment guideline as a quality of life measurement tool. The WTP per QALY values were calculated from WTP values compared to additional QALYs.

1.2 Objective of study

To examine willingness-to-pay per quality-adjusted life year in Thailand.

1.3 Expected benefits of this study

Cost-effectiveness threshold is important for decision making in economic evaluation of health interventions e.g. drugs, vaccines, and health programs. WTP per QALY values determined in this study would be basic information for setting threshold, which reflects the public preference.

Chapter II

Literature review

2.1 Economic evaluation

Economic evaluation, cost-effectiveness analysis (CEA), cost-utility analysis (CUA), and cost-benefit analysis (CBA), is a tool used for allocating scarce resources in healthcare system by comparing between costs and benefits. It helps policy makers to evaluate the new health interventions, such as medicines and vaccines (47-49).

However, the theories, perspectives, and applications of CBA and CEA or CUA are very different general markets, and health care field. While CBA is based on welfarism perception, CEA and CUA are based on extra-welfarism. Welfarists use individuals in society to evaluate the health outcomes of any interventions. The summation form all individuals such as preference, and utilities will be transformed into monetary which is easy to compare with intervention cost. Therefore, the utility measurement is important for CBA. On the other hands, preference of individual is not required for 'extra-welfarists' because it prefers to maximize benefits of health intervention not for specific individual, but all of public members should get as same as intervention. Therefore, individual preference is not required for CEA. Although CBA theoretically is superior more than CEA and CUA, but it is not easier to implement in healthcare practice. Because it is very controversial among healthcare professionals, and there was not definite method to value benefits or health outcomes (49-51).

2.2 Cost effectiveness analysis (CEA)

CEA are used to evaluate two or more health technologies or medicines. Generally, benefits of the health technologies or medicines are natural unit of health outcome such as glucose level (mg/dl), blood pressure (mmHg), and life expectancy (year) etc. According to CEA analysis, it compares both costs and benefits of an intervention with other interventions.

Therefore, it uses an incremental cost effectiveness ratio (ICER) to evaluate cost-effectiveness. The calculation can be presented as the following equation:

$$ICER = (C_{new} - C_{old})/ (E_{new} - E_{old})$$

whereas; C_{new} is cost of new treatment, C_{old} is cost of old treatment

E_{new} is medical effectiveness of new treatment, E_{old} is medical effectiveness of old treatment

If new treatment incurs less cost and more effective or if it incurs more cost and less effective, there will be a dominant alternative and its ICER would not necessarily be considered. On the other hand, if it is more costly and more effective, then the ICER will be useful for decision making (49).

2.3 Cost utility analysis (CUA)

CUA has been frequently used in recently years. It considers outcome of interventions in the number of life-years saved from a particular medical intervention along with the utility derived from quality of life for instance, quality-adjusted life years (QALYs), and disability-adjusted life years (DALYs). CUA equation is

$$ICER = Cost_{new} – Cost_{old}/No.\ of\ QALYs_{new} – No.\ of\ QALYs_{old}$$

C_{new} is cost of new treatment, C_{old} is cost of old treatment

$QALYs_{new}$ is the number of quality adjusted lifer years of new treatment,

$QALYs_{old}$ is the number of quality adjusted lifer years of old treatment.

The methods of utility valuation can be classified into direct or indirect measurement methods of utility valuation (49, 51-55).

2.3.1 Direct measurement methods

They are generally three techniques widely used to evaluate health utility index:

1) Visual analog scale (VAS): The VAS normally is a rating scale. The information integration theory is ground basic of this measurement method, which involves with valuation and integration. The VAS shows a respondent a vertical line consisting scale of numbers. The highest and lowest points are defined as perfect health and dead states, respectively. The VAS is a simple direct method and takes less time for each individual to evaluate the utility. The most common visual analogue scale (VAS), EQ-5D VAS, comprise a 20 cm vertical scale, ranging from 0 to 100. At 0 is the worst health state, while 100 is the best health state (56, 57).

2) Standard gamble (SG): Generally, this method starts with giving an individual two hypothetical health alternatives. The first alternative contains a health outcome that is less than perfect, such as being unable to walk or hear. The second alternative contains that the individual undergoes a medical procedure that has a probability of success equal to P. If the procedure is successful, the individual will be in perfect health. However, if the procedure is unsuccessful with probability (1-P), the individual dies. The individual is then asked to choose the probability of success P that generates an indifferent response between the two alternatives; living with the disability or undergoing the procedure with P probability of success. Then, the probability provided in the standard gamble equals the value of the health utility index for the examined health outcome (57).

3) Time trade off (TTO): In its simplest terms, an individual is given a hypothetical choice that respondents can live for x years in perfect health, then they will be dead, or respondent can live y years with a particular chronic condition, such as the inability to walk, where y>x. The health utility index in this simple example equals x/y. For instance, the respondents are asked to choose one alternative between 1) having a lung cancer for five years and their health states are similar lung cancer patient or 2) prefer to loss a number of years for living with perfect health state. The utility derives from number of years preferring to loss divide by five years (57).

2.3.2 Indirect measurement methods

1) Generic utility instruments: They have been usually used to evaluate utility of health states, and do not aim to evaluate utility of specific diseases. The instruments are composted of dimensions of health and levels. The representatives from general population of each country assign their values. The EQ-5D, the HUI (Health Utilities Index), and the SF-6D (Short Form six dimension) are commonly indirect measurement methods used in several studies (52, 56, 58). Among these methods, health states of EQ-5D were valued in several counties including Netherland, US, and Thailand etc.

2) Disease specific utility instruments: They have been used to measure utility for specific diseases due to sensitivity issues, for example, the International Index of Erectile Function (IIEE) and the Cambridge Pulmonary Hypertension Outcome Review (CAMPHOR), and preference-based scoring systems include the International Prostate Symptom Score (IPSS) for benign prostatic hyperplasia (53-55, 58).

2.4 Cost benefit analysis (CBA)

CBA has a long history of applications in investment decision-making in various fields. Governments often undertake these decisions when the measurements of the costs and the benefits associated with projects cannot be practically observed (18). Basically, decision makers would be interested in choices that are expected to have benefits exceed their costs as showed in the following equation:

$$NB^{e}(x) = B^{e}(x)-C^{e}(x)$$

whereas;

NB^{e} is the expected net benefits

x is the individual decision or choice under consideration

B^{e} is the expected benefits from that choice

C^{e} is the expected costs resulting from the choice

To properly estimate the total benefits of a medical intervention, it must be able to measure the value of health state or life. Most of these measurements are based on human capital approach or WTP approach (58).

2.5 Cost-effectiveness Threshold

In 1973, Weinstein and Zeckhauser first explained the theoretical foundation of using a cost-effectiveness ratio, as a cut-off point for resource allocation (59). They showed the case of a government agency working with a fixed budget that not of all projects can be funded but they depended on the cost-effectiveness ratio. Threshold or critical ratio (λ) is the cut-off point that the last implemented program is accepted and considered to be cost-effective. However, recently incremental cost-effectiveness ratio (ICER) has been used rather than average-effectiveness ratio in the determining of health care programs with cost effectiveness analysis (CEA) and cost utility analysis (CUA) (60, 61). For instance, the National Institute for Health and Clinical Excellence (NICE) produced clinical guidelines for the National Health Service (NHS) showing the decision rule in drug selection process by using ICER and Threshold. If the new treatment both improves health outcomes and reduces cost (Figure.1, bottom right quadrant on cost-effectiveness plane) then the new treatment will be offered to patients. If the new treatment both reduces health and increases cost (Figure.1, top left quadrant on cost-effectiveness plane), in consideration the new treatment is dominated and recommend staying with the standard treatment. However, if the new treatment is both more effective at increasing health and more costly (Figure.1, top right quadrant on cost-effectiveness plane), then judging whether the health gain is large enough to justify the additional cost becomes an issue. This is usually done by calculating ICER and comparing it with a pre-specified cost-effectiveness threshold. The ICER is the difference between the mean costs of each strategy divided by the difference in mean health outcome (the slope of the line that connects the strategies)

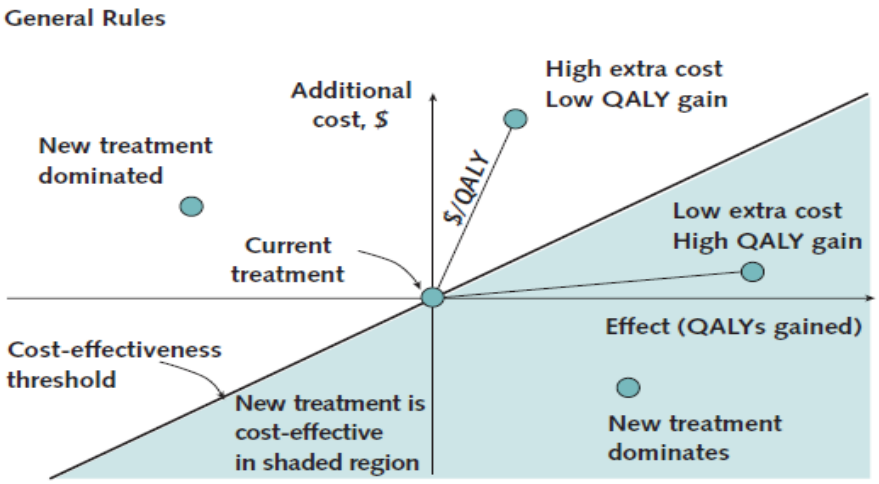

Figure 1 Decision rules of cost-effectiveness analysis in 2 comparators(62)

Values of CE threshold per QALY are different in each country e.g. CAN$20,000 -100,000 (in Canada), AUS$20,000-100,000 (in Australia), NZ$20,000 (in New Zealand), 20,000-30,000 GBP (in UK) and US$50,000 (in US) (21, 41, 63, 64). The CE threshold is very important. If it is at too high value, it may lead to an increase in health expenditure. If it is set at too low value, not many new drugs, which are usually expensive, will be cost-effective. For example, threshold used in the US is a statistic value and unable to reflect costs overtime for example, e.g. threshold of US$ 50,000 per QALY has been used since 1982 and it was derived from cost per QALY for medicine patients with chronic renal failure (65). Threshold is not an absolute decision making to reject innovative treatments whose marginal costs are above threshold since they may be necessary treatments (15). Hence, the defining of threshold values with upper and lower boundaries is suitable rigid implementation of a single criterion (66).

In Thailand, the CE threshold was based on WHO guideline (11). WHO defined CE threshold into three cost-effective levels including 1) if CE threshold is less than one time GPD per capita, it is highly cost-effective, 2) if it falls between one to three GDP per capital, it is cost-effective, and 3) if it is more than three times GDP per capita, it is not effective. Although WHO recommends CE threshold by comparing between GDP per capita and disability-adjusted life year (DALYS), several studies compared GDP per capita with QALY more than DALYs because QALY is a common outcome in CUA. However, this recommendation from WHO is sometimes questionable because it does not reflect social's perspective and it is excessive in high-income countries(66). Sometimes this threshold is therefore not applied in decision making. For

instance, provider-initiated HIV testing (70,000 Baht/QALY), statin (82,000 Baht/QALY) and gancyclovir (185,000 Baht/QALY) were still reimbursable after their ICERs were compared with the CE threshold (67).

2.6 Willingness to pay

The concept of willingness-to-pay (WTP) has become very popular over the last twenty years in health economic assessment. WTP is a created tool to elicit the maximum payment of definite population and to value the goods, services, and health interventions in health care filed (68-70). Also, WTP has been used in measuring benefits in CBA due to WTP can transfer benefits into monetary values. CBA is based on welfare economic theory. In CBA, the benefits to an individual of a service or an intervention are interpreted that individual's maximum WTP for the goods, and services. The benefits to society of the interventions are therefore the sum of WTP of each individual. The concept of economic efficiency for reallocation, which is the sum of benefits gained by resource reallocation, should be under the marginal costs(69). Recently, the number of WTP studies, especially, in health care field has been increasing from at least three main reasons. First, WTP supports "theoretically correct" because it is based on welfare economics, which present individuals' preference. Second, QALYs are common unit of health outcome in CUA but WTP is based on preferences for both health outcomes and non-health outcomes. Finally, WTP aims to transform the benefits into monetary as same as cost. It cans help policy maker to increase efficiency in resource allocation (47, 71).

There have been several previously studies of determining WTP in various diseases e.g. cancer, osteoporosis, pain and asthma (71-74). The aims of these studies were to value individual's WTP for diagnosis, treatments, and new medicines, to understand opinion in intervention in societal perspective and to find factors influencing for WTP. For example, results in the study of WTP for hormone replacement therapy showed that women who had experiences in taking hormone replacement therapy prefer in this treatment and they were willing to pay about SEK 40,000 per year and this WTP was above costs. Both income and education had influence on their WTP (42). In addition, WTP were important methods used for estimating the cost-effective threshold in many countries (31-42, 44, 45, 75).

2.6.1 Methods of determining willingness-to-pay

Two main methods in valuing WTP include revealed preference and stated preference approaches. The revealed preference approach is a classical method used for seeking the capacity of individuals to pay for attributes of goods and services, but it has several limitations for estimating WTP. First, the reveal preference cannot estimate WTP of goods or services, which are not present in the actual markets because there are no data involving cost, price, and customers, which are necessary. Second, the consumers may not have full information of goods and services from vendors when they pay out-of-pocket and it has effects to amount WTP. Moreover, if the number of customers who buy the interesting goods and services are a few, process of data collection must take a long time to finish. Finally, we cannot control choice sets, attributes, and it is difficult to select participants in valuing the goods and services. On the other hand, stated preference approach can eradicate these disadvantages of reveled preference (46, 51). There are several methods in stated preference, including contingent valuation (bidding game, payment cared, opened-ended question etc.) and choice modeling techniques (conjoint analysis, and discrete choice experiment). Figure 2 presents methods of WTP.

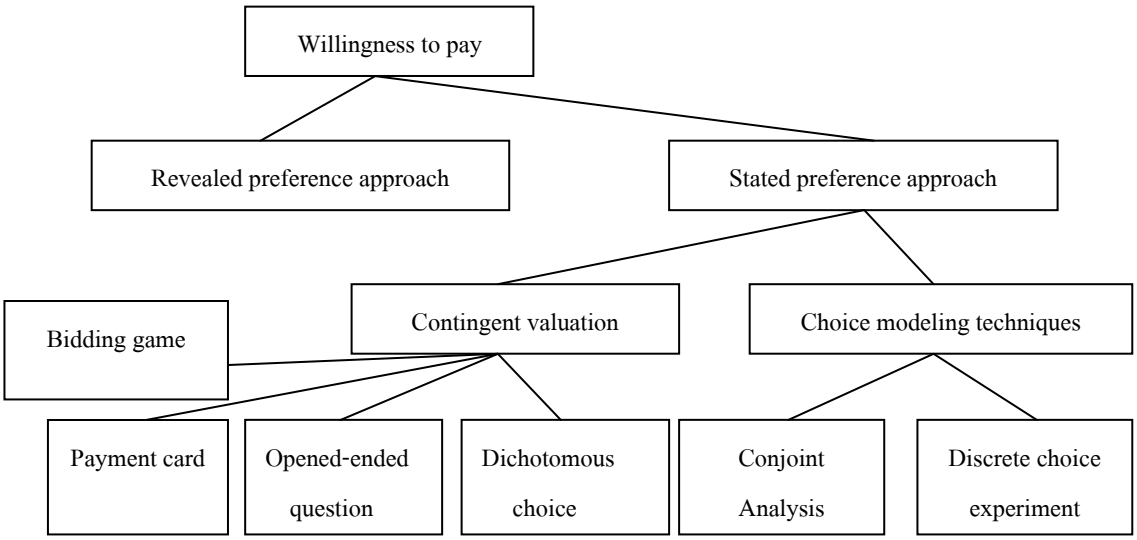

Figure 2 Classification methods to measure WTP

2.6.2 Contingent valuation method

Contingent valuation (CV), a stated preference method, is a direct measurement for each individual to estimate both minimum and maximum values of WTP, and willingness to accept (WTA) for goods or services. Individual utility maximization is the root of welfare theory, and supports the neo-classical concept because WTP derived from individual preference. Generally, the CV questions are designed for asking the whole of goods, not for estimating WTP for attributes of goods. According to its design, the elicitation techniques (or approaches) used in CV studies, there were four main techniques including bidding game, payment card, opened-ended question, and dichotomous choice question. In addition, some researchers mixed two CV techniques for efficiently estimating maximum WTP and minimum WTA, for example, respondents were asked by using dichotomous choice questions then, they were asked to express definite WTP and WTA by using opened-ended questions (46, 76).

The oldest technique of contingent valuation is bidding game. Each respondent has started at one point between lowest or highest level by random assignment. The interviewer presents the prices of goods and asks the respondent to accept or reject by yes-no question. The bidding will go on until highest level or lowest level. This technique is most likely the real market because respondents can find the maximum preference. Nevertheless, the starting point should be randomized since starting point influences with maximum WTP.

Mitchell and Carson began to use payment card to estimate WTP in 1984. A range of WTP for goods or services is presented on the card. The respondent will be asked to choose only one value on the card, which expresses the maximum WTP for goods or services. A range of WTP presented on the payment card influences with WTP because it can make bias when a range is narrow, or the presented WTP values are too high or too low values. In addition, respondents have limited education or have no experience often cannot understand this method.

The opened-ended question is to ask respondent to estimate the maximum WTP for goods or services by direct questions. Therefore, this technique does not require a range of WTP, controlling the starting point bias, and complicated tools. The duration of interview is short since it is a simple method. However, some respondents often feel that it is hard to express their WTP. In addition, this technique is fully efficiency to elicit maximum WTP, especially, from respondents who have no experience with goods or services.

Dichotomous choice or referendum choice has been used in several studied. This method presents binary choice attached WTP value of goods or services to respondent for saying yes or no. The dichotomous choice can be divided follow number of times for asking per a respondent such as single-bounded dichotomous choice, double-bounded dichotomous choice, and triple-bounded dichotomous choice. This technique can estimate maximum WTP with easy question as take it or leave it. However, the start point bias, yea-saying, and number of respondents are it limitations.

2.6.3 Discrete Choice Experiment

Discrete choice experiment (DCE) has a long history in several disciplines (77). DCE was originally developed in marketing research in early 1970s and have been widely used in transportation and environment research. In late 1990s, it is increasingly being applied to health care (74, 78-84). DCE combines psychology theory and random utility theory. The questionnaire design in WTP part is composed several choice sets, and each choice set is attached at least two alternatives. These choice sets are based on hypothetical scenario. Therefore, DCE can estimate WTP for goods, and services in situation existing non-markets that are relevant to research questions (79).

Data analysis in DCE is based on random utility theory (RUT), Whereas, U is utility, i is individual, j is alternative, V is explainable component and is non-explainable component. The equation is

$$U_{ij} = V_{ij} + \varepsilon_{ij} \text{ , } j=1,2,3,\ldots..J$$

The explainable component represents the attributes of goods or services, and co-variates, which are individual characteristics of respondents. The equation is

$$V_{ij} = X_{ij}\beta + Z_i\gamma$$

Where X_{ij} is the vector of attributes which are comprised cost and attributes of good. j is alternative, i is individual, and β are coefficient of X. Z is a vector of characteristics of individual of respondent, and γ are coefficients of Z.

In case, utility is higher than the utility of any other option in the set of J alternatives. Assuming a joint probability distribution for i, the probability P that utility is maximized by choosing option 1 is given by following equation

$$P(Y_j=1) = P(U_{i1} > U_{ij}) = P(V_{i1} + \varepsilon_{i1} > V_{ij} + \varepsilon_{ij}) = P(V_{i1} - V_{ij} > \varepsilon_{ij} - \varepsilon_{i1}), j \neq 1$$

Y_i is a random variable denoting the choice outcome. Estimable choice models are derived by assuming a distribution for the random component. For example, if the errors are independently and identically distributed (iid) as extreme value type 1 random variates, this results in a conditional logit experimental design theory, which is discussed in specification for the choice probabilities by following equation

$$P(Y_j=1) = e^{\mu V_{i1}} / \sum_{j=1}^{J} e^{\mu V_{ij}}, j=1,2,3,\ldots J$$

Some advantages of DCE methods that solve the drawbacks of contingent valuation (CV) are: 1) when the attributes change, CV cannot value WTP because it designs to value WTP for fixed and whole attributes. The only one way that CV can estimate these attributes is to design different valuation scenario for each level of each attribute. But, DCE can handle it. 2) DCE can input cost as a variable in model. We can estimate marginal utility derived from changing cost level. 3) Respondents usually understand how to answer DCE question. DCE can help respondents avoid the difficult responses such as opened-ended question, and 'say-yea' in dichotomous choice. 4) DCE can reduce the multicollinearity between attributes level by using orthogonal design to select choice sets. 5) Question such as 'what are you willing to pay?' are thought by some critics of CV to present cognitive problems. DCE does not explicitly ask about money values so it argued that DCE is easier for people to understand. 6) DCE offers a more efficient means of sampling than CV does since, typically, more responses are obtained from each individual in DCE than in CV (30, 46, 50, 70).

Since the first DCE application to health care field in the early 1990s, the number of studies using DCE has grown rapidly and becomes a common method to appraise the economic benefits of health policies. In economic evaluation in health, DCE contributes in eliciting preferences, quantifying trade-off, predicting uptake of new policies or programs and measuring outcomes of interventions. In addition, DCE has the potential to provide input both CBA and CUA because DCE can measure benefits in monetary units for time, health service configurations, and health insurance packages (72, 74, 83, 85). For example, Johnson FR (2000) studied WTP for improving respiratory and cardiovascular health (86) and Ryan M (2006) estimated older people's preference in social care (87).

2.7 Systematic review of willingness-to-pay per quality-adjusted life year

2.7.1 Study characteristics

The number of published WTP per QALY studies has grown rapidly over time; one study in 1995-1999, one study in 2000-2004, four studies in 2005-2009, and eight studies in 2010 to 2014. These studies were conducted in various geographical regions e.g. Europe (7/14, 50.00%) (31, 32, 34-36, 42, 75), Asia (3/14, 21.43%) (37-39), and United states (3/14, 21.43%) (33, 40, 45). In addition, one study was (7.14%) conducted across four regions including Europe, America, Asia, and Australia (41). Totally, WTP per QALY studies were conducted in 16 countries and all of them were cross-sectional studies. Only two of 16 countries (18.75%) were low and middle-income countries including China and Thailand (38, 39).

Nine studies (64.28%) (31-38, 41) were conducted in a general population, while three studies (21.43%) (39, 40, 42) were in patients. However, respondents of two studies (14.29%) (39, 45) were from both general and patient populations. Among 11 studies including general populations, subjects were randomly sampled in only six studies (54.50%) (33-35, 37, 38, 41). Three studies used stratified random sampling based on race (33), age, gender (37), region, and income level (38) . The number of respondents varied from 104 to 21,896 persons. The sample size was less than 500 in three studies (21.43%) (33, 40, 42) and more than 1,000 in seven studies (50.00%) (31, 32, 34, 36-38, 41).

2.7.2 Examples of willingness-to-pay per quality-adjusted life year study

There are several studies estimating the value of QALY e.g. human capital approach, revealed preference, contingent valuation (CV) and discrete choice experiment (DCE) (19). However, most previous studies used CV to determine WTP per QALY. In addition, some researchers studied both WTP per QALY and other factors that may influence with the value. These factors included diseases, severity of disease, risk of disease, duration of disease, payment for other persons (relatives and not relative), and duration of times (31, 34-37, 39, 40, 42, 45).

Zhao (2011) estimated WTP per QALY and compared the results between chronic prostatic patients and general population in China. EQ-5D and SF-6D were used to reflect utility for participants' own health. Participants were asked about WTP values for moving away from current health state to perfect health state by using closed–ended iterative biding contingent valuation method. The results showed that WTP per QALY were closed to lower bound of GDP per capita and WTP per QALY from general population was less than WTP per QALY from chronic prostatitis patients (39).

Gyrd-Hanen (2003) studied WTP per QALY in Denmark. Hypothetical health states were selected from 42 health states of EQ-5D previously used in deriving current UK EuroQoL tariff. A total of 23 choice scenarios were established by pairing those 42 health states. Respondents were asked to compare two health states from each scenario and indicated higher health state and lower health state. Then, the amount of WTP for medicine was asked by closed–ended questions. There were 11 WTP values were randomly presented. Discrete choice modeling was used to analyze the data. The result showed that WTP per QALY was 88,000 DKK per QALY. It was lower than value of standard CE threshold at that time (34).

Bobinac A (2010) elicited the individual WTP per QALY from general population in Netherlands. The 29 paired choice scenarios were generated from full EQ-5D health states. The respondents were asked to imagine follow a pair of health state. Then, they has chosen better health state, and answered WTP for living this health state for one year by payment scale and open-ended format. To evaluate utility of hypothetical state, respondents rated the two health states on a visual analog scale (VAS). The result showed that WTP per QALY was strongly associated with incomes, varying from €5,000 in lowest to €75,400 (31).

Shiroiwa T (2010) surveyed WTP per QALY in Japan, South Korea, The US Taiwan, the UK and Australia. This study used internet survey which measured WTP for extension live for one year with perfect health state. The questionnaire had categorized WTP into 1) WTP for the respondent's additional QALY 2) WTP for respondent's additional QALY for five years 3) WTP for the respondent's additional QALY for family member and 4) WTP for the respondent's additional QALY for non-family member. WTP question was bid values in double-bound dichotomous choice. The results showed that WTP per QALY of all countries in this study were less than GDP per capita. In all countries with the exception of Taiwan, the respondents preferred to pay money for themselves less than other people in their society and their family members. Respondents from South Korea had the highest WTP for their family members (41).

In Thailand, there are two studies. First, Thavorncharoensap (2013) assessed a societal value for a ceiling threshold in 2009. This study aimed to assess the WTP per QALY for use as a CE threshold in determining the cost-effectiveness of health interventions in the country. In addition, they compared WTP between WTP for treatment and prevention. There were three scenarios consisting blindness, paralysis, and allergy. They divided severity of diseases into two levels. Both TTO and VAS were used for measuring utilities of current health state and disease health states. Respondents were asked about the amount of money paid for moving from hypothetical health state to current health state and the amount paid for preventing diseases by using bidding game technique. The results showed that WTP per QALY for treatment in all scenarios was higher than for prevention. The highest WTP per QALY, unilateral blindness hypothetical situation, was 285,331 $\pm$ 487,817 Baht (mean$\pm$ SD) and its median was 111,576 Baht. The results from multivariate analysis showed that WTP per QALY for prevention was estimated 53,382 Baht and WTP per QALY for treatment was approximately 105,669 Baht. They were consistent with WHO-guided CE threshold (16). Thavorncharoensap et al. also conducted the second study of WTP per QALY in 2013. Seven hypothetical scenarios, including mild moderate, and severe health states, were created. The aimed of this study was to estimate WTP per QALY from treatment, life extension, and life saving. Additional QALY were 0.2 and 0.4. The respondents were asked amount of WTP value using dichotomous bidding technique follow by opened-ended question. Utility measures were visual analog scale (VAS), and EQ-5D03L Thai tariff. They found that WTP per QALY values derived from treatment scenarios were lower than

extending life, and saving life scenarios. There were insignificant between WTP per QALY values derived from life extension in terminal illness (194,000 to 324,000 Baht (1.1 -1.9 GDP per capita)) and life saving (202,000 to 334,000 Baht (1.2 to 2.0 GDP per capita)) (38).

Chapter III

Methods

This part of the study was composed of three main steps, which were questionnaire design, data collection, and data analysis.

3.1 Questionnaire design

3.1.1 Determining attributes and levels

There were several previous WTP per QALY studies, which created the hypothetical scenarios from health state of EQ-5D-3L(34-37) because EQ-5D-3L was weighted utilities of health states and has been used in several countries. In addition, EQ-5D is a standardized measurement of health status. EuroQol group has developed it since 1987. It has been validated in over twenty countries and widely used to measure of population health status in clinics and health economics. Therefore, it was highly plausible to use EQ-5D-3L in this study. EQ-5D can be classified by number of response levels into two types, including EQ-5D-3L and EQ-5D-5L. EQ-5D-3L contains five dimensions of health including mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. Each dimension is divided into three levels of response including no problem, some problems and extreme problems. EQ-5D-5L contains the same five dimensions as in EQ-5-3L. Its difference is in dividing the levels of response into five levels including no problems, slight problems, moderate problems, severe problems, and extreme problems(88). In Thailand, EQ-5D-5L is in the process of translation and development (89). Therefore, EQ-5D-3L was selected since it was the standard measurement of quality of life recommended by Thai health technology assessment guideline. Also, EQ-5D-3L has been currently used in various studies in Thailand. For instance, Chaiyawat studied effectiveness of home rehabilitation for ischemic stroke. The aim of this study was to develop and examine the effectiveness of an individual home rehabilitation program for patients with ischemic stroke (90). Sakthong studied health utilities in patients with HIV/AIDS in Thailand (57) and Kittikraisak studied health related quality of life among patients with tuberculosis and HIV in Thailand (91).

A total of 243 possible health states of EQ-5D-3L are defined by referring in term of a five-digit code. For instance, state "11111" means no problem across five dimensions, while state "13223" means no problems with mobility, self-care with extreme problems, some problems with performing usual activities, moderate pain or discomfort and extreme anxiety or depression.

Cost is an important attribute in DCE studies for determining WTP. It should cover minimum and maximum value that respondents' WTP in improving quality of life. We interviewed 20 respondents face-to-face to ask them the minimum and maximum amount of payments for life saving. The WTP values varied between 3,000 and 100,000 Baht per month for one year; the average was 25,400±26,493 Baht per month. We then used 3,000 Baht per month to be the minimum cost. Also, this cost level needed to cover the WTP per QALY values that WHO recommends and the results of previous studies in Thailand suggested. We used CE threshold recommended by WHO (REF) and previous results of WTP per QALY study (REF) in Thailand, which were 493,417.59 Baht/QALY and 285,331+ 487,817 Baht/QALY, respectively, to select the cost levels in this study as well. Finally, cost/payment levels were 3,000 6,000 9,000 12,000 15,000 18,000 21,000 and 24,000 Baht per month. Summary of establishing attributes and levels are showed in table 1.

Table 1 Attributes and levels for WTP per QALY

Attributes	**levels**							
Mobility	no problem			some problems			extreme problems	
Self-care	no problem			some problems			extreme problems	
Usual activities	no problem			some problems			extreme problems	
Pain/discomfort	no problem			some problems			extreme problems	
Anxiety/depression	no problem			some problems			extreme problems	
Payment (Baht/month)	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000

3.1.2 Choice sets design

The full combination of attribute levels form five attributes with three levels (EQ-5D-3L), and one attribute with eight levels (cost attribute) totally contains 3^5 x 8 = 1,944 characteristics for each alternative. Therefore, if we design two alternatives in one choice set, a number of full combinations of all choice sets would be 1,888,596. It is not possible to include them all in a study. This study therefore used an orthogonal design to reduce number of choice set and to select representative choice sets.

The orthogonal design is a general fractional factorial design. This design assumes no correlation between attribute levels in each alternative. In contrast, non-orthogonal designs render determination of the contribution of each independent attribute difficulty, as the attributes are confounded with one another. Statistically, non-orthogonality tends to produce higher amounts of share variation with lower unique variation from which individual attribute estimates are derived(46, 92).

In addition, the reference alternative was included into choice set for increasing respondents' understanding of hypothetical situations and enabling them to choose an alternative in each choice set. Two reference alternatives, including current health state and death state, were tested in a small conveniently sampled sample size (twenty respondents). The result found that using current health state as a reference alternative had no power to reinforce respondents for choosing other alternatives in the same choice set because utility of current health state of respondents might be higher than utilities of other alternatives. Therefore, we selected death state with no payment to be the reference alternative.

Orthogonal design created 36 choice sets and each choice set contained alternative A, B, and reference alternative. The characteristics of three alternatives are shown in Table 2. In addition, we checked for the representativeness in term of utility by transforming the health states to utility, based on EQ-5D-3L Thai tariff. Utilities of alternative A varied from -0.317 to 0.726, while utilities of alternative B varied from -0.343 to 0.766. Utility of reference alternative was 0.000 (death). Utilities of all alternatives show in Figure 3. However, 36 scenarios were also too much for one respondent to answer. We used blocking technique at nine blocks to select the scenarios. A respondent were asked to answer a total of four choice sets.

Table 2 Characteristics of three alternatives

Choice set	**Alternative A** (Cost (Baht/month))	**Alternative B** (Cost (Baht/month))	**Reference alternative** (Cost (Baht/month))
1	23113 (15,000)	32322 (18,000)	Death (0)
2	31332 (18,000)	12232 (12,000)	Death (0)
3	13222 (18,000)	33213 (15,000)	Death (0)
4	22331 (21,000)	23123 (9,000)	Death (0)
5	22212 (3,000)	11112 (3,000)	Death (0)
6	11121 (3,000)	21222 (24,000)	Death (0)
7	13233 (24,000)	22131 (6,000)	Death (0)
8	32321 (21,000)	32311 (21,000)	Death (0)
9	13311 (12,000)	11333 (15,000)	Death (0)
10	31133 (12,000)	31113 (24,000)	Death (0)
11	31212 (9,000)	23321 (6,000)	Death (0)
12	22123 (6,000)	13231 (9,000)	Death (0)
13	21122 (12,000)	22111 (15,000)	Death (0)
14	12211 (12,000)	12221 (24,000)	Death (0)
15	12323 (9,000)	31132 (6,000)	Death (0)
16	33231 (6,000)	21312 (9,000)	Death (0)
17	21333 (18,000)	11321 (15,000)	Death (0)
18	33112 (21,000)	31231 (9,000)	Death (0)
19	31221 (15,000)	13133 (12,000)	Death (0)
20	12113 (18,000)	23313 (12,000)	Death (0)
21	33323 (3,000)	22223 (3,000)	Death (0)
22	22232 (3,000)	32333 (24,000)	Death (0)
23	21311 (24,000)	33212 (6,000)	Death (0)
24	13132 (21,000)	13122 (21,000)	Death (0)
25	11131 (3,000)	33331 (3,000)	Death (0)
Choice set	**Alternative A** (Cost (Baht/month))	**Alternative B** (Cost (Baht/month))	**Reference alternative** (Cost (Baht/month))

26	33313 (3,000)	13111 (24,000)	Death (0)
27	32122 (24,000)	11323 (6,000)	Death (0)
28	212223 (21,000)	21233 (21,000)	Death (0)
29	32233 (12,000)	33222 (15,000)	Death (0)
30	23322 (12,000)	23332 (6,000)	Death (0)
31	23131 (9,000)	12213 (6,000)	Death (0)
32	11312 (6,000)	32123 (9,000)	Death (0)
33	32111 (18,000)	22131 (15,000)	Death (0)
34	11223 (21,000)	12312 (9,000)	Death (0)
35	12332 (15,000)	21211 (18,000)	Death (0)
36	21223 (18,000)	31121 (12,000)	Death (0)

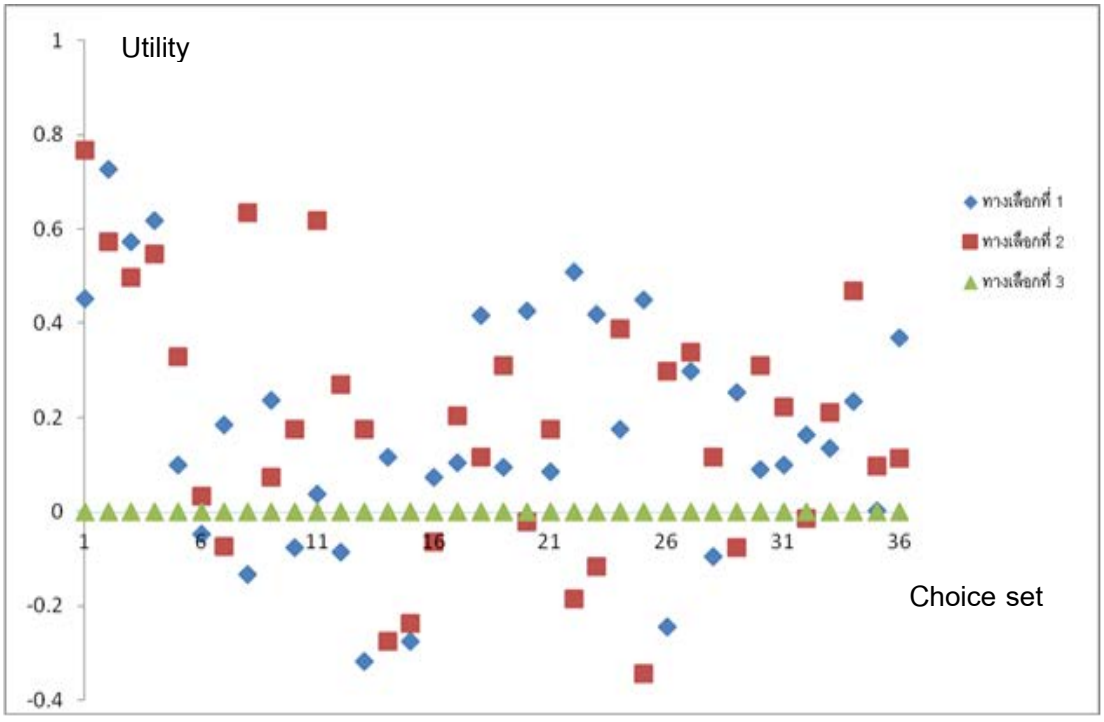

Figure 3 Scattering utilities of all alternatives

3.1.3 Questionnaire development

The questionnaire contained three parts,

- First part contained questions concerning demographic data including age, gender, marital status, education, health insurance schemes, resident area, incomes both individual incomes and household income, number of people living on household, number of children, education, employment status, status of family, and current disease.

- Second part contained VAS and EQ-5D question. Respondents measured their current health state by using both VAS and EQ-5D. In addition, they measured utility score of a total 11 thermometer scales including perfect health state (1), death (1), current health state (1), Health states presented in choice set (8), respectively. They marked three points on every scale including perfect health state, death, and health state of this scale. Except, thermometer scales of perfect health state and death were marked only one point because they were set to warm up. Utilities of health sates on thermometer scales number three to 11 were rescaled. In VAS rescaling, the end points set on a scale of VAS 'full imaginable health state' is 100 and 'worst imaginable health state' is zero. Rescaling is to set utility of '11111' as 1.000 and utility of 'death' as 0.000 by using the following equation (39):

$$\text{VAS rescaled heath state} = \frac{\text{VAS raw health state} - \text{Deathraw}}{\text{'11111'raw} - \text{Deathraw}}$$

where VASrescale heath state-rescaled is utility of rescaled health state, VASraw health state is raw score of a health state, Deathraw is raw score of death and '11111'raw is raw score of perfect health state.

- Third part contained WTP questions including discrete choice experiment (DCE) part and contingent valuation (CV) part.

The DCE question contained a total of five choice sets including four choice sets which were selected by orthogonal design with blocking technique and another choice set was included for testing of understanding (Appendix). Respondents were asked to imagine that "Please imagine that you have life threatening disease for one year. If you will not get any treatment, you will die. Please choose only one alternative from three alternatives, which had different payment and outcome.

Table 3 A choice set example

Attribute	Alternative A	Alternative B	Reference alternative
Mobility	Some problem	Extreme problems	Death
Self-care	Extreme problems	Some problems	
Usual activities	No problem	Extreme problems	
Pain/discomfort	No problem	Some problems	
Anxiety/depression	Extreme problems	Some problems	
Payment (Baht/month)	15,000	18,000	0

The CV question was an opened-ended question. Hypothetical scenario of CV question was similar with DCE question. The respondents were asked to imagine that "Please imagine that you have life threatening disease for one year. If you will not get any treatment, you will die. On the other hand, if there is a treatment that will help you to get back to your current health state, what is the maximum value would you be willing to pay per month for that treatment for one year?"

3.2 Questionnaire testing

We asked three experts to review the questionnaire for checking content validity and we made a revision accordingly. To ensure the validity of the questionnaire, we did three rounds of interviews with 10 conveniently sampled each participants and adjusted the questionnaire.

The results found that respondents could understand and imagined the created hypothetical scenarios. However, almost of them felt the questionnaire was difficult and required a long time to finish due to complicate descriptions of attribute levels in each choice set. Consequently, we decided to use green, yellow, and red color for the attribute levels of no problem, some problems, and extreme problems, respectively. We then piloted it with 20 participants residing in Songkla province for testing the final questionnaire version and found that

they clearly understood the questions. They spent time to finish three parts of questionnaire within 30 minutes.

3.3 Data collection

3.3.1 Respondents

General population residing in three provinces including Suratthani, Songkla, and Yala were conveniently sampled with following inclusion and exclusion criteria.

Inclusion criteria:

- Age minimum 20 years
- Literacy and no extreme hearing problem
- Able to independent communicate
- Prefer to be respondent

Exclusion criteria:

- Not able to answer the question
- Want to stop during interview

3.3.2 Sample size

The number of sample size in DCE study is calculated according formula (Orme 1998):

$$N = \frac{500\ L}{J.S}$$

N = Number of sample size

L = the largest number of levels for any of the attributes

J = the number of alternatives

S = Number of choice set per respondent

Therefore, $N = \frac{500 * 8}{3 * 4}$

$= 334$ respondents

3.3.3 Process of data collection

After the ethics committee of Faculty of Pharmaceutical Sciences, Prince of Songkla University approved the study protocol on 26 April 2013, the data collection period started in August 2013 and finished in November 2013. We trained seven interviewers about objectives of this study, using questionnaire and tools, and interview process and we evaluated their skills and knowledge for interview before they collected data.

In process of data collection, interviewers selected respondents, based on inclusion criteria. They introduced themselves, explained detail of study, and invited respondent to participate. The interviewers informed respondents that their names and surnames were not released and were protected. In addition, they could stop any time during the interview. After they agreed, interviewers started by asking his/her demographic data. Then, their utilities of 11 health states by VAS and current health state by EQ-5D-3L were measured. Finally, respondents were asked to both DCE and CV WTP questions. In addition, when respondents were not willing to pay, interviewers asked for reasons. We provided a token of appreciation for both interviewers and participants after the interviews.

3.4 Data analysis

Data were recorded into SPSS and Microsoft excel software. All data were cleaned before proceeding analyses.

3.4.1 Demographic data analysis

Descriptive statistics e.g. frequency, mean, standard division were calculated for all demographic variables.

3.4.2 Discrete choice analysis

Data were analyzed by Nlogit® software. The analyses were based on Random utility theory (RUT) which posits that utility (U) for individual i conditional on choice j which have k characteristic in scenario s (s=1,2,3,…s) following equation

$$U_{isj} = X'_{isjk}\beta_k + \varepsilon_{nsj}$$

X'_{isjk} is vector of attribute, β_k is coefficient in each attribute and ε_{nsj} is a non-explainable or random component. ε_{nsj} has IID characteristic and extreme value type I (EV1) distribution. It can calculate possibility that each respondent (i) will chose alternative (j) in each scenario (s). Data were analyzed by mutinomial logit model (MNL) following equation

$$P_{isj} = e^{(X'_{isjk}\beta_k)} / \Sigma^{J}_{j=1} e^{(X'_{isjk}\beta_k)}$$

3.4.3 Calculating WTP

WTP was estimated from marginal utility changing of each attribute and cost attribute. The relative importance of the different attributes and ration of the coefficients are a measure for trade-offs that respondents are willing to make between attributes(79). Conceptually, WTP for the attributes could be calculated given as following equation.

$$WTP = \beta_K / \beta_{cost} \quad (k= 1,2,3,\ldots.)$$

Whereas β_K is coefficient of each attribute, and β_{cost} is coefficient of cost

In addition, we simulated model for analysis 5,000 times to estimate mean, median, and 95% confidence interval of WTP values.

3.4.3 Calculating WTP for life saving treatment

We calculated WTP for life saving and moving to each dimension level of EQ-5D-3L. Therefore, WTP for life saving and moving to a health state was derived from summation of WTP for all attribute levels in each health state.

For example, WTP for life saving and moving to ‘21212’ is

$$= WTP_{\text{for D1L2}} + WTP \text{ for } D2L1 + WTP \text{ for } D3L2 + WTP \text{ for } D4L1 + WTP \text{ for } D5L2$$

$WTP_{\text{for D1L2}}$ is WTP for life saving and moving to mobility with some problems

WTP for D2L1 is WTP for life saving and moving to self-care with no problem

WTP for D3L2 is WTP for life saving and moving to usual activities with some problems

WTP for D4L1 is WTP for life saving and moving to pain/discomfort with no problem

WTP for D5L2 is WTP for life saving and moving to anxiety/depression with some problems

3.4.5 Calculating WTP for the treatments of 243 health states

DCE also allowed us to estimate WTP for moving from a health state to other health states. For instance, WTP for moving from a health state (A) to a health state (B) is calculated from the different values of WTP for life saving and moving to health state (A) and WTP for life saving and moving to health state (B).

For example, WTP from '22222' to '11111' = WTP for life saving and moving to '11111' - WTP for life saving and moving to '22222'

3.4.6 Calculating WTP for moving form life threatening disease to current health state

Similar to WTP for the treatments of 243 health states, we calculated the different values of WTP for life saving and moving to current health state of each respondent.

3.4.7 Calculating WTP per QALY

We calculated and presented WTP per QALY values in two different ways including WTP per QALY from a health state (A) to another health state (B) and average WTP per QALY from a health state to all of other health states.

- WTP per QALY from a health state to another health state was calculated from the following equation;

$$\text{WTP per QALY} = \text{WTP} / \text{additional QALY}$$

WTP per QALY is willingness to pay per quality adjusted life year

WTP is willing to pay for moving from a health state (A) to a health state (B)

Additional QALY is derived from different utilities of health state A and B multiplied by 1 (duration of hypothetical scenario = 1 year).

- Average WTP per QALY from a health state to all of other health states was derived from slope of incremental graph between a health state (A) compared to other health states. The X axis of the graph is additional QALY, Y axis is additional WTP, and intersect point is a health state (A). However, the slope was derived from only quadrant 1, where both additional QALY and additional WTP are positive, since, based on general WTP definition, WTP is the maximum WTP values. Also, previous studies excluded unwillingness to pay data when WTP and QALY calculation.

3.4.8 Comparison of WTP per QALY values

WTP per QALY values derived from DCE and CV were compared using Paired t-test at P-value < 0.05.

Chapter IV

Results

4.1 Demographic characteristics of respondents

After the ethics committee of Pharmacy faculty, Prince of Songkla University approved the study protocol in 26 April 2013, the data collection period started in August 2013 and finished in November 2013. Seven trained interviewers surveyed in 33 amphoes of 3 provinces including Surat thani, Songkla, and Yala. Originally, there were a total of 485 respondents. However, only 459 respondents (94.64%) completely answered the questionnaire. Sixteen respondents (3.30%) could not understand the question, three respondents (0.01%) gave incompletely answers, and seven respondents (1.44%) gave wrong answers in the choice set which tested for their understandings. Table 4 shows demographic characteristics of the respondents. Most of the respondents were female (57.3%) and had a bachelor or higher degree approximately (60%). Their average age was 37.54 years. Average individual income and household income were 15,500 and 42,800 Baht/month, respectively.

Table 4 Demographic characteristics of respondents

Demographic characteristics	Number
Gender (N (%))	
- Male	196 (42.7)
- Female	263 (57.3)
Age (years) (mean $\pm$ standard deviation)	37.54 $\pm$ 11.22
(minimum – maximum)	(20-69)
Education (N (%))	
- Primary school	74 (16.1)
- High school	115 (25.1)
- Bachelor or higher degree	270 (58.8)

Demographic characteristics	Number
Career (N (%))	
- Employee	203 (44.2)
- Government worker/enterprise	98 (21.4)
- Own business	75 (16.3)
- Farmer	69 (15.0)
- Other	10 (2.2)
- No career	4 (0.9)
Individual income (Baht/month)	
(mean + standard deviation)	15,502.79 ± 12,178.09
(minimum – maximum)	(0 – 100,000)
Household income (Baht/month)	
(mean + standard deviation)	42,784.97 ± 35,326.09
(minimum – maximum)	(2,000 – 400,000)
Utility of current health state	
- Rescaling Visual analog scale	
(mean ± standard deviation)	0.884 ± 1.235
(minimum – maximum)	(0.375 – 1.167)
- EQ-5D-3L	
(mean ± standard deviation)	0.826 ± 0.170
(minimum – maximum)	(0.392 – 1.000)

4.2 Utilities of 72 health states

A total of 72 health states presented in questionnaire were measured the utility by using visual analog scale (VAS). The scores derived from VAS were rescaled to adjust '11111' = 1.000 and death = 0.000. The correlation (r) between rescaled VAS and EQ-5D Thai tariff of 72 health states was 0.884 (P-value <0.01) following figure 4.

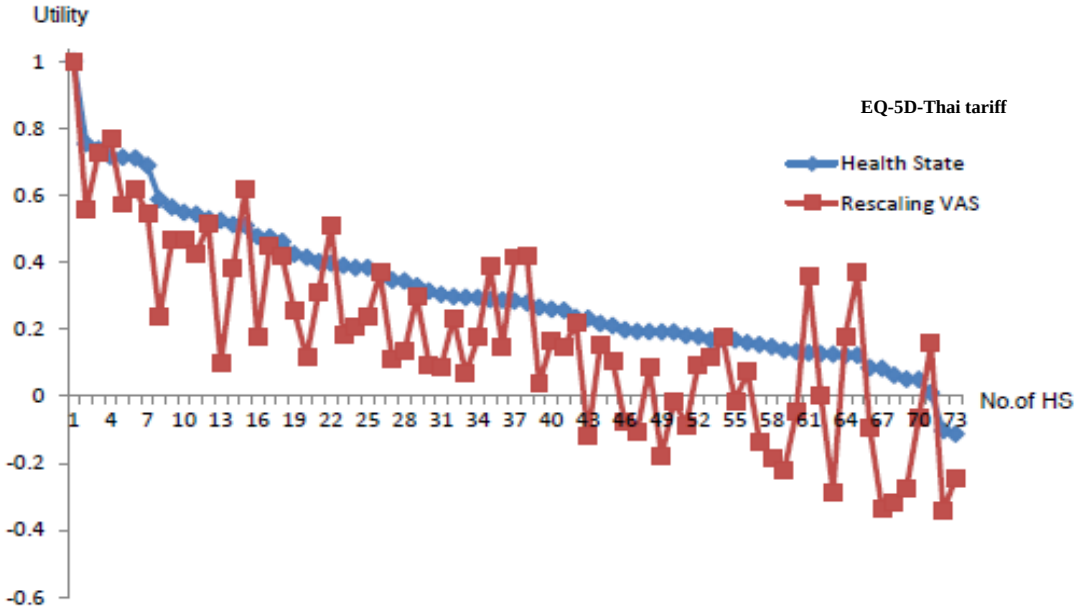

Figure 4 **C**orrelation of utilities of 72 health state measured by VAS and EQ-5D Thai tariff

4.3 Discrete choice analysis

Data were analyzed using multinomial logit models, based on utility function. We used effect coding (table 5) for determining beta coefficient of variables in three levels. Four models were created for data analyzed including

1) Model 1 is a basic model of utility function

$$U_{isj} = \text{constant} + \beta_1(MO1) + \beta_2(MO2) + \beta_3(SC1) + \beta_4(SC2) + \beta_5(AC1) + \beta_6(AC2) + \beta_7(PA1) + \beta_8(PA2) + \beta_9(AN1) + \beta_{10}(AN2) + \beta_{11}(COST) + \varepsilon_{isj}$$

2) Model 2 is a reduced model by removing insignificant variables from model 1.

3) Model 3 is a full model by input interaction of household income and cost into the basic model.

$$U_{isj} = \text{constant} + \beta_1(MO1) + \beta_2(MO2) + \beta_3(SC1) + \beta_4(SC2) + \beta_5(AC1) + \beta_6(AC2) + \beta_7(PA1) + \beta_8(PA2) + \beta_9(AN1) + \beta_{10}(AN2) + \beta_{11}(COST) + \beta_{11}(COST \times INCOME) + \varepsilon_{isj}$$

4) Model 4 is reduced model by removing insignificant variables from model 3.

Table 5 Variable explanation

Variable	Description
MO1	Mobility; =1 if no problems, -1 if extreme problems, else zero
MO2	Mobility; = 1 if some problems, -1 if extreme problems, else zero
SC1	Self-care; = 1if no problems, -1 if extreme problems, else zero
SC2	Self-care; = 1 if some problems, -1 if extreme problems, else zero
UA1	Usual activities; =1 if no problems, -1 if extreme problems, else zero
UA2	Usual activities; = 1 if some problems, -1 if extreme problems, else zero
PD1	Pain/Discomfort; = 1 if no problems, -1 if extreme problems, else zero
PD2	Pain/Discomfort; = 1 if some problems, -1 if extreme problems, else zero
AD1	Anxiety/Depression; =1 if no problems, -1 if extreme problems, else zero
AD2	Anxiety/Depression; =1 if some problems, -1 if extreme problems, else zero
Cost	Payment for treatment (Baht per month)
Cost x Income	Cost multiplied with household income

Each respondent was asked to answer four choice sets. Therefore, 459 created 1,836 observations in DCE question. We found that 80 observations (4.26%) were unwilling to pay for treatment and chose the reference alternative because 13 observations (0.71%) did not prefer presented outcomes in choice set, 37 observations (2.02%) did not have enough money as presenting in choice sets, and 30 observations (1.63%) did not prefer outcome and have enough money.

Table 6 shows the results of data analysis. All model fittings, explained by McFadden's R^2, were not different. The reduced models (Model 2 and Model 4) could not improve model fitting. Finally, we selected basic model (Model 1) to determine WTP value for dimension levels. Average WTP values for life saving and moving to each dimension level presented in table 7.

Table 6 Models and beta coefficients

Variable	Beta coefficient (standard error) (n=459)			
	Model 1	**Model 2**	**Model 3**	**Model 4**
constant	3.335* (0.164)	3.336*(0.163)	3.375* (0.165)	3.375* (0.165)
MO1	0.735* (0.073)	0.733* (0.072)	0.742* (0.073)	0.742* (0.073)
MO2	0.395* (0.070)	0.395* (0.070)	0.394* (0.070)	0.394* (0.070)
SC1	0.546* (0.062)	0.546* (0.062)	0.549* (0.062)	0.549* (0.062)
SC2	0.329* (0.065)	0.328* (0.065)	0.329* (0.065)	0.329* (0.065)
UA1	0.605* (0.067)	0.609* (0.063)	0.618* (0.067)	0.618* (0.067)
UA2	0.011** (0.0661)	-	-0.002**(0.066)	-
PD1	0.774* (0.061)	0.774* (0.061)	0.775*(0.061)	0.775*(0.061)
PD2	0.162* (0.058)	0.162* (0.058)	0.166* (0.580)	0.166* (0.580)
AD1	0.384* (0.064)	0.384* (0.064)	0.394* (0.064)	0.394* (0.064)
AD2	0.333* (0.062)	0.333* (0.062)	0.324* (0.063)	0.324* (0.063)
Cost	-0.584×10^{-04}* (0.727×10^{-05})	-0.585×10^{-04}* (0.728×10^{-05})	-0.783×10^{-04}* (0.984×10^{-05})	-0.783×10^{-04}* (0.984×10^{-05})
Cost X Income	-	-	0.428×10^{-09}* (0.138×10^{-09})	0.428×10^{-09}* (0.138×10^{-09})
Log likelihood function	-1023.859	-1023.872	-1019.172	-1019.173
Restricted Log likelihood function	-1513.372	-1513.372	-1513.372	-1513.372
McFadden's R^2	0.323	0.324	0.326	0.326

*P-value < 0.01 **P-value >0.10

Table 7 WTP for moving from life threatening disease to each dimension level

Dimension	Willingness to pay (Baht/month)		
	Mean	Median	95% confidence interval
Mobility			
No problem	12,719	12,546	9,014 - 17,486
Some problems	6,830	6,724	4,302 - 9,875
Extreme problems	- 19,550	- 19,273	-25,810 - -4,926
Self-care			
No problem	9,482	9,314	6,657 - 13,171
Some problems	5,683	5,616	3,510 - 8,346
Extreme problems	- 15,165	- 14,944	-11,450 - -20,230
Usual activities			
No problem	10,533	10,390	7,584 - 14,328
Some problems	185	177	-2,005 - 2,390
Extreme problems	- 10,718	-10,567	-14,948 - - 7,532
Pain/Discomfort			
No problem	13,446	13,210	10,175 - 17,821
Some problems	2,827	2,790	845 - 5,023
Extreme problems	-16,273	16,010	-21,351 - -12,485
Anxiety/Depression			
No problem	6,648	6,570	4,256 - 9,596
Some problems	5,773	5,667	3,513 - 8,529
Extreme problems	-12,421	-12,240	-16,568 - -9,257

4.4 Willingness-to-pay

We calculated and presented WTP values in three approaches including 1) WTP for the life-saving treatment2) WTP for moving from243 health states to other health states and 3) WTP for the treatment of life-threatening disease and moving back to current health state.

4.4.1 WTP for life saving treatment

The hypothetical scenario of this study was life-threatening disease for one year, which respondents will die from this disease if they do not get any treatment. Therefore, DCE was used to estimate WTP for the life-saving treatment. We found the increasing of WTP was related to additional QALY. Respondents were willing to pay for the treatment for moving from life-threatening state to 124 states, from a total of 243 health states. The maximum and minimum WTP for treatment of life saving were 633,940 and 1,994 Baht/year for moving to '11111' (additional QALY = 1.000) and to '23312', (additional QALY =0.145), respectively. They were not willing to pay for 50 health states although these states had utility higher than life-threatening state did (U=0.000). In addition, '33333' was the health state that respondents showed highest unwillingness to pay value (WTP = -889,517 Baht). Table 8 shows the WTP for life saving treatment.

Table 8 WTP for life saving treatment.

Outcome	Additional QALY	WTP (Baht/year)
Death	0.000	0
1 1 1 1 1	1.000	633,940
1 1 1 1 2	0.766	623,446
1 2 1 1 1	0.677	588,362
1 2 1 1 2	0.645	577,867
2 1 1 1 1	0.677	563,270
2 1 1 1 2	0.645	552,776
2 2 1 1 1	0.556	517,692
1 1 2 1 1	0.739	509,753
2 2 1 1 2	0.524	507,197
Outcome	**Additional QALY**	**WTP (Baht/year)**

1 1 1 2 1	0.726	506,507
1 1 2 1 2	0.707	499,258
1 1 1 2 2	0.693	496,012
1 2 2 1 1	0.618	464,175
1 2 1 2 1	0.605	460,929
1 2 2 1 2	0.586	453,680
1 2 1 2 2	0.572	450,434
2 1 2 1 1	0.618	439,083
2 1 1 2 1	0.605	435,837
2 1 2 1 2	0.586	428,588
2 1 1 2 2	0.573	425,342
1 1 1 1 3	0.548	405,117
2 2 2 1 1	0.497	393,505
2 2 1 2 1	0.484	390,259
2 2 2 1 2	0.465	383,010
1 1 2 2 1	0.666	382,320
2 2 1 2 2	0.452	379,764
1 1 3 1 1	0.54	378,919
1 1 2 2 2	0.634	371,825
1 1 3 1 2	0.508	368,424
1 2 1 1 3	0.427	359,538
1 3 1 1 1	0.417	338,180
1 2 2 2 1	0.546	336,741
2 1 1 1 3	0.427	334,446
1 2 3 1 1	0.419	333,341
1 3 1 1 2	0.384	327,686
1 2 2 2 2	0.513	326,247
2 1 2 2 1	0.546	311,650
Outcome	**Additional QALY**	**WTP (Baht/year)**
2 1 3 1 1	0.419	308,249

2 1 2 2 2	0.513	301,155
2 1 3 1 2	0.387	297,754
2 2 1 1 3	0.306	288,868
1 1 2 1 3	0.489	280,929
1 1 1 2 3	0.475	277,683
1 1 1 3 1	0.449	277,313
2 3 1 1 1	0.296	267,510
1 1 1 3 2	0.417	266,819
2 2 2 2 1	0.425	266,071
2 2 3 1 1	0.299	262,671
2 3 1 1 2	0.264	257,016
2 2 2 2 2	0.392	255,577
2 2 3 1 2	0.266	252,176
1 1 3 2 1	0.468	251,486
3 1 1 1 1	0.226	246,715
1 1 3 2 2	0.436	240,991
3 1 1 1 2	0.194	236,220
1 2 2 1 3	0.368	235,351
1 2 1 2 3	0.354	232,105
1 2 1 3 1	0.328	231,735
1 2 1 3 2	0.296	221,240
1 3 2 1 1	0.357	213,993
1 3 1 2 1	0.344	210,747
2 1 2 1 3	0.368	210,259
2 1 1 2 3	0.355	207,013
2 1 1 3 1	0.328	206,643
1 2 3 2 1	0.347	205,907

Outcome	**Additional QALY**	**WTP (Baht/year)**
3 2 1 1 1	0.105	201,137
1 3 1 2 2	0.312	200,252

2 1 1 3 2	0.296	196,149
1 2 3 2 2	0.315	195,413
3 2 1 1 2	0.073	190,642
2 1 3 2 1	0.347	180,816
2 1 3 2 2	0.315	170,321
2 2 2 1 3	0.247	164,681
2 2 1 2 3	0.234	161,435
2 2 1 3 1	0.207	161,065
1 1 2 2 3	0.416	153,496
1 1 2 3 1	0.390	153,126
2 2 1 3 2	0.175	150,570
1 1 3 1 3	0.430	150,095
2 3 2 1 1	0.237	143,323
1 1 2 3 2	0.358	142,631
2 3 1 2 1	0.223	140,077
2 2 3 2 1	0.226	135,237
2 3 2 1 2	0.204	132,828
2 3 1 2 2	0.191	129,582
2 2 3 2 2	0.194	124,743
3 1 2 1 1	0.167	122,528
3 1 1 2 1	0.154	119,282
3 1 2 1 2	0.135	112,033
1 3 1 1 3	0.306	109,357
3 1 1 2 2	0.122	108,787
1 2 2 2 3	0.295	107,918
1 2 2 3 1	0.269	107,548
Outcome	**Additional QALY**	**WTP (Baht/year)**
1 2 2 3 2	0.237	97,053
1 3 2 2 1	0.285	86,560
1 3 3 1 1	0.298	83,159

2 1 2 2 3	0.295	82,826
2 1 2 3 1	0.269	82,456
2 1 3 1 3	0.309	79,425
3 2 2 1 1	0.046	76,950
1 3 2 2 2	0.253	76,065
3 2 1 2 1	0.033	73,704
1 3 3 1 2	0.266	72,664
2 1 2 3 2	0.237	71,961
3 2 2 1 2	0.014	66,455
3 2 1 2 2	0.001	63,209
1 1 1 3 3	0.338	48,489
2 3 1 1 3	0.185	38,687
2 2 2 2 3	0.175	37,248
2 2 2 3 1	0.148	36,878
2 2 3 1 3	0.188	33,847
2 2 2 3 2	0.116	26,383
1 1 3 2 3	0.357	22,662
1 1 3 3 1	0.331	22,292
3 1 1 1 3	0.116	17,891
2 3 2 2 1	0.164	15,890
2 3 3 1 1	0.178	12,489
1 1 3 3 2	0.299	11,797
2 3 2 2 2	0.132	5,395
1 2 1 3 3	0.217	2,911
2 3 3 1 2	0.145	1,994

Outcome	**Additional QALY**	**WTP (Baht/year)**
3 1 2 2 1	0.095	-4,905
3 1 3 1 1	0.108	-8,306
1 3 2 1 3	0.247	-14,831
3 1 2 2 2	0.063	-15,400

1 3 1 2 3	0.234	-18,077
1 3 1 3 1	0.207	-18,447
3 1 3 1 2	0.076	-18,801
2 1 1 3 3	0.217	-22,181
1 2 3 2 3	0.236	-22,916
1 2 3 3 1	0.210	-23,286
3 2 1 1 3	-0.005	-27,687
1 3 1 3 2	0.175	-28,941
1 2 3 3 2	0.178	-33,781
1 3 3 2 1	0.226	-44,274
2 1 3 2 3	0.236	-48,008
2 1 3 3 1	0.210	-48,378
3 3 1 1 1	-0.015	-49,045
3 2 2 2 1	-0.026	-50,484
3 2 3 1 1	-0.013	-53,884
1 3 3 2 2	0.194	-54,769
2 1 3 3 2	0.178	-58,873
3 3 1 1 2	-0.048	-59,539
3 2 2 2 2	-0.058	-60,978
3 2 3 1 2	-0.045	-64,379
2 2 1 3 3	0.096	-67,759
1 1 2 3 3	0.279	-75,698
2 3 2 1 3	0.126	-85,501
2 3 1 2 3	0.113	-88,747
Outcome	**Additional QALY**	**WTP (Baht/year)**
2 3 1 3 1	0.086	-89,117
2 2 3 2 3	0.115	-93,586
2 2 3 3 1	0.089	-93,956
2 3 1 3 2	0.054	-99,611
2 2 3 3 2	0.057	-104,451

3 1 2 1 3	0.057	-106,296
3 1 1 2 3	0.043	-109,542
3 1 1 3 1	0.017	-109,912
2 3 3 2 1	0.105	-114,944
3 1 1 3 2	-0.015	-120,407
1 2 2 3 3	0.158	-121,276
2 3 3 2 2	0.073	-125,439
3 1 3 2 1	0.036	-135,739
1 3 2 2 3	0.174	-142,264
1 3 2 3 1	0.148	-142,634
1 3 3 1 3	0.188	-145,665
3 1 3 2 2	0.004	-146,234
2 1 2 3 3	0.158	-146,368
3 2 2 1 3	-0.064	-151,874
1 3 2 3 2	0.116	-153,129
3 2 1 2 3	-0.078	-155,120
3 2 1 3 1	-0.104	-155,490
3 2 1 3 2	-0.136	-165,985
3 3 2 1 1	-0.075	-173,232
3 3 1 2 1	-0.088	-176,478
3 2 3 2 1	-0.085	-181,318
3 3 2 1 2	-0.107	-183,727
3 3 1 2 2	-0.120	-186,973
Outcome	**Additional QALY**	**WTP(Baht/year)**
3 2 3 2 2	-0.117	-191,812
2 2 2 3 3	0.037	-191,946
1 1 3 3 3	0.220	-206,532
2 3 2 2 3	0.054	-212,934
2 3 2 3 1	0.027	-213,304
2 3 3 1 3	0.067	-216,335

2 3 2 3 2	-0.005	-223,799
3 1 2 2 3	-0.016	-233,729
3 1 2 3 1	-0.042	-234,099
3 1 3 1 3	-0.003	-237,130
3 1 2 3 2	-0.074	-244,594
1 3 1 3 3	0.096	-247,270
1 2 3 3 3	0.099	-252,110
1 3 3 2 3	0.115	-273,098
1 3 3 3 1	0.089	-273,468
2 1 3 3 3	0.099	-277,202
3 3 1 1 3	-0.126	-277,869
3 2 2 2 3	-0.137	-279,307
3 2 2 3 1	-0.163	-279,678
3 2 3 1 3	-0.124	-282,708
1 3 3 3 2	0.057	-283,963
3 2 2 3 2	-0.195	-290,172
3 3 2 2 1	-0.147	-300,665
3 3 3 1 1	-0.134	-304,066
3 3 2 2 2	-0.179	-311,160
3 3 3 1 2	-0.166	-314,561
2 3 1 3 3	-0.025	-317,940
2 2 3 3 3	-0.022	-322,780
Outcome	**Additional QALY**	**WTP(Baht/year)**
3 1 1 3 3	-0.094	-338,736
2 3 3 2 3	-0.006	-343,768
2 3 3 3 1	-0.032	-344,138
2 3 3 3 2	-0.064	-354,633
3 1 3 2 3	-0.075	-364,563
3 1 3 3 1	-0.101	-364,933
1 3 2 3 3	0.037	-371,458

3 1 3 3 2	-0.133	-375,428
3 2 1 3 3	-0.215	-384,314
3 3 2 1 3	-0.185	-402,056
3 3 1 2 3	-0.199	-405,302
3 3 1 3 1	-0.225	-405,672
3 2 3 2 3	-0.196	-410,141
3 2 3 3 1	-0.222	-410,511
3 3 1 3 2	-0.257	-416,166
3 2 3 3 2	-0.254	-421,006
3 3 3 2 1	-0.206	-431,499
3 3 3 2 2	-0.238	-441,994
2 3 2 3 3	-0.084	-442,128
3 1 2 3 3	-0.153	-462,923
1 3 3 3 3	-0.022	-502,292
3 2 2 3 3	-0.274	-508,501
3 3 2 2 3	-0.258	-529,489
3 3 2 3 1	-0.284	-529,859
3 3 3 1 3	-0.244	-532,890
3 3 2 3 2	-0.316	-540,354
2 3 3 3 3	-0.143	-572,962
3 1 3 3 3	-0.212	-593,757
Outcome	**Additional QALY**	**WTP(Baht/year)**
3 3 1 3 3	-0.336	-634,496
3 2 3 3 3	-0.333	-639,335
3 3 3 2 3	-0.317	-660,323
3 3 3 3 1	-0.343	-660,693
3 3 3 3 2	-0.375	-671,188
3 3 2 3 3	-0.395	-758,683
3 3 3 3 3	-0.454	-889,517

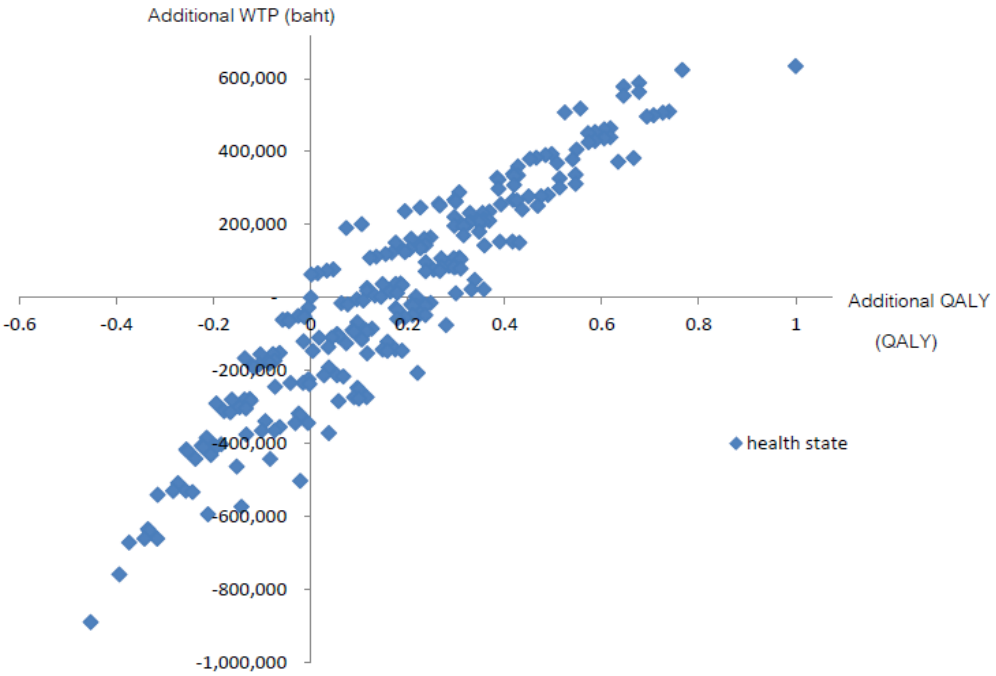

Figure 5 WTP for life saving and moving to 243 health states

Figure 5 shows additional QALY values and additional WTP values from table 7. The origin was life-threatening state, where additional QALY and additional WTP were zero. We found significant correlation (r) between additional WTP and additional QALY was 0.94 (P value < 0.01). Quadrant 1 shows that the respondents preferred to pay for the treatment of the life-threatening disease for those outcomes of 124 health states. The maximum and minimum WTP values were 633,940 and 1,994 Baht/year for moving to '11111' (additional QALY = 1.000) and to '23312', (additional QALY =0.145), respectively. For quadrant 2, there were no any respondent preferring to pay for the treatment when the treatment outcomes were worse than death. Sixty-three health states in quadrant 3 which were worse than death, and respondents were unwilling to pay. Finally, in quadrant 4, although 50 health states had utilities higher than death such as '11333', '123333', and '13323' etc., respondents were unwillingness to pay.

4.4.2 WTP for moving from 243 health states to other health states

DCE study could estimate not only WTP for life saving treatment but also the WTP for moving from 243 health states to other health states. For example, WTP for moving from '22222' to '12121' was

= WTP for life saving and moving to to '12121' - WTP for life saving to and moving to '22222'

= 460,929 – 255,577

= 205,352 Baht/year

The calculated WTP was associated with both characteristics of health state and additional QALY. For instance, the minimum willingness to pay was 134 Baht derived from moving '23233' to '33322', '22233' to '33322', and '21233' to '31322'. The maximum WTP was 1,523,457 Baht derived from '33333' to '11111'. Table 11 shows the maximum and minimum WTP of all health states. For example, if respondents were in '21111', they preferred to pay for moving to '11111', '11112', '12111', and '12112'. The range of payment was 14,597 to 70,670 Baht/year. In addition, '11111' was the best outcome which respondents preferred to get and expressed the maximum WTP.

Table 9 Willingness to pay of 243 health states

Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
1 1 1 1 1	-	-	-	-
1 1 1 1 2	10,495	1 1 1 1 1	10,495	1 1 1 1 1
1 2 1 1 1	35,084	1 1 1 1 2	45,578	1 1 1 1 1
1 2 1 1 2	10,495	1 2 1 1 1	56,073	1 1 1 1 1
2 1 1 1 1	14,597	1 2 1 1 2	70,670	1 1 1 1 1
2 1 1 1 2	10,495	2 1 1 1 1	81,165	1 1 1 1 1
2 2 1 1 1	35,084	2 1 1 1 2	116,248	1 1 1 1 1
1 1 2 1 1	7,939	2 2 1 1 1	124,187	1 1 1 1 1

2 2 1 1 2	2,556	1 1 2 1 1	126,743	1 1 1 1 1
1 1 1 2 1	690	2 2 1 1 2	134,682	1 1 1 1 1
1 1 2 1 2	7,249	1 1 1 2 1	137,928	1 1 1 1 1
1 1 1 2 2	3,246	1 1 2 1 2	137,928	1 1 1 1 1
1 2 2 1 1	31,838	1 1 1 2 2	169,766	1 1 1 1 1
1 2 1 2 1	3,246	1 2 2 1 1	173,012	1 1 1 1 1
1 2 2 1 2	7,249	1 2 1 2 1	180,260	1 1 1 1 1
1 2 1 2 2	3,246	1 2 2 1 2	183,506	1 1 1 1 1
2 1 2 1 1	11,351	1 2 1 2 2	194,857	1 1 1 1 1
2 1 1 2 1	3,246	2 1 2 1 1	198,103	1 1 1 1 1
2 1 2 1 2	7,249	2 1 1 2 1	205,352	1 1 1 1 1
2 1 1 2 2	3,246	2 1 2 1 2	208,598	1 1 1 1 1
1 1 1 1 3	20,226	2 1 1 2 2	228,824	1 1 1 1 1
2 2 2 1 1	11,612	1 1 1 1 3	240,436	1 1 1 1 1
2 2 1 2 1	3,246	2 2 2 1 1	243,682	1 1 1 1 1
2 2 2 1 2	7,249	2 2 1 2 1	250,930	1 1 1 1 1
1 1 2 2 1	690	2 2 2 1 2	251,621	1 1 1 1 1
2 2 1 2 2	2,556	1 1 2 2 1	254,176	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum
1 1 3 1 1	845	2 2 1 2 2	255,021	1 1 1 1 1
1 1 2 2 2	7,094	1 1 3 1 1	262,115	1 1 1 1 1
1 1 3 1 2	3,401	1 1 2 2 2	265,516	1 1 1 1 1
1 2 1 1 3	8,886	1 1 3 1 2	274,402	1 1 1 1 1
1 3 1 1 1	21,358	1 2 1 1 3	295,760	1 1 1 1 1
1 2 2 2 1	1,439	1 3 1 1 1	297,199	1 1 1 1 1
2 1 1 1 3	2,295	1 2 2 2 1	299,494	1 1 1 1 1
1 2 3 1 1	1,106	2 1 1 1 3	300,600	1 1 1 1 1
1 3 1 1 2	5,655	1 2 3 1 1	306,255	1 1 1 1 1
1 2 2 2 2	1,439	1 3 1 1 2	307,693	1 1 1 1 1

1 2 3 1 2	3,401	1 2 2 2 2	311,094	1 1 1 1 1
2 1 2 2 1	11,196	1 2 3 1 2	322,291	1 1 1 1 1
2 1 3 1 1	3,401	2 1 2 2 1	325,691	1 1 1 1 1
2 1 2 2 2	7,094	2 1 3 1 1	332,785	1 1 1 1 1
2 1 3 1 2	3,401	2 1 2 2 2	336,186	1 1 1 1 1
2 2 1 1 3	8,886	2 1 3 1 2	345,072	1 1 1 1 1
1 1 2 1 3	7,939	2 2 1 1 3	353,011	1 1 1 1 1
1 1 1 2 3	3,246	1 1 2 1 3	356,257	1 1 1 1 1
1 1 1 3 1	370	1 1 1 2 3	356,627	1 1 1 1 1
2 3 1 1 1	9,803	1 1 1 3 1	366,430	1 1 1 1 1
1 1 1 3 2	692	2 3 1 1 1	367,122	1 1 1 1 1
2 2 2 2 1	747	1 1 1 3 2	367,869	1 1 1 1 1
2 2 3 1 1	3,401	2 2 2 2 1	371,270	1 1 1 1 1
2 3 1 1 2	5,655	2 2 3 1 1	376,925	1 1 1 1 1
2 2 2 2 2	1,439	2 3 1 1 2	378,363	1 1 1 1 1
2 2 3 1 2	3,401	2 2 2 2 2	381,764	1 1 1 1 1
1 3 2 1 1	690	2 2 3 1 2	382,455	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
3 1 1 1 1	4,771	1 1 3 2 1	387,225	1 1 1 1 1
1 1 3 2 2	5,724	3 1 1 1 1	392,949	1 1 1 1 1
3 1 1 1 2	4,771	1 1 3 2 2	397,720	1 1 1 1 1
1 2 2 1 3	870	3 1 1 1 2	398,589	1 1 1 1 1
1 2 1 2 3	3,246	1 2 2 1 3	401,835	1 1 1 1 1
1 2 1 3 1	370	1 2 1 2 3	402,205	1 1 1 1 1
1 2 1 3 2	10,495	1 2 1 3 1	412,700	1 1 1 1 1
1 3 2 1 1	7,247	1 2 1 3 2	419,947	1 1 1 1 1
1 3 1 2 1	3,246	1 3 2 1 1	423,193	1 1 1 1 1
2 1 2 1 3	488	1 3 1 2 1	423,681	1 1 1 1 1
2 1 1 2 3	3,246	2 1 2 1 3	426,927	1 1 1 1 1

2 1 1 3 1	370	2 1 1 2 3	427,297	1 1 1 1 1
1 2 3 2 1	736	2 1 1 3 1	428,033	1 1 1 1 1
1 3 2 1 2	2,409	1 2 3 2 1	430,442	1 1 1 1 1
3 2 1 1 1	2,362	1 3 2 1 2	432,803	1 1 1 1 1
1 3 1 2 2	884	3 2 1 1 1	433,688	1 1 1 1 1
2 1 1 3 2	4,104	1 3 1 2 2	437,792	1 1 1 1 1
1 2 3 2 2	736	2 1 1 3 2	438,527	1 1 1 1 1
3 2 1 1 2	4,771	1 2 3 2 2	443,298	1 1 1 1 1
2 1 3 2 1	9,827	3 2 1 1 2	453,125	1 1 1 1 1
2 1 3 2 2	10,495	2 1 3 2 1	463,619	1 1 1 1 1
2 2 2 1 3	5,640	2 1 3 2 2	469,259	1 1 1 1 1
2 2 1 2 3	3,246	2 2 2 1 3	472,505	1 1 1 1 1
2 2 1 3 1	370	2 2 1 2 3	472,875	1 1 1 1 1
1 1 2 2 3	7,569	2 2 1 3 1	480,444	1 1 1 1 1
1 1 2 3 1	370	1 1 2 2 3	480,814	1 1 1 1 1
2 2 1 3 2	2,556	1 1 2 3 1	483,370	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
1 1 3 1 3	475	2 2 1 3 2	483,845	1 1 1 1 1
2 3 2 1 1	6,772	1 1 3 1 3	490,617	1 1 1 1 1
1 1 2 3 2	692	2 3 2 1 1	491,309	1 1 1 1 1
2 3 1 2 1	2,554	1 1 2 3 2	493,863	1 1 1 1 1
2 2 3 2 1	4,840	2 3 1 2 1	498,703	1 1 1 1 1
2 3 2 1 2	2,409	2 2 3 2 1	501,112	1 1 1 1 1
2 3 1 2 2	3,246	2 3 2 1 2	504,358	1 1 1 1 1
2 2 3 2 2	4,840	2 3 1 2 2	509,197	1 1 1 1 1
3 1 2 1 1	2,215	2 2 3 2 2	511,412	1 1 1 1 1
3 1 1 2 1	3,246	3 1 2 1 1	514,658	1 1 1 1 1
3 1 2 1 2	7,249	3 1 1 2 1	521,907	1 1 1 1 1
1 3 1 1 3	2,677	3 1 2 1 2	524,584	1 1 1 1 1

3 1 1 2 2	569	1 3 1 1 3	525,153	1 1 1 1 1
1 2 2 2 3	870	3 1 1 2 2	526,023	1 1 1 1 1
1 2 2 3 1	370	1 2 2 2 3	526,393	1 1 1 1 1
1 2 3 1 3	3,031	1 2 2 3 1	529,423	1 1 1 1 1
1 2 2 3 2	7,464	1 2 3 1 3	536,887	1 1 1 1 1
1 3 2 2 1	10,493	1 2 2 3 2	547,380	1 1 1 1 1
1 3 3 1 1	3,401	1 3 2 2 1	550,781	1 1 1 1 1
2 1 2 2 3	333	1 3 3 1 1	551,114	1 1 1 1 1
2 1 2 3 1	370	2 1 2 2 3	551,484	1 1 1 1 1
2 1 3 1 3	3,031	2 1 2 3 1	554,515	1 1 1 1 1
3 2 2 1 1	2,476	2 1 3 1 3	556,991	1 1 1 1 1
1 3 2 2 2	884	3 2 2 1 1	557,875	1 1 1 1 1
3 2 1 2 1	2,362	1 3 2 2 2	560,237	1 1 1 1 1
1 3 3 1 2	1,039	3 2 1 2 1	561,276	1 1 1 1 1
2 1 2 3 2	703	1 3 3 1 2	561,979	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
3 2 2 1 2	5,506	2 1 2 3 2	567,485	1 1 1 1 1
3 2 1 2 2	3,246	3 2 2 1 2	570,731	1 1 1 1 1
1 1 1 3 3	14,719	3 2 1 2 2	585,451	1 1 1 1 1
2 3 1 1 3	9,803	1 1 1 3 3	595,254	1 1 1 1 1
2 2 2 2 3	1,439	2 3 1 1 3	596,693	1 1 1 1 1
2 2 2 3 1	370	2 2 2 2 3	597,063	1 1 1 1 1
2 2 3 1 3	3,031	2 2 2 3 1	600,093	1 1 1 1 1
2 2 2 3 2	7,464	2 2 3 1 3	607,557	1 1 1 1 1
1 1 3 2 3	3,721	2 2 2 3 2	611,278	1 1 1 1 1
1 1 3 3 1	370	1 1 3 2 3	611,648	1 1 1 1 1
3 1 1 1 3	4,401	1 1 3 3 1	616,049	1 1 1 1 1
2 3 2 2 1	2,002	3 1 1 1 3	618,051	1 1 1 1 1
2 3 3 1 1	3,401	2 3 2 2 1	621,451	1 1 1 1 1

1 1 3 3 2	692	2 3 3 1 1	622,143	1 1 1 1 1
2 3 2 2 2	6,402	1 1 3 3 2	628,545	1 1 1 1 1
1 2 1 3 3	2,484	2 3 2 2 2	631,029	1 1 1 1 1
2 3 3 1 2	917	1 2 1 3 3	631,946	1 1 1 1 1
3 1 2 2 1	6,900	2 3 3 1 2	638,846	1 1 1 1 1
3 1 3 1 1	3,401	3 1 2 2 1	642,246	1 1 1 1 1
1 3 2 1 3	6,525	3 1 3 1 1	648,771	1 1 1 1 1
3 1 2 2 2	569	1 3 2 1 3	649,340	1 1 1 1 1
1 3 1 2 3	2,677	3 1 2 2 2	652,017	1 1 1 1 1
1 3 1 3 1	370	1 3 1 2 3	652,387	1 1 1 1 1
3 1 3 1 2	354	1 3 1 3 1	652,741	1 1 1 1 1
2 1 1 3 3	3,380	3 1 3 1 2	656,121	1 1 1 1 1
1 2 3 2 3	736	2 1 1 3 3	656,856	1 1 1 1 1
1 2 3 3 1	370	1 2 3 2 3	657,227	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
3 2 1 1 3	4,401	1 2 3 3 1	661,627	1 1 1 1 1
1 3 1 3 2	1,254	3 2 1 1 3	662,882	1 1 1 1 1
1 2 3 3 2	4,840	1 3 1 3 2	667,721	1 1 1 1 1
1 3 3 2 1	10,493	1 2 3 3 2	678,214	1 1 1 1 1
2 1 3 2 3	3,734	1 3 3 2 1	681,948	1 1 1 1 1
2 1 3 3 1	370	2 1 3 2 3	682,318	1 1 1 1 1
3 3 1 1 1	667	2 1 3 3 1	682,985	1 1 1 1 1
3 2 2 2 1	1,439	3 3 1 1 1	684,424	1 1 1 1 1
3 2 3 1 1	3,401	3 2 2 2 1	687,825	1 1 1 1 1
1 3 3 2 2	884	3 2 3 1 1	688,709	1 1 1 1 1
2 1 3 3 2	4,104	1 3 3 2 2	692,813	1 1 1 1 1
3 3 1 1 2	667	2 1 3 3 2	693,480	1 1 1 1 1
3 2 2 2 2	1,439	3 3 1 1 2	694,919	1 1 1 1 1
3 2 3 1 2	3,401	3 2 2 2 2	698,319	1 1 1 1 1

2 2 1 3 3	3,380	3 2 3 1 2	701,699	1 1 1 1 1
1 1 2 3 3	7,939	2 2 1 3 3	709,638	1 1 1 1 1
2 3 2 1 3	9,803	1 1 2 3 3	719,441	1 1 1 1 1
2 3 1 2 3	3,246	2 3 2 1 3	722,687	1 1 1 1 1
2 3 1 3 1	370	2 3 1 2 3	723,057	1 1 1 1 1
2 2 3 2 3	4,470	2 3 1 3 1	727,527	1 1 1 1 1
2 2 3 3 1	370	2 2 3 2 3	727,897	1 1 1 1 1
2 3 1 3 2	5,655	2 2 3 3 1	733,552	1 1 1 1 1
2 2 3 3 2	4,840	2 3 1 3 2	738,391	1 1 1 1 1
3 1 2 1 3	1,845	2 2 3 3 2	740,236	1 1 1 1 1
3 1 1 2 3	3,246	3 1 2 1 3	743,482	1 1 1 1 1
3 1 1 3 1	370	3 1 1 2 3	743,852	1 1 1 1 1
2 3 3 2 1	5,032	3 1 1 3 1	748,884	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
3 1 1 3 2	5,462	2 3 3 2 1	754,347	1 1 1 1 1
1 2 2 3 3	870	3 1 1 3 2	755,216	1 1 1 1 1
2 3 3 2 2	4,163	1 2 2 3 3	759,379	1 1 1 1 1
3 1 3 2 1	10,301	2 3 3 2 2	769,680	1 1 1 1 1
1 3 2 2 3	6,525	3 1 3 2 1	776,204	1 1 1 1 1
1 3 2 3 1	370	1 3 2 2 3	776,574	1 1 1 1 1
1 3 3 1 3	3,031	1 3 2 3 1	779,605	1 1 1 1 1
3 1 3 2 2	569	1 3 3 1 3	780,174	1 1 1 1 1
2 1 2 3 3	134	3 1 3 2 2	780,308	1 1 1 1 1
3 2 2 1 3	5,506	2 1 2 3 3	785,814	1 1 1 1 1
1 3 2 3 2	1,254	3 2 2 1 3	787,069	1 1 1 1 1
3 2 1 2 3	1,992	1 3 2 3 2	789,060	1 1 1 1 1
3 2 1 3 1	370	3 2 1 2 3	789,430	1 1 1 1 1
3 2 1 3 2	10,495	3 2 1 3 1	799,925	1 1 1 1 1
3 3 2 1 1	7,247	3 2 1 3 2	807,172	1 1 1 1 1

3 3 1 2 1	3,246	3 3 2 1 1	810,418	1 1 1 1 1
3 2 3 2 1	4,840	3 3 1 2 1	815,258	1 1 1 1 1
3 3 2 1 2	2,409	3 2 3 2 1	817,667	1 1 1 1 1
3 3 1 2 2	3,246	3 3 2 1 2	820,913	1 1 1 1 1
3 2 3 2 2	4,840	3 3 1 2 2	825,753	1 1 1 1 1
2 2 2 3 3	134	3 2 3 2 2	825,886	1 1 1 1 1
1 1 3 3 3	14,586	2 2 2 3 3	840,472	1 1 1 1 1
2 3 2 2 3	6,402	1 1 3 3 3	846,874	1 1 1 1 1
2 3 2 3 1	370	2 3 2 2 3	847,244	1 1 1 1 1
2 3 3 1 3	3,031	2 3 2 3 1	850,275	1 1 1 1 1
2 3 2 3 2	7,464	2 3 3 1 3	857,739	1 1 1 1 1
1 3 3 2 3	20,988	1 2 3 3 3	907,038	1 1 1 1 1

Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
1 3 3 3 1	370	1 3 3 2 3	907,408	1 1 1 1 1
2 1 3 3 3	3,734	1 3 3 3 1	911,142	1 1 1 1 1
3 3 1 1 3	667	2 1 3 3 3	911,809	1 1 1 1 1
3 2 2 2 3	1,439	3 3 1 1 3	913,248	1 1 1 1 1
3 2 2 3 1	370	3 2 2 2 3	913,618	1 1 1 1 1
3 2 3 1 3	3,031	3 2 2 3 1	916,648	1 1 1 1 1
1 3 3 3 2	1,254	3 2 3 1 3	917,903	1 1 1 1 1
3 2 2 3 2	6,210	1 3 3 3 2	924,112	1 1 1 1 1
3 3 2 2 1	10,493	3 2 2 3 2	934,606	1 1 1 1 1
3 3 3 1 1	3,401	3 3 2 2 1	938,006	1 1 1 1 1
3 3 2 2 2	7,094	3 3 3 1 1	945,100	1 1 1 1 1
3 3 3 1 2	3,401	3 3 2 2 2	948,501	1 1 1 1 1
2 3 1 3 3	3,380	3 3 3 1 2	951,881	1 1 1 1 1
2 2 3 3 3	4,840	2 3 1 3 3	956,720	1 1 1 1 1
3 1 1 3 3	15,956	2 2 3 3 3	972,676	1 1 1 1 1
2 3 3 2 3	5,032	3 1 1 3 3	977,708	1 1 1 1 1

2 3 3 3 1	370	2 3 3 2 3	978,078	1 1 1 1 1
2 3 3 3 2	10,495	2 3 3 3 1	988,573	1 1 1 1 1
3 1 3 2 3	9,930	2 3 3 3 2	998,503	1 1 1 1 1
3 1 3 3 1	370	3 1 3 2 3	998,873	1 1 1 1 1
1 3 2 3 3	6,525	3 1 3 3 1	1,005,398	1 1 1 1 1
3 1 3 3 2	3,970	1 3 2 3 3	1,009,368	1 1 1 1 1
3 2 1 3 3	8,886	3 1 3 3 2	1,018,254	1 1 1 1 1
3 3 2 1 3	17,742	3 2 1 3 3	1,035,996	1 1 1 1 1
3 3 1 2 3	3,246	3 3 2 1 3	1,039,242	1 1 1 1 1
3 3 1 3 1	370	3 3 1 2 3	1,039,612	1 1 1 1 1
3 2 3 2 3	4,470	3 3 1 3 1	1,044,082	1 1 1 1 1
Health state	Minimum WTP (Baht/year)	Outcome of minimum WTP	Maximum WTP (Baht/year)	Outcome of maximum WTP
3 2 3 3 1	370	3 2 3 2 3	1,044,452	1 1 1 1 1
3 3 1 3 2	5,655	3 2 3 3 1	1,050,107	1 1 1 1 1
3 2 3 3 2	4,840	3 3 1 3 2	1,054,946	1 1 1 1 1
3 3 3 2 1	10,493	3 2 3 3 2	1,065,440	1 1 1 1 1
3 3 3 2 2	10,495	3 3 3 2 1	1,075,934	1 1 1 1 1
2 3 2 3 3	134	3 3 3 2 2	1,076,068	1 1 1 1 1
3 1 2 3 3	20,795	2 3 2 3 3	1,096,863	1 1 1 1 1
1 3 3 3 3	39,369	3 1 2 3 3	1,136,232	1 1 1 1 1
3 2 2 3 3	6,210	1 3 3 3 3	1,142,441	1 1 1 1 1
3 3 2 2 3	20,988	3 2 2 3 3	1,163,429	1 1 1 1 1
3 3 2 3 1	370	3 3 2 2 3	1,163,799	1 1 1 1 1
3 3 3 1 3	3,031	3 3 2 3 1	1,166,830	1 1 1 1 1
3 3 2 3 2	7,464	3 3 3 1 3	1,174,294	1 1 1 1 1
2 3 3 3 3	32,608	3 3 2 3 2	1,206,902	1 1 1 1 1
3 1 3 3 3	20,795	2 3 3 3 3	1,227,697	1 1 1 1 1
3 3 1 3 3	40,739	3 1 3 3 3	1,268,436	1 1 1 1 1
3 2 3 3 3	4,840	3 3 1 3 3	1,273,275	1 1 1 1 1

3 3 3 2 3	20,988	3 2 3 3 3	1,294,263	1 1 1 1 1
3 3 3 3 1	370	3 3 3 2 3	1,294,633	1 1 1 1 1
3 3 3 3 2	10,495	3 3 3 3 1	1,305,128	1 1 1 1 1
3 3 2 3 3	87,495	3 3 3 3 2	1,392,623	1 1 1 1 1
3 3 3 3 3	130,834	3 3 2 3 3	1,523,457	1 1 1 1 1

The initial health states were divided from their utilities into three levels including mild, moderate, and severe health states to present their WTP. Table 10 shows average WTP for moving to '11111' and average of WTP for moving to all higher health states. Respondents in mild health states had average WTP for moving to '11111' and for moving to all higher health states which were 101,823 and 32,710 Baht/year, whereas respondents in moderate health states were willing to pay 290,425 and 113,162 Baht/year, respectively. Respondents in severe health states were willing to pay approximately 750,000 Baht/year for moving to '11111' and 309,891 Baht/year for moving to higher health states.

Table 10 Average WTP of mild, moderate and severe health states

Severity of initial health state	**Average WTP (Baht/year) for moving to**	
	'11111' (min–max)	**All Higher health states** (min–max)
Mild health states (U = 0.700 – 1.000)	**101,823 ± 61,167** (10,495 - 137,825)	**32,710 ± 14,966** (10,495 – 42,634)
Moderate health states (U = 0.350 – 0.700)	**290,425 ± 120,970** (45,578 - 401,835)	**113,162 ± 29,514** (44,661 – 148,815)
Severe health states (U <= - 0.454 - 0.350)	**749,825 ± 238,973** (345,072 -1,523,457)	**309,891 ± 135,458** (152,583 – 893,193)

The severity of health state was divided following the second WTP per QALY studies in Thailand

In addition, we found that WTP values for moving to '11111' were significantly correlated with utilities of initial health states (r = -0.94, P-value <0.01). When respondents were in low utility health states, they were willing to pay for the treatment more than when they were in high utility health states. For instance, the maximum WTP of respondents in '22222' (u=0.392) was 378,363 Baht/year, while the maximum WTP of respondents in '33333' (u= -0.454) was 1,523,457 Baht/year. Graph of maximum WTP and utility of initial health state are depicted in present in figure 7.

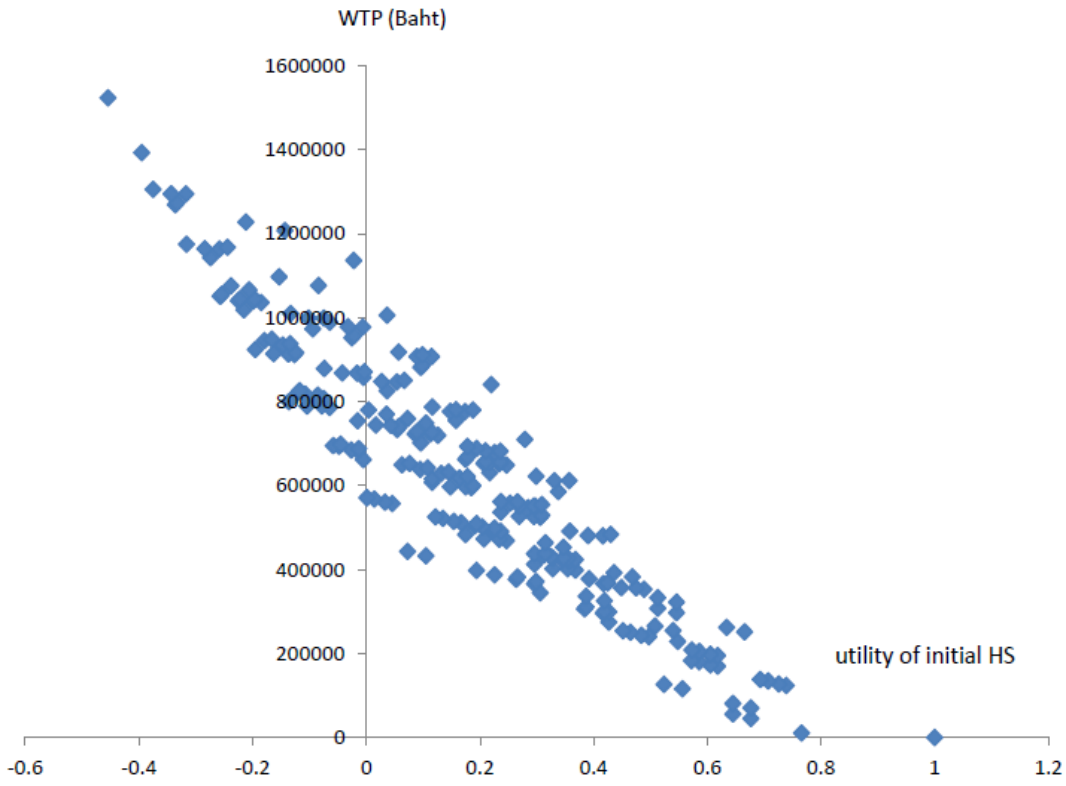

Figure 6 Graph of utility of initial health state and maximum WTP

4.4.3 WTP for the treatment of life-threatening disease and moving back to current health state

WTP for the treatment of life-threatening disease and moving back to current health state were measured using both DCE and CV approach. According to CV approach, we

used opened-ended question technique. There were 12/459 respondents (2.61%) were unwilling to pay for treatment because three respondents (0.65%) mentioned that they did not have money to pay, and eight respondents (1.74%) thought government should pay for public. Finally, data from 448 respondents were analyzed to estimate WTP values. Table 13 shows WTP derived from DCE and CV were 526,423 and 163,901 Baht/year, respectively.

Table 11 WTP for treatment of life saving and moving back to current health state

Method	WTP (Baht/year)	Minimum (Baht/year)	Maximum (Baht/year)
Discrete choice experiment	526,423 ± 143,822	62,345	633,940
Contingent valuation	163,901 ± 192,842	2,400	1,200,000

4.5 Willingness-to-pay per quality-adjusted life year

WTP per QALY, which were estimated from DCE study, were presented into three parts including 1) WTP per QALY for saving life treatment, 2) WTP per QALY for moving from 243 health states to other health states, and 3) WTP per QALY for the treatment of life-threatening disease and moving back to current health state.

4.5.1 WTP per QALY for saving life treatment

WTP values derived from DCE study (in 4.2.3) were compared to additional QALYs calculated from different utilities between 243 health states and life saving (U=0.000). Utilities of 243 health states from EQ-5D-3L Thai tariff were used in this calculation (REF). The maximum WTP per QALY of life saving was derived for moving to '32122' was 63,208,920 Baht/QALY (whereas WTP was 63,209 Baht/year and additional QALY was 0.001). This result

clearly confirmed that the maximum WTP was not the maximum WTP per QALY. Table 12 shows WTP per QALY values of life saving for moving to 243 health states.

Table 12 WTP per QALY of life saving and moving to 243 health states

Outcome	**Additional QALY**	**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
Death	0.000	0	-
1 1 1 1 1	1.000	633,940	633,940
1 1 1 1 2	0.766	623,446	813,898
1 2 1 1 1	0.677	588,362	869,072
1 2 1 1 2	0.645	577,867	895,918
2 1 1 1 1	0.677	563,270	832,009
2 1 1 1 2	0.645	552,776	857,016
2 2 1 1 1	0.556	517,692	931,101
1 1 2 1 1	0.739	509,753	689,787
2 2 1 1 2	0.524	507,197	967,934
1 1 1 2 1	0.726	506,507	697,668
1 1 2 1 2	0.707	499,258	706,165
1 1 1 2 2	0.693	496,012	715,746
1 2 2 1 1	0.618	464,175	751,092
1 2 1 2 1	0.605	460,929	761,866
1 2 2 1 2	0.586	453,680	774,198
1 2 1 2 2	0.572	450,434	787,472

2 1 2 1 1	0.618	439,083	710,490
2 1 1 2 1	0.605	435,837	720,392
2 1 2 1 2	0.586	428,588	731,379
2 1 1 2 2	0.573	425,342	742,308
1 1 1 1 3	0.548	405,117	739,264
2 2 2 1 1	0.497	393,505	791,760
2 2 1 2 1	0.484	390,259	806,319
2 2 2 1 2	0.465	383,010	823,677

Outcome	**Additional QALY**	**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
1 1 2 2 1	0.666	382,320	574,054
2 2 1 2 2	0.452	379,764	840,186
1 1 3 1 1	0.540	378,919	701,702
1 1 2 2 2	0.634	371,825	586,475
1 1 3 1 2	0.508	368,424	725,245
1 2 1 1 3	0.427	359,538	842,010
1 3 1 1 1	0.417	338,180	810,984
1 2 2 2 1	0.546	336,741	616,742
2 1 1 1 3	0.427	334,446	783,247
1 2 3 1 1	0.419	333,341	795,562
1 3 1 1 2	0.384	327,686	853,348
1 2 2 2 2	0.513	326,247	635,959
1 2 3 1 2	0.387	322,846	834,228
2 1 2 2 1	0.546	311,650	570,787
2 1 3 1 1	0.419	308,249	735,678
2 1 2 2 2	0.513	301,155	587,047
2 1 3 1 2	0.387	297,754	769,391
2 2 1 1 3	0.306	288,868	944,014
1 1 2 1 3	0.489	280,929	574,497

1 1 1 2 3	0.475	277,683	584,596
1 1 1 3 1	0.449	277,313	617,624
2 3 1 1 1	0.296	267,510	903,751
1 1 1 3 2	0.417	266,819	639,853
2 2 2 2 1	0.425	266,071	626,050
2 2 3 1 1	0.299	262,671	878,497
2 3 1 1 2	0.264	257,016	973,544

Outcome	**Additional QALY**	**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 2 2 2 2	0.392	255,577	651,981
2 2 3 1 2	0.266	252,176	948,030
1 1 3 2 1	0.468	251,486	537,363
3 1 1 1 1	0.226	246,715	1,091,660
1 1 3 2 2	0.436	240,991	552,732
3 1 1 1 2	0.194	236,220	1,217,631
1 2 2 1 3	0.368	235,351	639,541
1 2 1 2 3	0.354	232,105	655,664
1 2 1 3 1	0.328	231,735	706,509
1 2 1 3 2	0.296	221,240	747,433
1 3 2 1 1	0.357	213,993	599,420
1 3 1 2 1	0.344	210,747	612,637
2 1 2 1 3	0.368	210,259	571,357
2 1 1 2 3	0.355	207,013	583,136
2 1 1 3 1	0.328	206,643	630,010
1 2 3 2 1	0.347	205,907	593,393
1 3 2 1 2	0.325	203,498	626,149
3 2 1 1 1	0.105	201,137	1,915,589
1 3 1 2 2	0.312	200,252	641,835
2 1 1 3 2	0.296	196,149	662,664
1 2 3 2 2	0.315	195,413	620,358

3 2 1 1 2	0.073	190,642	2,611,537
2 1 3 2 1	0.347	180,816	521,083
2 1 3 2 2	0.315	170,321	540,702
2 2 2 1 3	0.247	164,681	666,724
2 2 1 2 3	0.234	161,435	689,893
2 2 1 3 1	0.207	161,065	778,091

Outcome	**Additional QALY**	**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
1 1 2 2 3	0.416	153,496	368,981
1 1 2 3 1	0.390	153,126	392,630
2 2 1 3 2	0.175	150,570	860,401
1 1 3 1 3	0.430	150,095	349,059
2 3 2 1 1	0.237	143,323	604,738
1 1 2 3 2	0.358	142,631	398,411
2 3 1 2 1	0.223	140,077	628,148
2 2 3 2 1	0.226	135,237	598,395
2 3 2 1 2	0.204	132,828	651,119
2 3 1 2 2	0.191	129,582	678,442
2 2 3 2 2	0.194	124,743	643,004
3 1 2 1 1	0.167	122,528	733,699
3 1 1 2 1	0.154	119,282	774,557
3 1 2 1 2	0.135	112,033	829,876
1 3 1 1 3	0.306	109,357	357,375
3 1 1 2 2	0.122	108,787	891,698
1 2 2 2 3	0.295	107,918	365,823
1 2 2 3 1	0.269	107,548	399,805
1 2 3 1 3	0.309	104,517	338,243
1 2 2 3 2	0.237	97,053	409,506
1 3 2 2 1	0.285	86,560	303,718
1 3 3 1 1	0.298	83,159	279,057

2 1 2 2 3	0.295	82,826	280,766
1 2 3 1 1	0.269	82,456	306,527
2 1 3 1 3	0.309	79,425	257,040
3 2 2 1 1	0.046	76,950	1,672,816
1 3 2 2 2	0.253	76,065	300,653

Outcome	**Additional QALY**	**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
3 2 1 2 1	0.033	73,704	2,233,440
1 3 3 1 2	0.266	72,664	273,175
2 1 2 3 2	0.237	71,961	303,634
3 2 2 1 2	0.014	66,455	4,746,780
3 2 1 2 2	0.001	63,209	63,208,920
1 1 1 3 3	0.338	48,489	143,460
2 3 1 1 3	0.185	38,687	209,117
2 2 2 2 3	0.175	37,248	212,844
2 2 2 3 1	0.148	36,878	249,173
2 2 3 1 3	0.188	33,847	180,037
2 2 2 3 2	0.116	26,383	227,439
1 1 3 2 3	0.357	22,662	63,479
1 1 3 3 1	0.331	22,292	67,347
3 1 1 1 3	0.116	17,891	154,236
2 3 2 2 1	0.164	15,890	96,888
2 3 3 1 1	0.178	12,489	70,163
1 1 3 3 2	0.299	11,797	39,456
2 3 2 2 2	0.132	5,395	40,872
1 2 1 3 3	0.217	2,911	13,416
2 3 3 1 2	0.145	1,994	13,754
3 1 2 2 1	0.095	- 4,905	- 51,637
3 1 3 1 1	0.108	- 8,306	- 76,909
1 3 2 1 3	0.247	- 14,831	- 60,043

3 1 2 2 2	0.063	-	15,400	-	244,446
1 3 1 2 3	0.234	-	18,077	-	77,251
1 3 1 3 1	0.207	-	18,447	-	89,115
3 1 3 1 2	0.076	-	18,801	-	247,378

Outcome	**Additional QALY**		**WTP (Baht/year)**		**WTP/QALY (Baht/QALY)**
2 1 1 3 3	0.217	-	22,181	-	102,215
1 2 3 2 3	0.236	-	22,916	-	97,103
1 2 3 3 1	0.210	-	23,286	-	110,887
3 2 1 1 3	-0.005	-	27,687		5,537,376
1 3 1 3 2	0.175	-	28,941	-	165,379
1 2 3 3 2	0.178	-	33,781	-	189,781
1 3 3 2 1	0.226	-	44,274	-	195,904
2 1 3 2 3	0.236	-	48,008	-	203,424
2 1 3 3 1	0.210	-	48,378	-	230,372
3 3 1 1 1	-0.015	-	49,045		3,269,656
3 2 2 2 1	-0.026	-	50,484		1,941,683
3 2 3 1 1	-0.013	-	53,884		4,144,957
1 3 3 2 2	0.194	-	54,769	-	282,314
2 1 3 3 2	0.178	-	58,873	-	330,746
3 3 1 1 2	-0.048	-	59,539		1,240,405
3 2 2 2 2	-0.058	-	60,978		1,051,351
3 2 3 1 2	-0.045	-	64,379		1,430,645
2 2 1 3 3	0.096	-	67,759	-	705,821
1 1 2 3 3	0.279	-	75,698	-	271,318
2 3 2 1 3	0.126	-	85,501	-	678,577
2 3 1 2 3	0.113	-	88,747	-	785,369
2 3 1 3 1	0.086	-	89,117	-	1,036,242
2 2 3 2 3	0.115	-	93,586	-	813,794
2 2 3 3 1	0.089	-	93,956	-	1,055,690

2 3 1 3 2	0.054	-	99,611	- 1,844,656
2 2 3 3 2	0.057	-	104,451	- 1,832,474
3 1 2 1 3	0.057	-	106,296	- 1,864,840

Outcome	**Additional QALY**		**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
3 1 1 2 3	0.043	-	109,542	- 2,547,486
3 1 1 3 1	0.017	-	109,912	- 6,465,409
2 3 3 2 1	0.105	-	114,944	- 1,094,707
3 1 1 3 2	-0.015	-	120,407	8,027,104
1 2 2 3 3	0.158	-	121,276	- 767,57
2 3 3 2 2	0.073	-	125,439	- 1,718,341
3 1 3 2 1	0.036	-	135,739	- 3,770,540
1 3 2 2 3	0.174	-	142,264	- 817,609
1 3 2 3 1	0.148	-	142,634	- 963,744
1 3 3 1 3	0.188	-	145,665	- 774,812
3 1 3 2 2	0.004	-	146,234	- 36,558,510
2 1 2 3 3	0.158	-	146,368	- 926,379
3 2 2 1 3	-0.064	-	151,874	2,373,034
1 3 2 3 2	0.116	-	153,129	- 1,320,074
3 2 1 2 3	-0.078	-	155,120	1,988,720
3 2 1 3 1	-0.104	-	155,490	1,495,098
3 2 1 3 2	-0.136	-	165,985	1,220,477
3 3 2 1 1	-0.075	-	173,232	2,309,762
3 3 1 2 1	-0.088	-	176,478	2,005,433
3 2 3 2 1	-0.085	-	181,318	2,133,150
3 3 2 1 2	-0.107	-	183,727	1,717,072
3 3 1 2 2	-0.120	-	186,973	1,558,106
3 2 3 2 2	-0.117	-	191,812	1,639,422
2 2 2 3 3	0.037	-	191,946	- 5,187,733
1 1 3 3 3	0.220	-	206,532	- 938,781

2 3 2 2 3	0.054	- 212,934	- 3,943,222
2 3 2 3 1	0.027	- 213,304	- 7,900,151

Outcome	**Additional QALY**	**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 3 3 1 3	0.067	- 216,335	- 3,228,876
2 3 2 3 2	-0.005	- 223,799	44,759,736
3 1 2 2 3	-0.016	- 233,729	14,608,073
3 1 2 3 1	-0.042	- 234,099	5,573,791
3 1 3 1 3	-0.003	- 237,130	79,043,280
3 1 2 3 2	-0.074	- 244,594	3,305,322
1 3 1 3 3	0.096	- 247,270	- 2,575,734
1 2 3 3 3	0.099	- 252,110	- 2,546,566
1 3 3 2 3	0.115	- 273,098	- 2,374,765
1 3 3 3 1	0.089	- 273,468	- 3,072,674
2 1 3 3 3	0.099	- 277,202	- 2,800,018
3 3 1 1 3	-0.126	- 277,869	2,205,306
3 2 2 2 3	-0.137	- 279,307	2,038,740
3 2 2 3 1	-0.163	- 279,678	1,715,813
3 2 3 1 3	-0.124	- 282,708	2,279,904
1 3 3 3 2	0.057	- 283,963	- 4,981,800
3 2 2 3 2	-0.195	- 290,172	1,488,062
3 3 2 2 1	-0.147	- 300,665	2,045,343
3 3 3 1 1	-0.134	- 304,066	2,269,150
3 3 2 2 2	-0.179	- 311,160	1,738,324
3 3 3 1 2	-0.166	- 314,561	1,894,944
2 3 1 3 3	-0.025	- 317,940	12,717,619
2 2 3 3 3	-0.022	- 322,780	14,671,822
3 1 1 3 3	-0.094	- 338,736	3,603,571
2 3 3 2 3	-0.006	- 343,768	57,294,660
2 3 3 3 1	-0.032	- 344,138	10,754,314

2 3 3 3 2	-0.064	-	354,633	5,541,135

Outcome	**Additional QALY**		**WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
3 1 3 2 3	-0.075	-	364,563	4,860,842
3 1 3 3 1	-0.101	-	364,933	3,613,200
1 3 2 3 3	0.037	-	371,458	- 10,039,398
3 1 3 3 2	-0.133	-	375,428	2,822,765
3 2 1 3 3	-0.215	-	384,314	1,787,507
3 3 2 1 3	-0.185	-	402,056	2,173,275
3 3 1 2 3	-0.199	-	405,302	2,036,692
3 3 1 3 1	-0.225	-	405,672	1,802,986
3 2 3 2 3	-0.196	-	410,141	2,092,558
3 2 3 3 1	-0.222	-	410,511	1,849,151
3 3 1 3 2	-0.257	-	416,166	1,619,325
3 2 3 3 2	-0.254	-	421,006	1,657,504
3 3 3 2 1	-0.206	-	431,499	2,094,657
3 3 3 2 2	-0.238	-	441,994	1,857,117
2 3 2 3 3	-0.084	-	442,128	5,263,426
3 1 2 3 3	-0.153	-	462,923	3,025,640
1 3 3 3 3	-0.022	-	502,292	22,831,440
3 2 2 3 3	-0.274	-	508,501	1,855,844
3 3 2 2 3	-0.258	-	529,489	2,052,283
3 3 3 1 3	-0.244	-	532,890	2,183,974
3 3 2 3 2	-0.316	-	540,354	1,709,980
2 3 3 3 3	-0.143	-	572,962	4,006,725
3 1 3 3 3	-0.212	-	593,757	2,800,740
3 3 1 3 3	-0.336	-	634,496	1,888,380
3 2 3 3 3	-0.333	-	639,335	1,919,925
3 3 3 2 3	-0.317	-	660,323	2,083,038
3 3 3 3 1	-0.343	-	660,693	1,926,219

Outcome	Additional QALY		WTP (Baht/year)	WTP/QALY (Baht/QALY)
3 3 3 3 2	-0.375	-	671,188	1,789,834
3 3 2 3 3	-0.395	-	758,683	1,920,716
3 3 3 3 3	-0.454	-	889,517	1,959,288

Moreover, we estimated the average WTP per QALY for the treatment of life-threatening disease, which was derived from the slope of incremental graph by comparing additional WTP and additional QALY between the life-threatening disease and 243 health states. However, the slope of the graph in only quadrant 1 was estimated because it represented positive values of additional WTP and additional QALY (Figure 8) since WTP definition generally stated that WTP is the maximum WTP values and previous studies also excluded unwillingness to pay data when WTP and QALY calculation (37-39, 42, 45). According to the slope of the graph in Figure 8, the average of WTP per QALY for treatment of life-threatening disease was 671,888 Baht/QALY ($R^2 = 0.76$).

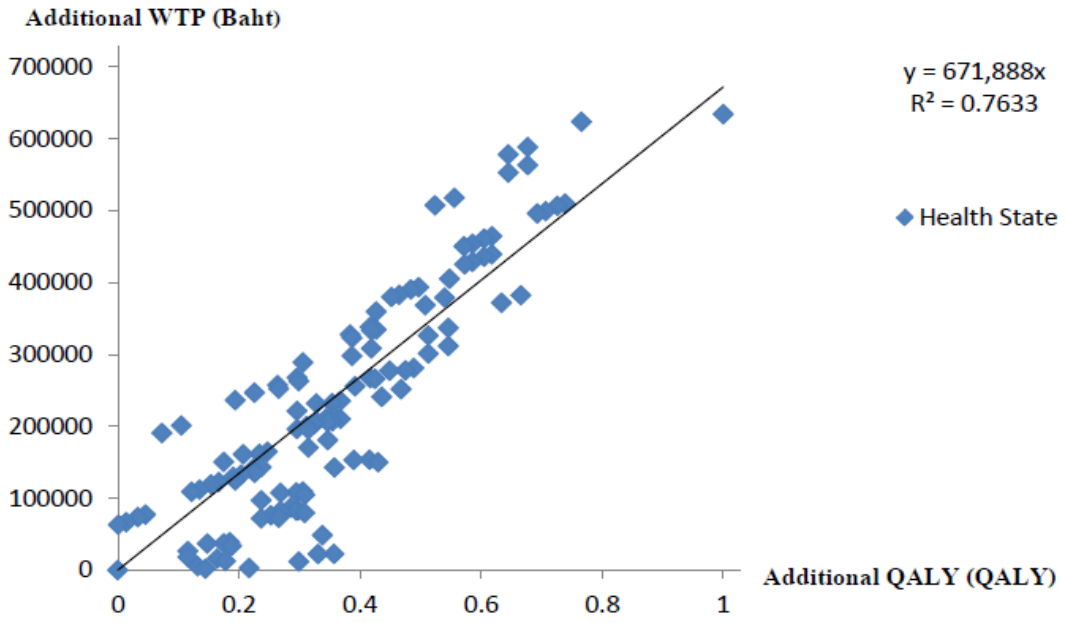

Figure 7 The average of WTP per QALY for treatment of life saving

4.5.2 WTP per QALY for moving from 243 health states to other health states

DCE method allowed us to estimate WTP for moving from 243 health states to other health states. Therefore, we could estimate WTP per QALY for moving to other health states by comparing WTP of those states to additional QALY. Table 15 shows the minimum, maximum, and average WTP per QALY derived from the slope of the graph as same as shown in Figure 8. The results found most of minimum WTP per QALY values of 243 health states were less than zero because WTP per QALY from respondents preferring to pay for worse health state (addition QALY < 0) were included. The minimum WTP per QALY value of 243 health state was -267,356,720 Baht/QALY derived from WTP of '23133 'for moving to '32221' (WTP = 267,457 Baht, additional QALY = -0.001). The maximum WTP per QALY value of 243 health state was 316,081,080 Baht/QALY derived from WTP of '23323'for moving to '32113' (WTP = 371,455, additional QALY = 0.001). However, the average WTP per QALY of 243 health states generated from the slope of the graph from the quadrant 1 (both additional WTP and additional QALY > 0) varied only between 44,849 to 1,821,048 Baht/QALY.

Table 15 Minimum, maximum and average WTP per QALY of 243 health states

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2
1 1 1 1 1	44,849	1,111,773	-	-
1 1 1 1 2	44,849	4,210,840	44,849	1.00
1 2 1 1 1	- 5,771,850	18,731,116	158,969	0.59
1 2 1 1 2	- 9,311,794	18,731,116	181,782	0.70
2 1 1 1 1	- 4,203,615	16,450,047	251,065	0.31
2 1 1 1 2	- 8,116,949	16,450,047	272,146	0.43
2 2 1 1 1	- 5,432,329	20,604,228	336,523	0.57
1 1 2 1 1	- 1,267,887	4,210,840	515,361	-0.06
2 2 1 1 2	- 8,888,531	18,731,116	515,361	-0.06
1 1 1 2 1	- 1,670,510	2,923,467	515,798	0.35
Initial Health state	Minimum WTP/QALY	Maximum WTP/QALY	Average WTP/QALY	R^2

	(Baht/QALY)	(Baht/QALY)	(Baht/QALY)	
1 1 2 1 2	- 2,970,120	2,852,163	520,999	0.51
1 1 1 2 2	- 5,771,850	4,210,840	505,922	0.51
1 2 2 1 1	- 5,771,850	4,210,840	567,588	-0.18
1 2 1 2 1	- 3,072,538	2,923,467	562,017	0.09
1 2 2 1 2	- 2,133,728	3,550,761	561,043	0.26
1 2 1 2 2	- 25,091,760	5,337,863	547,394	0.39
2 1 2 1 1	- 4,203,615	5,140,164	694,731	-0.31
2 1 1 2 1	- 2,207,305	3,550,761	687,772	0.09
2 1 2 1 2	- 2,970,120	2,923,467	682,976	0.31
2 1 1 2 2	- 25,091,760	4,210,840	667,459	0.42
1 1 1 1 3	- 4,253,365	46,733,460	704,115	0.35
2 2 2 1 1	- 5,771,850	14,071,920	626,844	0.45
2 2 1 2 1	- 21,865,872	12,508,373	609,430	0.52
2 2 2 1 2	- 43,841,440	6,654,706	595,420	0.58
1 1 2 2 1	- 9,311,794	18,731,116	1,029,231	-1.33
2 2 1 2 2	- 8,017,395	34,150,280	555,472	0.55
1 1 3 1 1	- 11,211,560	8,673,308	1,022,467	0.32
1 1 2 2 2	- 5,771,850	18,731,116	1,058,991	-1.84
1 1 3 1 2	- 13,453,872	8,673,307	728,385	0.31
1 2 1 1 3	- 69,814,320	46,733,460	559,827	0.57
1 3 1 1 1	- 14,965,680	184,684,320	621,007	0.58
1 2 2 2 1	- 7,747,996	34,187,580	1,007,545	0.14
2 1 1 1 3	- 61,450,400	34,187,580	652,606	0.56
1 2 3 1 1	- 16,658,673	59,948,240	637,687	0.60
1 3 1 1 2	- 29,093,300	11,297,173	580,819	0.65
1 2 2 2 2	- 8,435,520	16,450,047	947,596	0.10
Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2

1 2 3 1 2	- 56,573,400	10,006,136	600,020	0.65
2 1 2 2 1	- 11,211,560	46,733,460	1,137,329	-0.26
2 1 3 1 1	- 14,965,680	51,584,320	725,484	0.58
2 1 2 2 2	- 13,453,872	18,731,116	1,069,750	0.04
2 1 3 1 2	- 48,209,480	9,169,744	679,084	0.65
2 2 1 1 3	- 69,814,320	39,581,554	540,714	0.67
1 1 2 1 3	- 21,865,872	14,071,920	1,076,226	0.23
1 1 1 2 3	- 10,532,676	12,508,373	1,037,476	0.35
1 1 1 3 1	- 3,737,504	34,150,280	942,308	0.47
2 3 1 1 1	- 92,175,600	184,684,320	575,885	0.68
1 1 1 3 2	- 8,978,714	113,322,600	878,071	0.56
2 2 2 2 1	- 23,195,208	46,733,460	907,164	0.53
2 2 3 1 1	- 21,902,006	179,511,600	592,058	0.69
2 3 1 1 2	- 92,175,600	16,450,047	546,435	0.70
2 2 2 2 2	- 13,453,872	51,225,420	845,916	0.64
2 2 3 1 2	- 56,573,400	14,052,985	562,189	0.71
1 1 3 2 1	- 43,841,440	8,673,308	1,130,726	0.30
3 1 1 1 1	- 33,098,970	75,541,140	508,796	0.70
1 1 3 2 2	- 13,171,907	15,149,300	1,052,021	0.46
3 1 1 1 2	- 19,589,788	63,647,520	487,832	0.69
1 2 2 1 3	- 3,737,504	19,335,360	848,243	0.67
1 2 1 2 3	- 69,814,320	11,475,968	819,660	0.70
1 2 1 3 1	- 69,814,320	9,412,160	750,323	0.73
1 2 1 3 2	- 69,814,320	138,414,360	707,678	0.74
1 3 2 1 1	- 71,361,720	8,710,712	895,406	0.66
1 3 1 2 1	- 14,468,077	27,042,920	868,669	0.71

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2
2 1 2 1 3	- 2,596,969	17,054,291	943,327	0.62

2 1 1 2 3	- 92,175,600	9,324,925	915,108	0.68
2 1 1 3 1	- 61,450,400	6,718,821	836,947	0.76
1 2 3 2 1	- 18,324,540	17,490,880	894,937	0.72
1 3 2 1 2	- 30,201,080	9,412,160	839,432	0.78
3 2 1 1 1	- 69,814,320	79,723,100	442,887	0.67
1 3 1 2 2	- 14,769,300	40,275,720	814,680	0.79
2 1 1 3 2	- 61,450,400	113,322,600	786,290	0.79
1 2 3 2 2	- 10,820,055	19,331,260	839,530	0.78
3 2 1 1 2	- 69,814,320	67,829,480	427,500	0.67
2 1 3 2 1	- 15,815,364	14,702,907	986,393	0.67
2 1 3 2 2	- 13,171,907	15,149,300	925,679	0.77
2 2 2 1 3	- 14,769,300	19,335,360	766,273	0.80
2 2 1 2 3	-104,721,480	26,283,334	746,576	0.81
2 2 1 3 1	- 69,814,320	16,602,591	690,632	0.81
1 1 2 2 3	- 5,839,659	184,684,320	1,341,275	-0.02
1 1 2 3 1	- 56,573,400	51,225,420	1,240,067	0.33
2 2 1 3 2	- 69,814,320	292,834,200	650,527	0.78
1 1 3 1 3	- 69,814,320	15,149,300	1,415,461	0.03
2 3 2 1 1	- 15,815,364	191,331,000	795,719	0.77
1 1 2 3 2	- 71,361,720	119,969,280	1,159,924	0.50
2 3 1 2 1	- 61,450,400	115,536,240	770,702	0.78
2 2 3 2 1	- 19,164,255	56,961,520	792,156	0.78
2 3 2 1 2	- 50,425,040	18,759,720	749,740	0.79
2 3 1 2 2	- 61,450,400	91,749,000	731,430	0.79
2 2 3 2 2	- 12,741,328	45,067,900	751,443	0.79

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2
3 1 2 1 1	- 37,827,394	35,546,040	702,894	0.80
3 1 1 2 1	- 66,412,410	43,652,640	686,944	0.81

3 1 2 1 2	- 19,589,788	35,546,040	671,406	0.81
1 3 1 1 3	- 21,902,006	15,149,300	1,099,637	0.64
3 1 1 2 2	- 48,571,980	54,555,017	655,095	0.80
1 2 2 2 3	- 24,030,090	159,592,560	1,069,134	0.65
1 2 2 3 1	- 48,209,480	11,627,720	1,065,984	0.88
1 2 3 1 3	- 61,450,400	31,911,800	1,126,460	0.64
1 2 2 3 2	- 21,460,640	145,061,040	933,966	0.76
1 3 2 2 1	- 8,716,648	27,042,920	1,110,040	0.64
1 3 3 1 1	- 92,175,600	179,511,600	1,163,348	0.59
2 1 2 2 3	- 17,757,150	184,684,320	1,154,615	0.60
2 1 2 3 1	- 56,573,400	6,853,867	1,072,939	0.72
2 1 3 1 3	- 69,814,320	40,275,720	957,779	0.84
3 2 2 1 1	- 36,235,440	62,163,800	595,495	0.75
1 3 2 2 2	- 14,769,300	16,450,047	1,044,234	0.73
3 2 1 2 1	-111,290,310	47,834,600	583,044	0.75
1 3 3 1 2	- 92,175,600	11,627,720	1,095,299	0.71
2 1 2 3 2	- 29,824,560	119,969,280	1,009,489	0.77
3 2 2 1 2	- 58,788,960	21,268,896	570,214	0.74
3 2 1 2 2	- 69,814,320	75,084,690	560,467	0.74
1 1 1 3 3	- 18,324,540	27,042,920	1,433,259	0.20
2 3 1 1 3	- 61,450,400	21,948,213	963,967	0.76
2 2 2 2 3	- 32,040,120	179,511,600	942,257	0.77
2 2 2 3 1	- 18,324,540	13,734,040	877,323	0.80
2 2 3 1 3	- 14,769,300	33,728,920	986,060	0.75
2 2 2 3 2	- 15,886,713	299,480,880	828,580	0.77
1 1 3 2 3	- 92,175,600	119,969,280	1,607,626	-0.19
1 1 3 3 1	- 69,814,320	14,496,545	1,499,649	0.24

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2

3 1 1 1 3	- 16,658,673	290,989,320	848,158	0.79
2 3 2 2 1	- 15,815,364	35,546,040	968,307	0.76
2 3 3 1 1	- 46,027,080	38,688,240	1,015,141	0.73
1 1 3 3 2	- 85,237,640	39,581,554	1,410,004	0.37
2 3 2 2 2	- 10,339,212	35,546,040	915,594	0.78
1 2 1 3 3	- 69,814,320	27,089,320	1,156,472	0.65
2 3 3 1 2	- 48,209,480	13,031,933	956,387	0.77
3 1 2 2 1	-242,364,960	44,760,420	857,551	0.79
3 1 3 1 1	- 69,814,320	35,546,040	895,266	0.80
1 3 2 1 3	- 15,815,364	15,990,960	1,312,289	0.53
3 1 2 2 2	- 50,233,650	44,760,420	815,489	0.79
1 3 1 2 3	- 33,098,970	53,799,880	1,277,670	0.58
1 3 1 3 1	- 50,425,040	13,955,886	1,190,451	0.65
3 1 3 1 2	- 69,814,320	35,546,040	848,043	0.80
2 1 1 3 3	- 61,450,400	29,877,293	1,234,205	0.62
1 2 3 2 3	- 92,175,600	166,239,240	1,299,939	0.57
1 2 3 3 1	- 61,450,400	16,875,090	1,214,830	0.66
3 2 1 1 3	-104,721,480	316,081,080	713,369	0.77
1 3 1 3 2	- 18,933,645	113,322,600	1,123,747	0.71
1 2 3 3 2	- 61,450,400	27,120,750	1,146,958	0.70
1 3 3 2 1	- 61,450,400	27,042,920	1,333,281	0.51
2 1 3 2 3	-104,721,480	191,331,000	1,380,060	0.49
2 1 3 3 1	- 69,814,320	18,443,325	1,292,085	0.63

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2
3 3 1 1 1	- 32,747,013	184,684,320	736,269	0.77
3 2 2 2 1	-267,456,720	48,942,380	721,340	0.77
3 2 3 1 1	- 41,411,931	59,948,240	750,337	0.77
1 3 3 2 2	- 61,450,400	18,759,720	1,258,755	0.63

2 1 3 3 2	- 69,814,320	20,847,810	1,220,276	0.68
3 3 1 1 2	- 29,093,300	18,443,325	703,129	0.76
3 2 2 2 2	- 12,258,703	48,942,380	690,988	0.76
3 2 3 1 2	- 56,573,400	15,276,505	717,995	0.77
2 2 1 3 3	- 69,814,320	29,877,293	1,011,629	0.77
1 1 2 3 3	- 25,221,065	27,042,920	1,634,108	0.04
2 3 2 1 3	- 48,571,980	21,948,213	1,138,656	0.73
2 3 1 2 3	- 92,175,600	38,376,560	1,110,783	0.75
2 3 1 3 1	- 61,450,400	15,276,505	1,039,592	0.77
2 2 3 2 3	- 59,542,320	119,969,280	1,129,597	0.73
2 2 3 3 1	- 21,902,006	18,443,325	1,060,049	0.77
2 3 1 3 2	- 61,450,400	15,990,960	987,046	0.79
2 2 3 3 2	- 16,490,956	36,161,000	1,006,394	0.78
3 1 2 1 3	- 16,658,673	35,546,040	1,011,033	0.78
3 1 1 2 3	- 18,324,540	62,163,800	985,694	0.79
3 1 1 3 1	- 58,788,960	11,475,968	928,053	0.80
2 3 3 2 1	- 15,815,364	35,546,040	1,159,428	0.71
3 1 1 3 2	- 24,817,933	113,322,600	885,541	0.80
1 2 2 3 3	- 60,139,470	27,089,320	1,338,553	0.58
2 3 3 2 2	- 11,003,880	35,546,040	1,099,523	0.75
3 1 3 2 1	-235,718,280	21,268,896	1,032,327	0.79
1 3 2 2 3	- 37,827,394	292,834,200	1,453,247	0.44
1 3 2 3 1	- 48,209,480	43,652,640	1,367,573	0.56
1 3 3 1 3	- 61,450,400	91,749,000	1,512,165	0.33
3 1 3 2 2	- 69,814,320	21,268,896	979,616	0.79
2 1 2 3 3	- 66,412,410	29,877,293	1,411,324	0.54
3 2 2 1 3	- 8,343,274	19,335,360	853,234	0.80

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2

1 3 2 3 2	- 59,542,320	119,969,280	1,294,421	0.65
3 2 1 2 3	- 69,814,320	47,834,600	833,917	0.80
3 2 1 3 1	- 69,814,320	10,704,397	790,492	0.79
3 2 1 3 2	- 69,814,320	113,322,600	760,876	0.79
3 3 2 1 1	- 71,361,720	29,877,293	877,233	0.80
3 3 1 2 1	- 66,412,410	27,042,920	860,456	0.81
3 2 3 2 1	-260,810,040	17,490,880	875,823	0.81
3 3 2 1 2	- 30,201,080	10,812,083	842,074	0.81
3 3 1 2 2	- 9,366,341	23,933,850	826,722	0.81
3 2 3 2 2	- 10,820,055	14,659,592	841,246	0.82
2 2 2 3 3	- 66,412,410	29,877,293	1,169,189	0.73
1 1 3 3 3	- 69,814,320	115,536,240	1,821,049	-0.26
2 3 2 2 3	- 36,235,440	36,161,000	1,266,454	0.67
2 3 2 3 1	- 21,519,923	47,834,600	1,192,850	0.72
2 3 3 1 3	- 50,233,650	67,829,480	1,313,093	0.63
2 3 2 3 2	- 21,239,280	119,969,280	1,135,454	0.74
3 1 2 2 3	- 18,324,540	184,684,320	1,131,553	0.74
3 1 2 3 1	- 56,573,400	11,475,968	1,071,546	0.77
3 1 3 1 3	-104,721,480	75,084,690	1,171,688	0.73
3 1 2 3 2	- 71,361,720	119,969,280	1,024,584	0.79
1 3 1 3 3	-242,364,960	49,823,027	1,485,700	0.46

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2
1 2 3 3 3	- 61,801,140	75,541,140	1,508,711	0.43
1 3 3 2 3	- 92,175,600	299,480,880	1,620,859	0.28
1 3 3 3 1	- 61,450,400	44,760,420	1,532,666	0.45
2 1 3 3 3	- 69,814,320	79,723,100	1,576,518	0.38
3 3 1 1 3	- 11,188,368	17,358,424	982,569	0.81
3 2 2 2 3	- 24,030,090	113,322,600	964,567	0.81

3 2 2 3 1	- 18,324,540	11,627,720	918,393	0.82
3 2 3 1 3	- 9,726,940	23,933,850	996,087	0.80
1 3 3 3 2	- 61,450,400	44,760,420	1,455,689	0.56
3 2 2 3 2	- 11,188,368	119,969,280	882,915	0.82
3 3 2 2 1	- 68,074,080	27,042,920	986,551	0.81
3 3 3 1 1	- 71,361,720	29,877,293	1,018,107	0.80
3 3 2 2 2	- 7,272,270	15,149,300	948,367	0.82
3 3 3 1 2	- 11,412,480	11,627,720	977,976	0.82
2 3 1 3 3	-267,456,720	26,889,564	1,298,508	0.67
2 2 3 3 3	- 68,074,080	39,105,034	1,317,713	0.65
3 1 1 3 3	- 18,324,540	27,042,920	1,172,820	0.75
2 3 3 2 3	- 41,411,931	316,081,080	1,411,412	0.58
2 3 3 3 1	- 21,519,923	48,942,380	1,339,513	0.66
2 3 3 3 2	- 16,490,956	48,942,380	1,278,809	0.69
3 1 3 2 3	- 69,814,320	119,969,280	1,272,610	0.71
3 1 3 3 1	- 69,814,320	14,496,545	1,210,671	0.75
1 3 2 3 3	-235,718,280	49,823,027	1,612,372	0.39
3 1 3 3 2	- 71,361,720	19,753,392	1,158,976	0.78
3 2 1 3 3	- 69,814,320	5,123,305	1,013,253	0.83
3 3 2 1 3	- 11,188,368	15,149,300	1,102,259	0.82

Initial Health state	Minimum WTP/QALY (Baht/QALY)	Maximum WTP/QALY (Baht/QALY)	Average WTP/QALY (Baht/QALY)	R^2
3 3 1 2 3	- 2,993,927	28,782,420	1,080,954	0.82
3 3 1 3 1	- 14,468,077	6,695,678	1,033,267	0.84
3 2 3 2 3	- 3,072,082	119,969,280	1,095,622	0.82
3 2 3 3 1	- 18,324,540	5,562,649	1,047,275	0.84
3 3 1 3 2	- 8,978,714	113,322,600	995,657	0.85
3 2 3 3 2	- 11,188,368	27,120,750	1,008,993	0.85
3 3 3 2 1	- 5,242,827	27,042,920	1,115,142	0.82

3 3 3 2 2	- 5,837,035	15,149,300	1,073,435	0.84
2 3 2 3 3	-260,810,040	47,834,600	1,414,641	0.60
3 1 2 3 3	- 18,324,540	27,042,920	1,283,526	0.75
1 3 3 3 3	-112,951,980	64,749,549	1,731,637	0.19
3 2 2 3 3	- 1,375,092	5,431,454	1,119,605	0.84
3 3 2 2 3	- 1,397,126	113,322,600	1,185,040	0.82
3 3 2 3 1	- 887,468	4,210,840	1,136,876	0.84
3 3 3 1 3	- 11,188,368	15,149,300	1,218,465	0.80
3 3 2 3 2	- 513,492	119,969,280	1,097,321	0.86
2 3 3 3 3	- 68,074,080	58,139,554	1,525,680	0.51
3 1 3 3 3	- 69,814,320	27,042,920	1,394,849	0.68
3 3 1 3 3	- 1,613,200	4,707,090	1,209,331	0.83
3 2 3 3 3	- 1,613,200	5,822,435	1,222,341	0.83
3 3 3 2 3	- 1,359,341	119,969,280	1,285,611	0.80
3 3 3 3 1	14,234	4,457,013	1,237,102	0.83
3 3 3 3 2	187,322	4,374,756	1,196,005	0.85
3 3 2 3 3	687,376	4,374,756	1,289,196	0.82
3 3 3 3 3	896,354	2,763,659	1,367,152	0.79

In addition, tables 16 shows WTP per QALY of 243 health states for moving to ‘11111’ because ‘11111’ is the best health state and respondents expressed highest WTP. ‘11112’ had the minimum WTP per QALY for moving to ‘11111’ as 44,849 Baht/QALY. On the other hands, ‘13333’ had the maximum WTP per QALY for moving to ‘11111’ as 1,111,773 Baht/QALY.

Table 14 WTP per QALY of 243 health states for moving to ‘11111’

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
1 1 1 1 1	0.000	0	-

1 1 1 1 2	0.234	10,495	44,849
1 2 1 1 1	0.323	45,578	141,109
1 2 1 1 2	0.355	56,073	157,952
2 1 1 1 1	0.323	70,670	218,793
2 1 1 1 2	0.355	81,165	228,633
2 2 1 1 1	0.444	116,248	261,821
1 1 2 1 1	0.261	124,187	475,813
2 2 1 1 2	0.476	126,743	266,267
1 1 1 2 1	0.274	127,433	465,085
1 1 2 1 2	0.293	134,682	459,665
1 1 1 2 2	0.307	137,928	449,276
1 2 2 1 1	0.382	169,766	444,412
1 2 1 2 1	0.395	173,012	438,004
1 2 2 1 2	0.414	180,260	435,411
1 2 1 2 2	0.428	183,506	428,753
2 1 2 1 1	0.382	194,857	510,098
2 1 1 2 1	0.395	198,103	501,527
2 1 2 1 2	0.414	205,352	496,019

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 1 1 2 2	0.427	208,598	488,520
1 1 1 1 3	0.452	228,824	506,247
2 2 2 1 1	0.503	240,436	478,003
2 2 1 2 1	0.516	243,682	472,251
2 2 2 1 2	0.535	250,930	469,028
1 1 2 2 1	0.334	251,621	753,355
2 2 1 2 2	0.548	254,176	463,825
1 1 3 1 1	0.460	255,021	554,394
1 1 2 2 2	0.366	262,115	716,162
1 1 3 1 2	0.492	265,516	539,666

1 2 1 1 3	0.573	274,402	478,886
1 3 1 1 1	0.583	295,760	507,307
1 2 2 2 1	0.454	297,199	654,623
2 1 1 1 3	0.573	299,494	522,677
1 2 3 1 1	0.581	300,600	517,383
1 3 1 1 2	0.616	306,255	497,166
1 2 2 2 2	0.487	307,693	631,814
1 2 3 1 2	0.613	311,094	507,494
2 1 2 2 1	0.454	322,291	709,891
2 1 3 1 1	0.581	325,691	560,570
2 1 2 2 2	0.487	332,785	683,337
2 1 3 1 2	0.613	336,186	548,427
2 2 1 1 3	0.694	345,072	497,222
1 1 2 1 3	0.511	353,011	690,824
1 1 1 2 3	0.525	356,257	678,585
1 1 1 3 1	0.551	356,627	647,236
2 3 1 1 1	0.704	366,430	520,497

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
1 1 1 3 2	0.583	367,122	629,711
2 2 2 2 1	0.575	367,869	639,772
2 2 3 1 1	0.701	371,270	529,628
2 3 1 1 2	0.736	376,925	512,126
2 2 2 2 2	0.608	378,363	622,308
2 2 3 1 2	0.734	381,764	520,115
1 1 3 2 1	0.532	382,455	718,899
3 1 1 1 1	0.774	387,225	500,291
1 1 3 2 2	0.564	392,949	696,718
3 1 1 1 2	0.806	397,720	493,449
1 2 2 1 3	0.632	398,589	630,679

1 2 1 2 3	0.646	401,835	622,036
1 2 1 3 1	0.672	402,205	598,520
1 2 1 3 2	0.704	412,700	586,221
1 3 2 1 1	0.643	419,947	653,106
1 3 1 2 1	0.656	423,193	645,112
2 1 2 1 3	0.632	423,681	670,381
2 1 1 2 3	0.645	426,927	661,902
2 1 1 3 1	0.672	427,297	635,859
1 2 3 2 1	0.653	428,033	655,487
1 3 2 1 2	0.675	430,442	637,692
3 2 1 1 1	0.895	432,803	483,579
1 3 1 2 2	0.688	433,688	630,360
2 1 1 3 2	0.704	437,792	621,863
1 2 3 2 2	0.685	438,527	640,186
3 2 1 1 2	0.927	443,298	478,207
2 1 3 2 1	0.653	453,125	693,912

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 1 3 2 2	0.685	463,619	676,816
2 2 2 1 3	0.753	469,259	623,186
2 2 1 2 3	0.766	472,505	616,848
2 2 1 3 1	0.793	472,875	596,312
1 1 2 2 3	0.584	480,444	822,678
1 1 2 3 1	0.61	480,814	788,220
2 2 1 3 2	0.825	483,370	585,903
1 1 3 1 3	0.57	483,845	848,851
2 3 2 1 1	0.763	490,617	643,011
1 1 2 3 2	0.642	491,309	765,279
2 3 1 2 1	0.777	493,863	635,603
2 2 3 2 1	0.774	498,703	644,319

2 3 2 1 2	0.796	501,112	629,537
2 3 1 2 2	0.809	504,358	623,434
2 2 3 2 2	0.806	509,197	631,759
3 1 2 1 1	0.833	511,412	613,940
3 1 1 2 1	0.846	514,658	608,343
3 1 2 1 2	0.865	521,907	603,361
1 3 1 1 3	0.694	524,584	755,884
3 1 1 2 2	0.878	525,153	598,124
1 2 2 2 3	0.705	526,023	746,131
1 2 2 3 1	0.731	526,393	720,099
1 2 3 1 3	0.691	529,423	766,170
1 2 2 3 2	0.763	536,887	703,653
1 3 2 2 1	0.715	547,380	765,567
1 3 3 1 1	0.702	550,781	784,589
2 1 2 2 3	0.705	551,114	781,722

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 1 2 3 1	0.731	551,484	754,425
2 1 3 1 3	0.691	554,515	802,482
3 2 2 1 1	0.954	556,991	583,848
1 3 2 2 2	0.747	557,875	746,821
3 2 1 2 1	0.967	560,237	579,355
1 3 3 1 2	0.734	561,276	764,681
2 1 2 3 2	0.763	561,979	736,539
3 2 2 1 2	0.986	567,485	575,543
3 2 1 2 2	0.999	570,731	571,303
1 1 1 3 3	0.662	585,451	884,367
2 3 1 1 3	0.815	595,254	730,373
2 2 2 2 3	0.825	596,693	723,264
2 2 2 3 1	0.852	597,063	700,778

2 2 3 1 3	0.812	600,093	739,031
2 2 2 3 2	0.884	607,557	687,282
1 1 3 2 3	0.643	611,278	950,666
1 1 3 3 1	0.669	611,648	914,272
3 1 1 1 3	0.884	616,049	696,888
2 3 2 2 1	0.836	618,051	739,295
2 3 3 1 1	0.822	621,451	756,023
1 1 3 3 2	0.701	622,143	887,508
2 3 2 2 2	0.868	628,545	724,130
1 2 1 3 3	0.783	631,029	805,912
2 3 3 1 2	0.855	631,946	739,118
3 1 2 2 1	0.905	638,846	705,907
3 1 3 1 1	0.892	642,246	720,007
1 3 2 1 3	0.753	648,771	861,582

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
3 1 2 2 2	0.937	649,340	692,999
1 3 1 2 3	0.766	652,017	851,197
1 3 1 3 1	0.793	652,387	822,682
3 1 3 1 2	0.924	652,741	706,430
2 1 1 3 3	0.783	656,121	837,958
1 2 3 2 3	0.764	656,856	859,760
1 2 3 3 1	0.790	657,227	831,932
3 2 1 1 3	1.005	661,627	658,335
1 3 1 3 2	0.825	662,882	803,493
1 2 3 3 2	0.822	667,721	812,313
1 3 3 2 1	0.774	678,214	876,246
2 1 3 2 3	0.764	681,948	892,602
2 1 3 3 1	0.79	682,318	863,694
3 3 1 1 1	1.015	682,985	672,892

3 2 2 2 1	1.026	684,424	667,080
3 2 3 1 1	1.013	687,825	678,998
1 3 3 2 2	0.806	688,709	854,478
2 1 3 3 2	0.822	692,813	842,838
3 3 1 1 2	1.048	693,480	661,717
3 2 2 2 2	1.058	694,919	656,823
3 2 3 1 2	1.045	698,319	668,248
2 2 1 3 3	0.904	701,699	776,216
1 1 2 3 3	0.721	709,638	984,241
2 3 2 1 3	0.874	719,441	823,159
2 3 1 2 3	0.887	722,687	814,754
2 3 1 3 1	0.914	723,057	791,091
2 2 3 2 3	0.885	727,527	822,064
Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 2 3 3 1	0.911	727,897	799,008
2 3 1 3 2	0.946	733,552	775,425
2 2 3 3 2	0.943	738,391	783,024
3 1 2 1 3	0.943	740,236	784,980
3 1 1 2 3	0.957	743,482	776,888
3 1 1 3 1	0.983	743,852	756,716
2 3 3 2 1	0.895	748,884	836,742
3 1 1 3 2	1.015	754,347	743,199
1 2 2 3 3	0.842	755,216	896,931
2 3 3 2 2	0.927	759,379	819,179
3 1 3 2 1	0.964	769,680	798,423
1 3 2 2 3	0.826	776,204	939,714
1 3 2 3 1	0.852	776,574	911,472
1 3 3 1 3	0.812	779,605	960,104
3 1 3 2 2	0.996	780,174	783,307

2 1 2 3 3	0.842	780,308	926,732
3 2 2 1 3	1.064	785,814	738,547
1 3 2 3 2	0.884	787,069	890,349
3 2 1 2 3	1.078	789,060	731,967
3 2 1 3 1	1.104	789,430	715,064
3 2 1 3 2	1.136	799,925	704,159
3 3 2 1 1	1.075	807,172	750,858
3 3 1 2 1	1.088	810,418	744,870
3 2 3 2 1	1.085	815,258	751,390
3 3 2 1 2	1.107	817,667	738,633
3 3 1 2 2	1.12	820,913	732,958
3 2 3 2 2	1.117	825,753	739,259

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
2 2 2 3 3	0.963	825,886	857,618
1 1 3 3 3	0.78	840,472	1,077,528
2 3 2 2 3	0.946	846,874	895,216
2 3 2 3 1	0.973	847,244	870,755
2 3 3 1 3	0.933	850,275	911,334
2 3 2 3 2	1.005	857,739	853,472
3 1 2 2 3	1.016	867,669	854,005
3 1 2 3 1	1.042	868,039	833,051
3 1 3 1 3	1.003	871,070	868,465
3 1 2 3 2	1.074	878,534	818,002
1 3 1 3 3	0.904	881,211	974,791
1 2 3 3 3	0.901	886,050	983,408
1 3 3 2 3	0.885	907,038	1,024,902
1 3 3 3 1	0.911	907,408	996,057
2 1 3 3 3	0.901	911,142	1,011,256
3 3 1 1 3	1.126	911,809	809,777

3 2 2 2 3	1.137	913,248	803,208
3 2 2 3 1	1.163	913,618	785,570
3 2 3 1 3	1.124	916,648	815,523
1 3 3 3 2	0.943	917,903	973,386
3 2 2 3 2	1.195	924,112	773,316
3 3 2 2 1	1.147	934,606	814,826
3 3 3 1 1	1.134	938,006	827,166
3 3 2 2 2	1.179	945,100	801,612
3 3 3 1 2	1.166	948,501	813,466
2 3 1 3 3	1.025	951,881	928,664
2 2 3 3 3	1.022	956,720	936,126

Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
3 1 1 3 3	1.094	972,676	889,100
2 3 3 2 3	1.006	977,708	971,877
2 3 3 3 1	1.032	978,078	947,750
2 3 3 3 2	1.064	988,573	929,110
3 1 3 2 3	1.075	998,503	928,840
3 1 3 3 1	1.101	998,873	907,242
1 3 2 3 3	0.963	1,005,398	1,044,027
3 1 3 3 2	1.133	1,009,368	890,881
3 2 1 3 3	1.215	1,018,254	838,069
3 3 2 1 3	1.185	1,035,996	874,258
3 3 1 2 3	1.199	1,039,242	866,757
3 3 1 3 1	1.225	1,039,612	848,663
3 2 3 2 3	1.196	1,044,082	872,978
3 2 3 3 1	1.222	1,044,452	854,707
3 3 1 3 2	1.257	1,050,107	835,407
3 2 3 3 2	1.254	1,054,946	841,265
3 3 3 2 1	1.206	1,065,440	883,449

3 3 3 2 2	1.238	1,075,934	869,091
2 3 2 3 3	1.084	1,076,068	992,683
3 1 2 3 3	1.153	1,096,863	951,312
1 3 3 3 3	1.022	1,136,232	1,111,773
3 2 2 3 3	1.274	1,142,441	896,736
3 3 2 2 3	1.258	1,163,429	924,825
3 3 2 3 1	1.284	1,163,799	906,386
3 3 3 1 3	1.244	1,166,830	937,966
3 3 2 3 2	1.316	1,174,294	892,321
2 3 3 3 3	1.143	1,206,902	1,055,907
Health state	**Additional QALY**	**Additional WTP (Baht/year)**	**WTP/QALY (Baht/QALY)**
3 1 3 3 3	1.212	1,227,697	1,012,951
3 3 1 3 3	1.336	1,268,436	949,428
3 2 3 3 3	1.333	1,273,275	955,195
3 3 3 2 3	1.317	1,294,263	982,736
3 3 3 3 1	1.343	1,294,633	963,986
3 3 3 3 2	1.375	1,305,128	949,184
3 3 2 3 3	1.395	1,392,623	998,296
3 3 3 3 3	1.454	1,523,457	1,047,770

There were several a number of WTP per QALY values, which were practically used. Therefore, 243 health states were divided into three groups including mild, moderate, and severe health state for presenting their WTP per QALY. Table 14 shows the average WTP per QALY of each health state and WTP per QALY for moving to '11111'. WTP per QALY values of mild, moderate, and severe health states for moving to '11111' were 361,353 555,129 and 786,168 baht/QALY, while the average WTP per QALY values were 399,252 785,146 and 1,035,267 baht/QALY respectively. Moreover, we found that WTP per QALY of all health states for moving to '11111' and 'average WTP per QALY were significantly related with utility

of initial health state. The correlation values were -0.676 (p-value < 0.01), and -0.402 (p-value < 0.01), consequently (Table 15 and Figure 8).

Table 15 The average WTP per QALY of mild health states, moderate health states, and sever health states

Severity of initial health states	**Average WTP (Baht/year) for moving to**	
	all higher health states (min–max)	**'11111'** (min–max)
Mild health states (U >0.700)	**399,252 ± 236,282** (44,849 – 520,998)	**361,353 ± 211,110** (44,849 – 475,813)
Moderate health state (U = 0.350 – 0.700)	**785,146 ± 304,592** (158,969 – 1,607,628)	**555,129 ± 169,964** (141,109 – 950,666)
Severe health state (U < 0.350)	**1,035,267± 274,947** (427,520 – 1,821,049)	**786,168 ± 135,803** (478,207- 1,111,773)

The severity of health state was divided following the second WTP per QALY study in Thailand

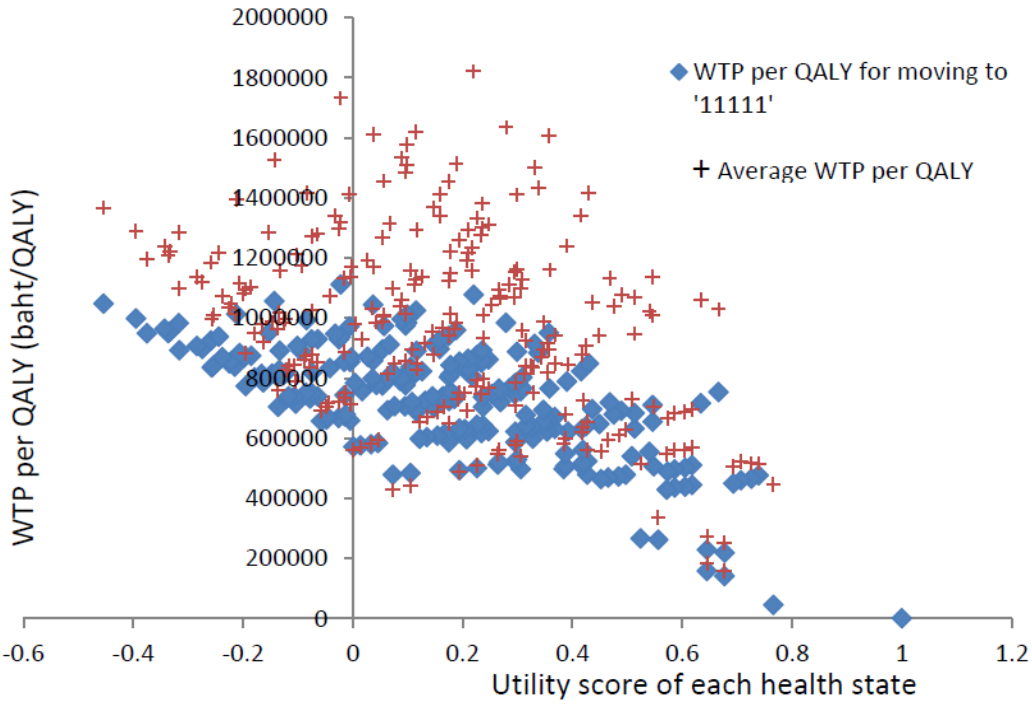

Figure 9 WTP per QALY and utility of 243 health states

4.5.3 WTP per QALY for the treatment of life-threatening disease and moving back to current health state

After estimating WTP values for the treatment of life-threatening disease and moving back to current health state by DCE and CV, we compared the results from two utility measurements including EQ-5D-3L Thai tariff and rescaled VAS to determine additional QALY. Results found the WTP per QALY derived from DCE was significantly higher than CV (P-value < 0.01) as shown in Table 16.

Table 16 WTP per QALY of life saving and moving back to current health state

Method	**DCE** (Baht/QALY)	**CV** (Baht/QALY)	**Mean difference** (Baht/QALY) (95%CI)
EQ-5D-3L	640,455 ± 145,426	208,980 ± 256,864	431,475 (403,710 – 459,239)
Rescaling	607,693 ± 190,284	190,284 ± 225,404	417,408

VAS	(389,788 – 445,029)

Chapter V

Discussions and Conclusions

5.1 Discussions

The main aim of this study was to determine WTP per QALY, which reflected public opinion in Thailand and could possibly be used as CE thresholds. WTP is based on cost-benefit analysis (CBA) consisting with classical economic theory and social welfare(48-51). The theory stated that individual in each society well knows own welfare, health coverage scheme, and choosing health care services. Therefore, public opinion is important information for government in decision making and resource allocation. This study therefore elicited WTP per QALY by using a new method, DCE.

Although DCE has been popularly applied in health care field, there was only one previous study valuing QALY by using DCE for setting CE threshold(34). However, this study developed method and created hypothetical scenario, which was different from previous study. Gyrd-Hasen created 23 choice sets by using orthogonal design. A choice set was consisted of two health states, and respondents were asked to indicate the low and high health states from these two health states. Only one WTP value from 11 values of WTP was randomly presented to respondent by closed-ended question. Therefore, the design of previous study was similar to contingent valuation as dichotomous technique, which has ‘say-yea’ problem, and required number of respondents. Instead, we created the multiple choices (three alternatives) for a choice set, and one from three alternatives was the reference alternative, which presented a hypothetical scenario. This choice set design could increase respondents’ understanding for DCE question. In addition, it resembled real situation, which the respondents likely wanted to move away from the life-threatening disease or health state. Specifically, the treatment outcome of this study was recovery from life-threatening disease, while the treatment outcome of several previous studies were extended life or living with limited duration. In this study, there was no ‘say-yea’ problem because we did not use closed-ended questions and respondents took their decisions to choose an

alternative from each choice set. Also, each respondent was asked to answer for four choice sets, therefore this DCE study did not require large sample size (46).

However, there are several mainly challenges when DCE has been applied in heal care filed. First, the attributes should be reasonable, and derived from demand and/or supply driven because they are important information for decision-makers and benefit transfer. Therefore, both customer perspective and expert perspective are necessary in the attribute defining process Second, the causal heuristic is basic reason of respondent in estimating WTP or choosing alternative, but it is easy to lead misinterpret and unreasonable choice selection. We can reduce causal heuristic by remove unrealistic alternative, number of choice set, and fully describe alternative. Third, embedding effect is a bias problem of WTP approach both CV and DCE. It occurs when the frequent finding that WTP for a good is not different from more inclusive good. Embedding effect can be reduced by setting appropriate attribute, and attribute levels (46, 93). This study reduced the advantage of DCE by the attributes, and attribute levels were defined from literature review, expert opinion, and public opinion. The questionnaire was test in small sample size for three times, and it was adjusted according to all comments. The results found that ninety-four percent of all respondents understood and finished the questionnaire. We excluded data derived from respondents who has causal heuristic and miss understand by using the choice set which tested their understand in all respondents. Finally, the results of this study were correct because the direction of beta coefficient of all parameter could be explained following random utility theory, and respondents expressed WTP for high attribute levels more than low attribute levels in all EQ-5D-3L dimensions.

During the development of questionnaire in this study, we tested two types of reference alternatives including current health state with free cost and dead state with free cost because these two alternatives were used to be hypothetical scenario in several WTP per QALY studies (33, 34, 37, 39-42, 75). Although the respondents clearly understood and were able to imagine both two situations, the life-threatening disease with free cost could enable respondents to choose among alternatives, while current health state could not. One of the reasons might be most utilities of current health state of respondents, who were general population, were higher

than the utilities of 72 alternatives created by orthogonal design (U = -0.317 to 0.766). However, current health state should be used and tested as a reference alternative in the future study.

Participants were conveniently sampled from three provinces of Thailand including Surathani, Songkla, and Yala. Forty-two participants were male which were less than proportion of male and female of Thailand population in 2013 (49.7%). Ninety-six of respondents had career, but the National statistical office reported 28.1% of population had no career. The average household income of participant was higher than of all population in 2013, which were 42,785 and 19,061 Baht/month, respectively (93). Therefore, demographic characteristics of participants including gender, career status, and household income did not likely show good representativeness of overall Thailand population. Especially, there was positive interaction between household income and cost (P=value < 0.01) supporting that WTP derived from respondent with high household income was higher than respondent with low household income. These study results should be cautiously used in general population.

We found the significant correlation between utilities of 72 health states measured by EQ-5D-3L, and rescaled visual analog scale was 0.884 (P-value < 0.01). Therefore, the utilities of EQ-5D-3L health state weighted by respondents of this study would not be different from Thailand population. In other words, the Thai tariff could be undoubtedly applied in this study.

One of the advantages of DCE, compared to CV, is that it allows us to estimate WTP for each dimension level of EQ-5D-3L by using limited resources. The results showed that the respondents were willing to pay higher for moving from extreme problems of pain/discomfort, mobility, usual activities, self-care, and anxiety/depressant, respectively. These results were different from a previous study by Tongsiri S (2009) showing that, based on preference score for EQ-5D health state, the respondents weighed higher for mobility, self-care, pain/discomfort, self-care, and anxiety/depressant, respectively (89). Various reasons could cause this difference. For example, these studies used different populations and preference elicitation methods, which were similarly found in the systematic review part of this study. Also, cost attribute was not included in the previous study.

Not only we could estimate WTP for dimension levels of EQ-5D-3L, but we also could determine the WTP for moving from 243 EQ-5D-3L health states to other health states. The results of this study supported Bateman recommendation DCE was designed to value the attribute of change, therefore, it is appropriately used in estimate goods or services which have high number of attribute levels. On the contrary, CV can estimate these attribute levels with designing specific valuation scenarios for each attribute levels leading to many scenarios(46). We divided 243 health states into three levels of their utilities and presented their average WTP values. The average WTP of mild, moderate, and sever health states were 101,823 $\pm$ 61,167 290,425 $\pm$ 120,970 and 749,825 $\pm$ 238,973 Baht, respectively. This data were likely useful for policy makers for specifying fee-for-service and cost-sharing, and for health technologies assessment. For example, chemotherapies for treatment of cancer in severe state are usually high cost, and government cannot support all regimens for patients. Therefore, policy makers could possibly specify cost-sharing not over average WTP of severe health state which was 749,825 Baht, which was derived from public perspective in this study.

In life threatening hypothetical scenario, minimum WTP was 1,994 Baht for moving to '23312', and maximum WTP was 633,940 for moving to '23312'. It was 31 times of maximum WTP compared to minimum WTP in same situation because of different additional QALY. According to Figure 6, WTP for life saving and moving to 243 health states showed WTP for treatment of life saving were significantly related with additional QALY ($r=0.94$, P-value < 0.01). In addition, WTP derived from this study was higher than the second WTP per QALY study in Thailand showing average WTP for moving intermediated death to '11111' was 55,886 $\pm$ 103,729 Baht (43). The difference might be from different outcomes or final health states used in these studies. The outcome in the previous study was the extension of life for two months (0.2 additional QALY), while the outcome of this study was cure and back to current health state after treatment at 12^{th} month (one additional QALY). Moreover, not only additional QALY, but also the characteristics of outcome had effect on WTP. For instance, respondents would get 0.108 QALY and 0.247 QALY when they are WTP for moving from life-threatening disease to '31311' and to '13211' respectively, but results shown they were unwillingness to pay for these health states.

In addition, the WTP of 243 EQ-5D-3L health states were consistent with the WTP per QALY for the treatment of life saving and characteristics of treatment outcome. The respondents expressed maximum to pay for moving to '11111' and minimum to pay for moving to '33333' from every initial health state. The WTP of 243 health states varied 134 to 1,523,457 Baht. The WTP of 243 health states for moving to '11111' depended on utility of its health state ($r=-0.94$, P-value<0.01). Therefore, the respondents, who were staying in severity health state, had higher maximum WTP value than those, who had mild health state, did. These results supported the results of Thavornchareonsap that the WTP for the treatment of moderate allergy ($u=0.58$) was lower that for bilateral blindness ($u=0.30$) and quadriplegia ($u=0.05$), respectively (38). Byne also showed that the WTP for severe osteoarthritis and mild osteoarthritis were 10,333 and 5,980 $US respectively (33).

As a part of questionnaire, the respondents were asked to estimate WTP for life saving and moving back to current health state. This scenario was more realistic than the scenario in the previous study that set the recovery from life-threatening disease to perfect heath state '11111' because it is not likely possible. The study results also showed that the WTP derived using DCE and CV were significantly different (P value < 0.01), which were $526,423 \pm 143,822$ and $163,901 \pm 192,842$ Baht, respectively. Although CV with an opened-ended question is a simple technique, takes shorter time for interview, and most of respondents understand, it can be inefficient method to elicit maximum WTP from individuals who do not have experience in hypothetical scenarios (46). In addition, WTP derived by CV from this study was slightly different from the previous study in Thailand that showed the WTP for treatment of quadriplegia for five years was 165,600 Baht.

This study could also estimate the WTP per QALY for moving from life-threatening disease to the 243 health states of EQ-5D-3L. Therefore, there were totally 243 WTP per QALY values, which were derived from life-threatening disease. The average WTP per QALY (671,888 Baht/QALY or four times of GDP per capita in 2013) generated from the slope of incremental graph of life-threatening disease compared to 243 health states could be used to set as a CE threshold for the country. In other words, if we derived the CE threshold for life saving, it should be reasonably higher than the threshold recommended by WHO (three times GDP per

capita) and the current CE threshold of Thailand, which is 1.2 times of GNI per capita (160,000 Baht/QALY) (17). Since this information was reflected from public opinion, policy makers should be comfortable enough to use it in the assessment the new technologies for life saving, which are usually expensive (19, 20, 67, 71). This would allow higher patient access to these technologies, which was not the case with the currently used threshold. In addition, WTP per QALY of 242 health states of EQ-5D-3L ('11111' was excluded because it was perfect health state, and WTP was zero) varied 44,849 to 1,821,049 Baht/QALY or 0.27 to 10.85 times of GDP per capita. The variation depended on the utility of initial health state, additional QALY, and characteristic of outcome as same as WTP value. Two previous WTP per QALY studies in Thai population also showed that WTP per QALY for treatment allergy, blindness, and paralysis varied 28,000 to 285,000 Baht/QALY or 0.4 to 2.0 times of GDP per capita (38). WTP per QALY derived from secondary study for getting 0.2 and 0.4 QALY varied 69,842 $\pm$108,207 to 334,045$\pm$622,188 Baht/QALY or 0.4 to 3.9 times of GDP per capita (43). Therefore, all results of all WTP per QALY studies in Thailand had confirmed that CE threshold should not be set as only one CE threshold.

The WTP per QALY derived from DCE with utility measurements using EQ-5D-3L, and VAS were 640,455 $\pm$ 145,426 (3.82), and 607,693 $\pm$ 190,284 (2.62) Baht/QALY (times of GDP per capita), respectively. On the other hand, the WTP derived from the opened-ended question with EQ-5D-3L and VAS were 208,980 $\pm$ 256,864 (1.25) and 190,284 $\pm$ 225,404 (1.13) Baht/QALY (times of GDP per capita), respectively. Apparently, the WTP per QALY values derived from CV with an opened-ended question were lower. One of the reasons could be that the opened-ended question might not be an efficient method to elicit maximum WTP, as compared to other methods, e.g. bidding game, double-dichotomous choice, because this type of direct question highly depended on the respondents' opinion and normally every individual would prefer to pay less or the WTP derived by using opened-ended question usually were less than respondent's ability to pay (46).

There were some studies (33, 38-41, 43)using WTP per QALY for moving to '11111' to set CE threshold because '11111' is perfect health state since respondents usually expressed the maximum value of WTP for getting to the perfect health state. This study showed

that the WTP per QALY for treatment of life-threatening disease and getting one QALY was 633,940 Baht/QALY or 3.9 times of GDP per capita. This result was similar to the previous study result by Thavornchareonsap M. and et al. that estimated WTP per QALY for the treatment of immediate death and getting 0.2 QALY as 334,045 $\pm$ 622,188 Baht/QALY or 2.0 $\pm$ 3.9 GDP per capita(43).

In addition, we found WTP per QALY of 243 health states for moving to '11111' varied 44,849 – 1,111,773 Baht/QALY or 0.27 to 6.62 times of GDP per capita. The average WTP per QALY for moving to '11111' of mild, moderate, and severe health states were 361,353 (2.15), 555,129 (3.31), and 786,168 (4.69) Baht/QALY (times of GDP per capita). The WTP per QALY were significantly related with utility of initial health state ($r = -0.676$, P-value < 0.01) that means WTP per QALY decreased when the utility of initial health state increased. These results were consistent with the previous study results of Shiroiwa, which showed that the WTP per QALY of mild, moderate, and severity health states, as initial or beginning health states, for increasing 0.2 QALY were 8,240,000 6,150,000 and 3,730,000 Yen/QALY, respectively.

The results shown that the WTP per QALY derived from different initial health states varied from 0.27 to 10.85 times of GDP per capita (167,816 baht in 2013). These suggested that the country should not set CE threshold as single threshold for all technology assessments. Somehow CE threshold should be based on the utility of initial health state or severity of disease and treatment outcome. According to results from this study, the average WTP per QALY of mild, moderate, and severe health states were 399,252 (2.38) , 785,146 (4.68), and 1,035,267 (6.17) Baht/QALY (times of GDP per capita). These data could help policy makers for setting the flexible CE thresholds. Although the current CE threshold of Thailand set as 1.2 times of GNI per capita or approximately 160,000 Baht/QALY could control total health expenditure, it might be too rigid and could cause the problem of patient access to life-saving technologies and certainly became controversy. However, the average WTP per QALY for moving from 243 health states to all higher health states were higher than average WTP per QALY for moving from 243 health states to '11111' because the moving to higher health states which was consisted some extreme WTP per QALY values derived from WTP's respondent for getting a minimal QALY.

According to Table 13, there were extreme values of maximum WTP per QALY, for example, the maximum WTP per QALY of '23323' was 316,081,080 Baht/QALY because respondents were willingness to pay 26,340 Baht/month for moving to '32113' (additional QALY = 0.001), and the maximum WTP per QALY of '33221' was 68,074,080 Baht/QALY because respondents were willingness to pay 17,019 Baht/month for moving to '23333' (additional QALY = 0.003). Apparently, these high values of WTP per QALY were derived from respondents' WTP for getting the very low additional QALY. Figure 9 shows relation between WTP and additional QALY for moving from 243 health states to other health states. The figure showed that when additional QALY was less than 0.011 QALY, WTP per QALY would be extremely high. This was consistent with the economic evaluation when ones were still willing to pay large amount of money for technologies with little additional outcomes.

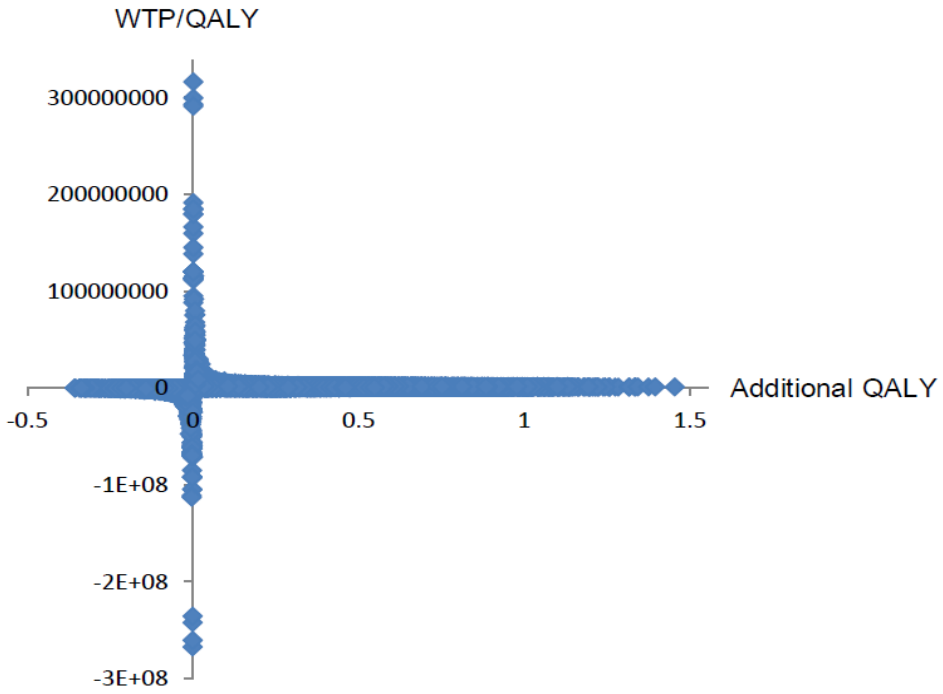

Figure 9 WTP per QALY and additional QALY of 243 health state

There were at least six limitations in this study. First, the participants were not representative of overall Thailand population and their average household income was higher than general population's. The income potentially affected WTP values. Second, although the opened-

ended question used in this study was not the main approach, but it might not be the best way to estimate the maximum WTP from respondents. It, however, was chosen to compare with DCE in this study because it was simple method and it took a short duration for interview. It is interesting to use other CV methods in comparison with DCE in the future study. Third, choice sets were selected by using orthogonal design without bias selection and multicollinearity of attribute levels. Unrealistic alternatives were still included in this study in order to maintain the characteristics of the study design; however, these alternatives might not make sense to some respondents. Fourth, the duration of hypothetical scenario was set at one year. The results of this study might change if we set shorter or longer durations, as noticed in previous studies. Fifth, we cannot include demographic parameter into the model because of limitation of sample size. Finally, WTP and WTP per QALY derived from this study were based on a particular reference alternative, which was the treatment of life-threatening disease. It might not be subject to generalize to other types of treatments.

5.2 Conclusions

Willingness-to-pay per quality-adjusted life year using DCE and defining attributes and levels following EQ-5D-3L could estimate WTP and WTP per QALY for saving life treatment, and for moving from 243 health states of EQ-5D-3L to other health states. The WTP of all health states varied from 134 to 1,523,457 Baht/year and the average WTP per QALY varied from 44,849 to 1,821,049 Baht/QALY or 0.27 to 10.85 times of GDP per capita. Both WTP and WTP per QALY depended on the utility of initial health state, additional QALY, and characteristics of treatment outcome. These WTP per QALY values from this study could be used to set the flexible and public opinion-based cost-effectiveness thresholds.

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Appendix

Appendix I An example of Questionnaire

แบบสอบถามชุดที่ 1

เครื่องมือ Visual Analog Scale (VAS)

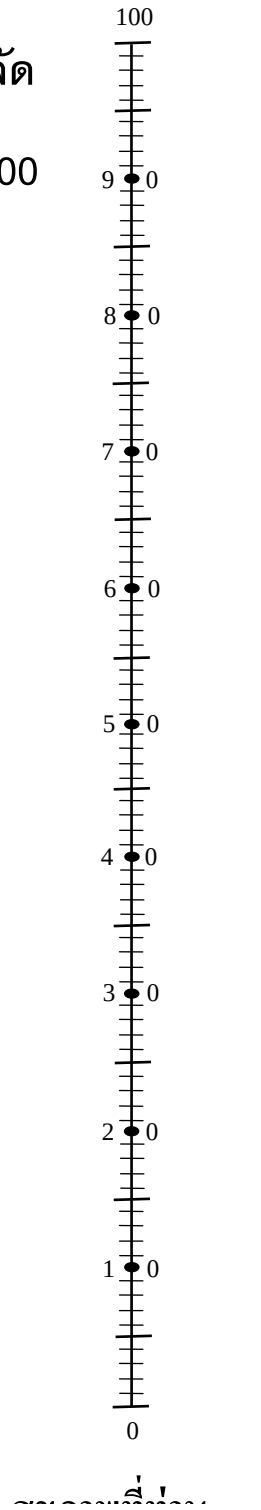
(ให้ผู้ตอบแบบสอบถามทำเครื่องหมายลงบนเครื่องมือนี้)

จังหวัด_____

ผู้ให้ข้อมูลคนที่_____

คำอธิบาย

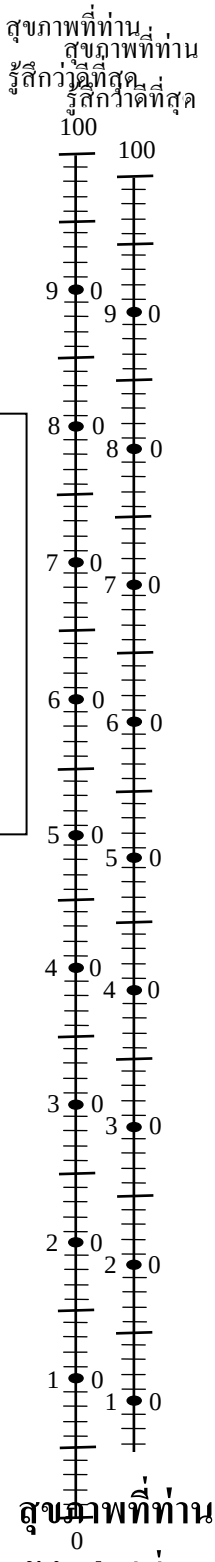
เพื่อช่วยในการประเมินสุขภาพของท่านทางเราได้จัดทำสเกลวัดระดับสุขภาพขึ้นเริ่มตั้งแต่ระดับ 0 ถึง 100 โดยที่ 100 หมายถึงสุขภาพที่ดีที่สุด และ 0 หมายถึง สุขภาพที่แย่ที่สุด ดังภาพ



ข้อที่ 1

กรุณาทำเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

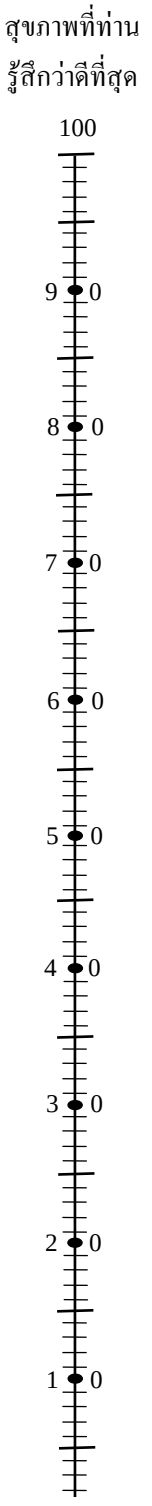
ไม่มีปัญหาในการเดิน
ไม่มีปัญหาในการดูแลตนเอง
ไม่มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำ
ไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย
ไม่รู้สึกวิตกกังวลหรือซึมเศร้า



ข้อที่ 2

กรุณาทำเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

เสียชีวิต

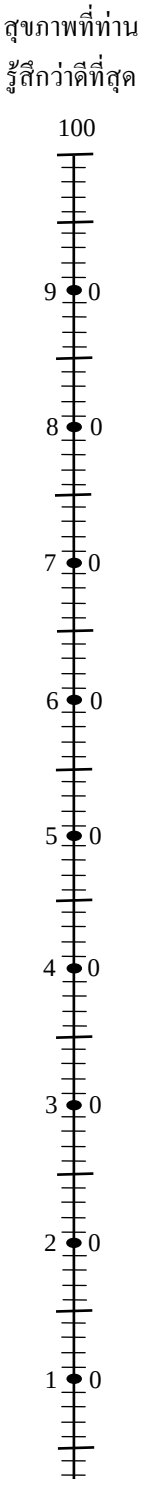


สุขภาพที่ท่าน
รู้สึกว่าแย่ที่สุด

ข้อที่ 3

รู้สึกว่าดีที่สุด

กรุณาทำเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้



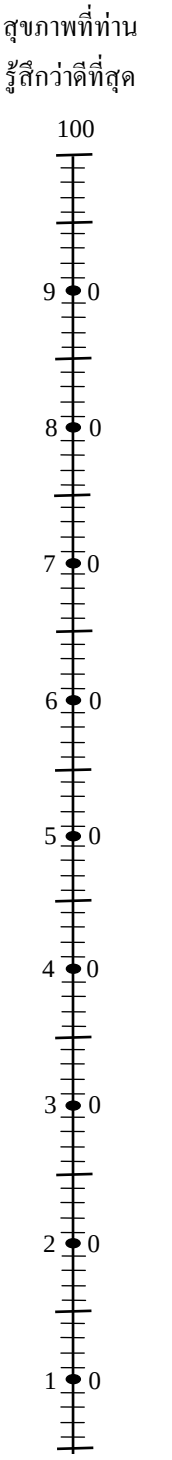
สุขภาพของท่านวันนี้

สุขภาพที่ท่าน
สุขภาพที่ท่าน
รู้สึกว่าดีที่สุด

ข้อที่ 4

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

การเดิน<u>มีปัญหาบ้าง</u>
การอาบน้ำหรือการแต่งตัว<u>ไม่สามารถทำได้</u>
ไม่มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำ
ไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย
รู้สึกวิตกกังวลหรือซึมเศร้า<u>มากที่สุด</u>



สุขภาพที่ท่าน
สุขภาพที่ท่าน **ด**

ข้อที่ 5 **รู้สึกว่าดีที่สุด**

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

ไม่สามารถไปไหนมาไหนได้และจำเป็นต้องนอนอยู่บนเตียง
การอาบน้ำหรือการแต่งตัวมีปัญหาบ้าง
กิจกรรมที่ทำเป็นประจำไม่สามารถทำได้
มีอาการเจ็บปวดหรืออาการไม่สุขสบายปานกลาง
รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง

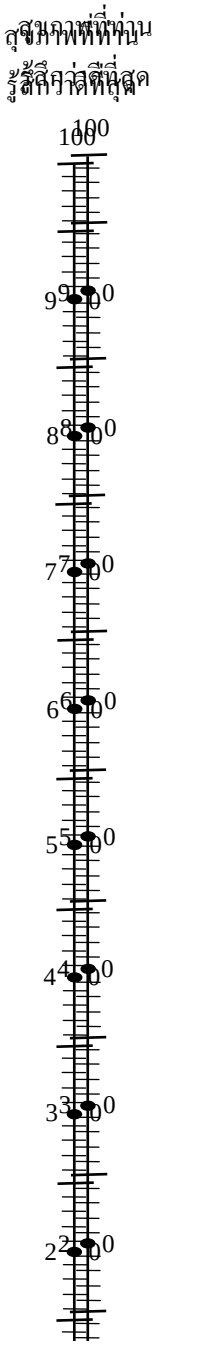
สุขภาพที่ท่าน
สุขภาพที่ท่าน
รู้สึกว่าดีที่สุด

ข้อที่ 6

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัด

ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

ไม่สามารถไปไหนมาไหนได้และจำเป็นต้องนอนอยู่บนเตียง
ไม่มีปัญหาในการอาบน้ำหรือการแต่งตัว
การทำกิจกรรมที่ทำเป็นประจำไม่สามารถทำได้
มีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด
รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง



ข้อที่ 7
กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัดที่ตรงกับสุขภาพของท่าน

เมื่อท่านมีสุขภาพดังนี้

ไม่มีปัญหาในการเดิน
การอาบน้ำหรือแต่งตัว<u>มีปัญหาบ้าง</u>
การทำกิจกรรมที่ทำเป็นประจำ<u>มีปัญหาบ้าง</u>
มีอาการเจ็บปวดหรืออาการไม่สุขสบาย<u>มากที่สุด</u>
<u>รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง</u>

สุขภาพที่ท่าน
รู้สึกว่าแย่ที่สุด

ข้อที่ 8

สุขภาพที่ท่านรู้สึกว่าดีที่สุด

สุขภาพที่ท่านรู้สึกว่าแย่ที่สุด

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัดที่ตรงกับสุขภาพของท่านเมื่อท่านมีสุขภาพดังนี้

ไม่มีปัญหาในการเดิน
การอาบน้ำหรือแต่งตัว<u>ไม่สามารถทำได้</u>
การทำกิจกรรมที่ทำเป็นประจำ<u>มีปัญหาบ้าง</u>
มีอาการเจ็บปวดหรืออาการไม่สุขสบาย<u>ปานกลาง</u>
รู้สึกวิตกกังวลหรือซึมเศร้า<u>ปานกลาง</u>

ข้อที่ 9

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

ไม่สามารถไปไหนมาไหนได้และจำเป็นต้องนอนอยู่บนเตียง
การอาบน้ำหรือแต่งตัวไม่สามารถทำได้
กิจกรรมที่ทำเป็นประจำมีปัญหาบ้าง
ไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย
รู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด

สุขภาพที่ท่าน
รู้สึกว่าดีที่สุด

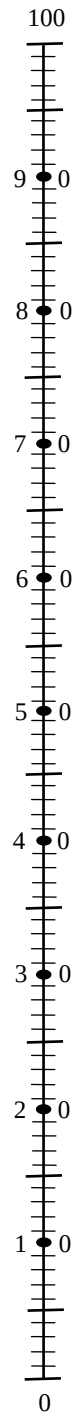
สุขภาพที่ท่าน
รู้สึกว่าแย่ที่สุด

ข้อที่ 10

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

การเดินมีปัญหาบ้าง
การอาบน้ำหรือแต่งตัวมีปัญหาบ้าง
กิจกรรมที่ทำเป็นประจำไม่สามารถทำได้
มีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด
ไม่รู้สึกวิตกกังวลหรือซึมเศร้า

สุขภาพที่ท่าน
รู้สึกว่าดีที่สุด



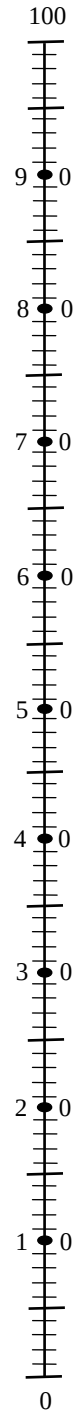
สุขภาพที่ท่าน
รู้สึกว่าแย่ที่สุด

ข้อที่ 11

กรุณาเครื่องหมาย X (กากบาท) ลงบนสเกลวัด
ที่ตรงกับสุขภาพของท่าน
เมื่อท่านมีสุขภาพดังนี้

การเดินมีปัญหาบ้าง
การอาบน้ำหรือแต่งตัวไม่สามารถทำได้
ไม่มีปัญหาการทำกิจกรรมที่ทำเป็นประจำ
มีอาการเจ็บปวดหรืออาการไม่สุขสบายปานกลาง
รู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด

สุขภาพที่ท่าน
รู้สึกว่าดีที่สุด



สุขภาพที่ท่าน
รู้สึกว่าแย่ที่สุด

Appendix II Interview Tool

เครื่องมือ Willingness to pay (WTP) question

คำถามชุดที่ 1

(ผู้ให้ข้อมูลเลือกตอบโดยผู้สัมภาษณ์เป็นผู้บันทึกคำตอบลงแบบบันทึกข้อมูลสำหรับผู้สัมภาษณ์)

สถานการณ์ที่ “ท่านเป็นโรครุนแรงที่สามารถทำให้เสียชีวิต”

คำถามข้อที่ 1 โปรดจินตนาว่าท่านป่วยเป็นโรคที่มีความรุนแรงและหากไม่รักษาจะเสียชีวิตได้ การรักษาจำเป็นต้องจ่ายเงินทุกเดือนเป็นเวลา 12 เดือน โดยตลอดการรักษา 12 เดือนท่านจะมีสุขภาพตามทางเลือกที่ท่านเลือก ทางเลือกที่ท่านพึงพอใจมากที่สุดคือ?

คุณลักษณะสุขภาวะ	ทางเลือกที่ 1	ทางเลือกที่ 2	สถานการณ์ของท่าน
การเคลื่อนไหว	การเดินมีปัญหาบ้าง	ไม่สามารถไปไหนมาไหนได้และจำเป็นต้องอยู่บนเตียง	ท่านเป็นโรครุนแรง ที่สามารถทำให้เสียชีวิต
การดูแลตนเอง	การอาบน้ำหรือการแต่งตัวด้วยตัวเองไม่สามารถทำได้	การอาบน้ำหรือการแต่งตัวมีปัญหาบ้าง	
กิจกรรมที่ทำเป็นประจำ	ไม่มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำ	การทำกิจกรรมที่ทำเป็นประจำไม่สามารถทำได้	
ความเจ็บปวด หรือความไม่สุขสบาย	ไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย	มีอาการเจ็บปวดหรืออาการไม่สุขสบายปานกลาง	
ความวิตกกังวล หรือความซึมเศร้า	รู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด	รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง	
เงินที่ท่านต้องจ่ายต่อเดือนเป็นเวลา 12 เดือน	15,000 บาท	18,000 บาท	0
ท่านพึงพอใจที่เลือกทางเลือกใด	ทางเลือกที่ 1	ทางเลือกที่ 2	ไม่ทำการรักษา (ไม่เลือกทั้งทางเลือกที่ 1 และ 2)

มีปัญหามาก มีปัญหาปานกลาง / บ้าง ไม่มีปัญหา

สถานการณ์ที่ “ท่านเป็นโรครุนแรงที่สามารถทำให้เสียชีวิต”

คำถามข้อ 2 โปรดจินตนาว่าท่านป่วยเป็นโรคที่มีความรุนแรงและหากไม่รักษาจะเสียชีวิตได้ การรักษาจำเป็นต้องจ่ายเงินทุกเดือนเป็นเวลา 12 เดือน โดยตลอดการรักษา 12 เดือนท่านจะมีสุขภาพตามทางเลือกที่ท่านเลือก ทางเลือกที่ท่านพึงพอใจมากที่สุดคือ?

คุณลักษณะสุขภาวะ	ทางเลือกที่ 1	ทางเลือกที่ 2	สถานการณ์ของท่าน
การเคลื่อนไหว	ไม่สามารถไปไหนมาไหนได้และจำเป็นต้องอยู่บนเตียง	ไม่มีปัญหาการเดิน	ท่านเป็นโรครุนแรงที่สามรถทำให้เสียชีวิต
การดูแลตนเอง	ไม่มีปัญหาในการอาบน้ำหรือการแต่งตัว	มีปัญหาในการอาบน้ำหรือการแต่งตัวบ้าง	
กิจกรรมที่ทำเป็นประจำ	การทำกิจกรรมที่ทำเป็นประจำไม่สามารถทำได้	การทำกิจกรรมที่ทำเป็นประจำมีปัญหาบ้าง	
ความเจ็บปวด หรือความไม่สุขสบาย	มีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด	มีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด	
ความวิตกกังวล หรือความซึมเศร้า	รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง	รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง	
เงินที่ท่านต้องจ่ายต่อเดือนเป็นเวลา 12 เดือน	18,000 บาท	12,000 บาท	0
ท่านพึงพอใจที่เลือกทางเลือกใด	ทางเลือกที่ 1	ทางเลือกที่2	ไม่ทำการรักษา (ไม่เลือกทั้งทางเลือกที่ 1 และ 2)

มีปัญหามาก | มีปัญหาปานกลาง / บ้าง | ไม่มีปัญหา

สถานการณ์ที่ “ท่านเป็นโรครุนแรงที่สามารถทำให้เสียชีวิต”

คำถามข้อที่ 3 โปรดจินตนาว่าท่านป่วยเป็นโรคที่มีความรุนแรงและหากไม่รักษาจะเสียชีวิตได้ การรักษาจำเป็นต้องจ่ายเงินทุกเดือนเป็นเวลา 12 เดือน โดยตลอดการรักษา 12 เดือนท่านจะมีสุขภาพตามทางเลือกที่ท่านเลือก ทางเลือกที่ท่านพึงพอใจมากที่สุดคือ?

คุณลักษณะสุขภาวะ	ทางเลือกที่ 1	ทางเลือกที่ 2	สถานการณ์ของท่าน
การเคลื่อนไหว	ไม่มีปัญหาในการเดิน	ไม่สามารถไปไหนมาไหนได้และจำเป็นต้องอยู่บนเตียง	ท่านเป็นโรครุนแรงที่สามารถทำให้เสียชีวิต
การดูแลตนเอง	ไม่มีปัญหาในการอาบน้ำหรือการแต่งตัว	การอาบน้ำหรือการแต่งตัวด้วยตนเองไม่สามารถได้	
กิจกรรมที่ทำเป็นประจำ	ไม่มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำ	การทำกิจกรรมที่ทำเป็นประจำไม่สามารถทำได้	
ความเจ็บปวด หรือความไม่สุขสบาย	ไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย	มีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด	
ความวิตกกังวล หรือความซึมเศร้า	ไม่รู้สึกวิตกกังวลหรือซึมเศร้า	รู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด	
เงินที่ท่านต้องจ่ายต่อเดือนเป็นเวลา 12 เดือน	3,000 บาท	24,000 บาท	0
ท่านพึงพอใจที่เลือกทางเลือกใด	ทางเลือกที่ 1	ทางเลือกที่2	ไม่ทำการรักษา (ไม่เลือกทั้งทางเลือกที่ 1 และ 2)

มีปัญหามาก มีปัญหาปานกลาง / บ้าง ไม่มีปัญหา

สถานการณ์ที่ “ท่านเป็นโรครุนแรงที่สามารถทำให้เสียชีวิต”

คำถามข้อที่ 4 โปรดจินตนาว่าท่านป่วยเป็นโรคที่มีความรุนแรงและหากไม่รักษาจะเสียชีวิตได้ การรักษาจำเป็นต้องจ่ายเงินทุกเดือนเป็นเวลา 12 เดือน โดยตลอดการรักษา 12 เดือนท่านจะมีสุขภาพตามทางเลือกที่ท่านเลือก ทางเลือกที่ท่านพึงพอใจมากที่สุดคือ?

คุณลักษณะสุขภาวะ	ทางเลือกที่ 1	ทางเลือกที่ 2	สถานการณ์ของท่าน
การเคลื่อนไหว	ไม่มีปัญหาในการเดิน	ไม่สามารถไปไหนมาไหนได้ และจำเป็นต้องอยู่บนเตียง	ท่านเป็นโรครุนแรง ที่สามารถทำให้เสียชีวิต
การดูแลตนเอง	การอาบน้ำหรือการแต่งตัวด้วยตนเองได้ไม่สามารถทำได้	การอาบน้ำหรือการแต่งตัวด้วยตัวเองไม่สามารถทำได้	
กิจกรรมที่ทำเป็นประจำ	มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำอยู่บ้าง	มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำอยู่บ้าง	
ความเจ็บปวดหรือความไม่สุขสบาย	มีอาการเจ็บปวดหรืออาการไม่สุขสบายปานกลาง	ไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย	
ความวิตกกังวลหรือความซึมเศร้า	รู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง	รู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด	
เงินที่ท่านต้องจ่ายต่อเดือนเป็นเวลา 12 เดือน	18,000 บาท	15,000 บาท	0
ท่านพึงพอใจที่เลือกทางเลือกใด	ทางเลือกที่ 1	ทางเลือกที่2	ไม่ทำการรักษา (ไม่เลือกทั้งทางเลือกที่ 1 และ 2)

มีปัญหามาก มีปัญหาปานกลาง / บ้าง ไม่มีปัญหา

สถานการณ์ที่ “ท่านเป็นโรครุนแรงที่สามารถทำให้เสียชีวิต”

คำถามข้อที่ 5 โปรดจินตนาว่าท่านป่วยเป็นโรคที่มีความรุนแรงและหากไม่รักษาจะเสียชีวิตได้ การรักษาจำเป็นต้องจ่ายเงินทุกเดือนเป็นเวลา 12 เดือน โดยตลอดการรักษา 12 เดือนท่านจะมีสุขภาพตามทางเลือกที่ท่านเลือก ทางเลือกที่ท่านพึงพอใจมากที่สุดคือ?

คุณลักษณะสุขภาวะ	ทางเลือกที่ 1	ทางเลือกที่ 2	สถานการณ์ของท่าน
การเคลื่อนไหว	การเดินมีปัญหาบ้าง	การเดินมีปัญหาบ้าง	ท่านเป็นโรครุนแรง ที่ทำให้เสียชีวิต
การดูแลตนเอง	การอาบน้ำหรือการแต่งตัว มีปัญหาบ้าง	การอาบน้ำหรือการแต่งตัว ด้วยตัวเองไม่สามารถทำได้	
กิจกรรมที่ทำเป็นประจำ	การทำกิจกรรมที่ทำเป็นประจำ ไม่สามารถทำได้	ไม่มีปัญหาในการทำกิจกรรม ที่ทำเป็นประจำ	
ความเจ็บปวดหรือ ความไม่สุขสบาย	มีอาการเจ็บปวดหรือ อาการไม่สุขสบายมากที่สุด	มีอาการเจ็บปวดหรือ อาการไม่สุขสบายปานกลาง	
ความวิตกกังวลหรือความซึมเศร้า	ไม่รู้สึกวิตกกังวลหรือ ซึมเศร้า	รู้สึกวิตกกังวลหรือ ซึมเศร้ามากที่สุด	
เงินที่ท่านต้องจ่ายต่อเดือน เป็นเวลา 12 เดือน	21,000 บาท	9,000 บาท	0
ท่านพึงพอใจที่เลือกทางเลือกใด	ทางเลือกที่ 1	ทางเลือกที่2	ไม่ทำการรักษา (ไม่เลือกทั้งทางเลือกที่ 1 และ 2)

มีปัญหามาก มีปัญหาปานกลาง / บ้าง ไม่มีปัญหา

3.2 เหตุผลที่ท่านไม่ทำการรักษา (ไม่เลือกทั้งทางเลือกที่ 1 และทางเลือกที่ 2) โดยยอมเสียชีวิตเพราะว่า?

1. ไม่พึงพอใจต่อสุขภาพตามทางเลือกที่เสนอมาให้
2. พึงต่อใจต่อสุขภาพตามทางเลือกที่เสนอให้ แต่ไม่สามารถหาเงินมาจ่ายได้
3. ไม่พึงพอใจทั้งต่อสุขภาพที่นำเสนอและไม่สามารถหาเงินมาจ่ายได้
4. อื่น ๆ โปรดระบุ_____

***** ถามเมื่อข้อที่ 1-5 มีการเลือกตอบข้อ ไม่ทำการรักษา*****

3.3 หากท่านป่วยเป็นโรคที่มีความรุนแรงและหากไม่รักษาจะเสียชีวิตได้ การรักษาจำเป็นต้องจ่ายเงินทุกเดือนเป็นเวลา 12 เดือน โดยเมื่อจ่ายเงินแล้วสุขภาพของท่านจะเป็นเหมือนสุขภาพในปัจจุบัน จำนวนเงินที่ท่านเต็มใจจ่ายสูงสุดต่อเดือนคือ?

เต็มใจจ่ายเงิน _____ บาทต่อเดือน

3.4 เพราะเหตุใดท่านจึงไม่เต็มใจจ่ายเงินเพื่อทำการรักษาเมื่อท่านป่วยเป็นโรครุนแรงโดยยอมเสียชีวิต?

1. ไม่สามารถหาเงินมาจ่ายเพื่อการรักษา
2. รัฐบาลควรรับผิดชอบต่อค่ารักษา
3. อื่น ๆ โปรดระบุ_____

****** ถามเมื่อข้อ 3.3 เต็มใจจ่าย 0 บาท (ไม่เต็มใจจ่ายเงิน)*******

Appendix III Answer record for interviewer

บันทึกข้อมูลสำหรับผู้สัมภาษณ์

<u>สำหรับผู้สัมภาษณ์</u>

ให้ผู้สัมภาษณ์แจกเอกสารคำชี้แจงโครงการวิจัยแก่ผู้ให้ข้อมูล อ่านคำชี้แจงโครงการวิจัย ให้ผู้ให้ข้อมูลอ่านคำชี้แจงโดยละเอียดอีกครั้ง และสอบถามว่าต้องการเข้าร่วมการวิจัยหรือไม่

คำชี้แจงโครงการวิจัยเรื่องความเต็มใจจ่ายต่อปีสุขภาวะ

เรียนอาสาสมัครผู้เข้าร่วมในการศึกษา

การวิจัยมีจุดประสงค์เพื่อศึกษาความเต็มใจจ่ายต่อปีสุขภาวะโดยใช้วิธีการสร้างชุดคำถามแบบตัวเลือก ผลการวิจัยที่ได้จะสะท้อนถึงความคิดเห็นของประชาชนต่อความเต็มใจจ่ายเงินเพื่อสุขภาพ และจะถูกนำไปใช้เป็นข้อมูลประกอบการพิจารณาคัดเลือกยาเข้าสู่รายการยาบัญชียาหลักแห่งชาติสำหรับมาใช้ในการดูแลรักษาประชาชนในประเทศ แบบสอบถามประกอบด้วย 3 ส่วน คือ ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม การประเมินค่าสุขภาพที่สถานการณ์ต่างๆ และประเมินความเต็มใจจ่ายต่อสุขภาพ

การสัมภาษณ์ใช้เวลาการตอบแบบสอบถามใช้เวลาไม่เกิน 30 นาที การตอบแบบสอบถามของท่านจะไม่ส่งผลต่อสิทธิการรักษา ข้อมูลของท่านจะถูกเก็บเป็นความลับ ผู้วิจัยจะวิเคราะห์และสรุปผลภาพรวมโดยไม่มีการระบุชื่อหรืออ้างอิงถึงตัวบุคคลแต่ประการใด ในระหว่างดำเนินการสัมภาษณ์หากท่านมีข้อสงสัยสามารถสอบถามผู้สัมภาษณ์ได้ และท่านสามารถยุติการให้สัมภาษณ์ก่อนที่การสัมภาษณ์จะสิ้นสุดได้ ท่านจะได้ค่าตอบแทน 100 บาท เมื่อท่านตอบแบบสอบถามสมบูรณ์

คณะผู้วิจัย
คณะเภสัชศาสตร์ มหาวิทยาลัยสงขลานครินทร์
อ. หาดใหญ่ จ.สงขลา โทร. 074-288908

ส่วนที่ 1: ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

<u>สำหรับผู้ให้ข้อมูล</u>

ให้ผู้สัมภาษณ์สอบถามข้อมูลทั่วไปของผู้ให้ข้อมูลพร้อมทั้งบันทึกคำตอบลงในแบบสอบถามทีละข้อตั้งแต่ข้อที่ 1 ถึง 11 ตามลำดับ

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1. เพศ ❒ ชาย ❒ หญิง

2. บ้านพักของท่านตั้งอยู่ที่อำเภอ..... จังหวัด.....

❒ ในเขตเทศบาล ❒ นอกเขตเทศบาล

3. อายุปี.....

4. ท่านจบการระดับการศึกษาสูงสุดระดับใด

❒ 1. ไม่ได้เรียน ❒ 2. ประถมศึกษา

❒ 3. มัธยมศึกษา ❒4. อุดมศึกษาหรือสูงกว่า

5. ท่านใช้สิทธิใดในการรักษาพยาบาล

❒ 1.ประกันสุขภาพถ้วนหน้า (บัตรทอง) ❒ 2.สวัสดิการข้าราชการ

❒ 3.ประกันสังคม ❒ 4.ประกันชีวิตเอกชน

❒ 5.จ่ายเอง/ไม่มีสิทธิ ❒ 6. รัฐวิหาสกิจ

❒ 7. อื่นๆ ระบุ.....

6. สถานภาพสมรสคือข้อใด

❒1. โสด ❒2.สมรส ❒3.หย่าร้าง, หม้าย

7. จำนวนสมาชิกในครอบครัวของท่านทั้งหมดกี่คน .....คน

8. จำนวนสมาชิกในครอบครัวของท่านที่มีอายุตั้งแต่ 20 ปี ขึ้นไป (รวมตัวท่านเองด้วย) กี่คน.....คน

9.สถานภาพของท่านในครอบครัวคือข้อใด

❒1. หัวหน้าครอบครัว ❒2. คู่สมรสของหัวหน้าครอบครัว

❒3.บุตรของหัวหน้าครอบครัว ❒4.บิดา/มารดาของหัวหน้าครอบครัว

❒5. ญาติ/ผู้อาศัย ❒6.อื่นๆ

10. ปัจจุบันรายได้ของท่านเดือนละกี่บาท ..... บาท

11. ปัจจุบันรายได้ของท่านและครอบครัวรวมกันเดือนละกี่บาท .....บาท

12. ท่านมีโรคประจำตัวใดบ้าง (ตอบได้มากกว่า 1 คำตอบ)

❒1. ไม่มีโรคประจำตัว ❒2. เบาหวาน

❒3. ความดันโลหิตสูง ❒4.ไขมันในเลือดสูง

❒5. โรคหัวใจ ❒6. อื่นๆ (โปรดระบุ).....

Health state___ ___ ___ ___ ___ **ค่า EQ-5D**_____

ส่วนที่ 2 **แบบประเมินค่าสุขภาพ** (health sate)

2.1 **แบบประเมินค่าสุขภาพสุขภาพปัจจุบันของท่านโดยใช้แบบวัด** EQ-5D

<u>สำหรับผู้สัมภาษณ์</u>

ให้ผู้สัมภาษณ์อ่านคำชี้แจงให้ผู้ให้ข้อมูลฟัง ต่อจากนั้นให้ผู้ให้ข้อมูลเลือกระดับของสุขภาพทีละมิติโดยใช้เครื่องมือ EQ-5D **และบันทึกคำตอบลงในแบบสอบถาม**

<u>คำชี้แจง</u> หากสุขภาพของท่านประกอบด้วยมิติจำนวน 5 มิติ ได้แก่ การเคลื่อนไหว การดูแลตนเอง กิจกรรมที่ทำเป็นประจำ **ความเจ็บปวด/ความไม่สุขสบาย** และ**ความวิตกกังวล/ความซึมเศร้า** ซึ่งแต่ละมิติระดับความรุนแรงแบ่งออกเป็น 3 ระดับ คือ ไม่มีปัญหา มีปัญหาปานกลาง และมีปัญหามาก กรุณาเลือกระดับของสุขภาพในแต่ละมิติให้ตรงกับภาวะ**สุขภาพของท่านในวันนี้มากที่สุด**

การเคลื่อนไหว

ข้าพเจ้าไม่มีปัญหาในการเดิน ❑

ข้าพเจ้ามีปัญหาในการเดินบ้าง ❑

ข้าพเจ้าไม่สามารถไปไหนได้ และจำเป็นต้องอยู่บนเตียง ❑

การดูแลตนเอง (เช่น การอาบน้ำ แต่งตัว)

ข้าพเจ้าไม่มีปัญหาในการดูแลตนเอง ❑

ข้าพเจ้ามีปัญหาในการอาบน้ำหรือการแต่งตัวบ้าง ❑

ข้าพเจ้าไม่สามารถอาบน้ำหรือแต่งตัวด้วยตนเองได้ ❑

กิจกรรมที่ทำเป็นประจำ *(เช่น การทำงาน, การเรียนหนังสือ, การทำงานบ้าน, การทำกิจกรรมในครอบครัว หรือการทำกิจกรรมยามว่าง)*

ข้าพเจ้าไม่มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำ ❑

ข้าพเจ้ามีปัญหาในการทำกิจกรรมที่ทำเป็นประจำอยู่บ้าง ❑

ข้าพเจ้าไม่สามารถทำกิจกรรมที่ทำเป็นประจำได้ ❑

ความเจ็บปวด/ความไม่สุขสบาย

ข้าพเจ้าไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย ❑

ข้าพเจ้ามีอาการเจ็บปวดหรืออาการไม่สุขสบายปานกลาง ❑

ข้าพเจ้ามีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด ❑

ความวิตกกังวล/ ความซึมเศร้า

ข้าพเจ้าไม่รู้สึกวิตกกังวลหรือซึมเศร้า ❑

ข้าพเจ้ารู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง ❑

ข้าพเจ้ารู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด ❑

2.2 **การประเมินภาวะสุขภาพโดยใช้สเกล** (Visual analog scale)

<u>สำหรับผู้สัมภาษณ์</u>

ให้ผู้สัมภาษณ์อ่านคำชี้แจง และแสดงสเกลวัดระดับสุขภาพโดยใช้เครื่องมือ VAS ต่อจากนั้นให้ผู้ให้ข้อมูลทำเครื่องหมายกากบาทลงบนสเกลวัดระดับสุขภาพทีละภาวะสุขภาพที่กำหนดให้จนครบ 5 สถานการณ์สุขภาพ และบันทึกตำแหน่งที่ผู้ให้ข้อมูลทำเครื่องหมายลงบนแบบสอบถาม

****แต่ละสเกลผู้สัมภาษณ์ให้กากบาทตำแหน่งของสถานการณ์สุขภาพที่ผู้ให้ข้อมูลได้กากบาทไว้เมื่อไม่มีปัญหาและเมื่อเสียชีวิต ลงบนสเกลที่ 4-8 ก่อนที่ผู้ให้ข้อมูลจะกากบาทลงบนสเกลนั้น********

<u>หมายเหตุ</u> ในกรณีที่ผู้ให้ข้อมูลกากบาทลงบนสเกลตรงตำแหน่งเท่ากับเสียชีวิต ให้ผู้สัมภาษณ์สอบถามว่าคิดว่าสถานการสุขภาพนี้ จริงๆแล้วแย่กว่า เสียชีวิตหรือไม่

<u>หากผู้ให้ข้อมูลคิดว่าแย่กว่าเสียชีวิต</u> ให้ผู้สัมภาษณ์ลากเส้นขนานกับสเกลเดิมโดยกำหนดจุดบนสุดเป็น 0 และจุดล่างสุดเป็น -100 (ลบหนึ่งร้อย) และให้ผู้ตอบแบบสอบถามกากบาทอีกครั้ง

<u>คำชี้แจง</u> เพื่อช่วยในการประเมินภาวะสุขภาพของท่านทางเราได้จัดทำสเกลวัดระดับสุขภาพขึ้นเริ่มตั้งแต่ระดับ 0 ถึง 100 โดยที่ 100 หมายถึงสุขภาวะที่ดีที่สุด และ 0 หมายถึงสุขภาวะที่แย่ที่สุด

<u>ผลการประเมินภาวะสุขภาพโดยใช้สเกล</u>

1) ตำแหน่งที่ผู้ให้ข้อมูลกากบาทบนสเกลภาวะสุขภาพที่1 (ภาวะสุขภาพที่ไม่มีปัญหาในทุกด้าน)

คือตำแหน่งที่_____

2) ตำแหน่งที่ผู้ให้ข้อมูลกากบาทบนสเกลภาวะสุขภาพที่ 2 (เมื่อเสียชีวิต)

คือตำแหน่งที่_____

3) ตำแหน่งที่ผู้ให้ข้อมูลกากบาทบนสเกลภาวะสุขภาพที่ 3 (ภาวะสุขภาพของท่านวันนี้)

คือตำแหน่งที่_____

4) ตำแหน่งที่ผู้ให้ข้อมูลกากบาทบนสเกลวัดภาวะสุขภาพที่ 4

คือตำแหน่งที่_____

5) ตำแหน่งที่ผู้ให้ข้อมูลกากบาทบนสเกลวัดภาวะสุขภาพที่ 5

คือตำแหน่งที่_____

ส่วนที่ 3 แบบประเมินความเต็มใจที่จ่ายต่อสุขภาพ

3.1 ความเต็มใจจ่ายด้วยคำถามแบบตัวเลือก

<u>สำหรับผู้สัมภาษณ์</u>

ให้ผู้สัมภาษณ์อ่านคำชี้แจง และให้ผู้สัมภาษณ์เลือกตอบคำถามความเต็มใจที่จะจ่ายทีละข้อจนครบ 5 ข้อ โดยใช้เครื่องมือ WTP questions และบันทึกผลลงในแบบสอบถาม หากข้อที่ 3 ผู้ตอบแบบสอบถามเลือกตอบทางเลือกที่ 2 แล้วให้ยุติการสัมภาษณ์

คำชี้แจง ในแบบสอบถามท่านต้องจินตนาการว่าท่านป่วยเป็นโรครุนแรงหากไม่ทำการรักษาจะเสียชีวิต เราขอเสนอทางเลือกในการรักษาให้ท่าน 2 ทางเลือก แต่ต้องมีค่าใช้จ่ายและผลการรักษาที่ได้แตกต่างกัน โดยท่านต้องมีสุขภาพตามผลการรักษาที่ท่านเลือกเป็นเวลา 12 เดือน หลังจากนั้นสิ้นสุดการรักษาท่านจะกลับมามีสุขภาพเหมือนปัจจุบัน ท่านโปรดพิจารณาคุณลักษณะของแต่ละทางเลือกเปรียบเทียบกันแล้วเลือกทางเลือกที่ท่านพึงพอใจที่สุด หรือท่านจะเลือกไม่ทำการรักษาก็ได้

หมายเหตุ จำนวนเงินที่ท่านเลือกจ่ายนั้นต้องเป็นเงินที่**<u>ท่านประสงค์จะนำมาจ่ายจริงและสามารถนำมาจ่ายได้ในแต่ละเดือนเป็นเวลา 12 เดือน</u>**

ข้อที่ 1 ทางเลือกที่เลือก

☐ สถานการณ์เดิม ☐ ทางเลือก 1 ☐ ทางเลือก 2

ข้อที่ 2 ทางเลือกที่เลือก

☐ สถานการณ์เดิม ☐ ทางเลือก 1 ☐ ทางเลือก 2

ข้อที่ 3 ทางลือกที่เลือก

☐ สถานการณ์เดิม ☐ ทางเลือก 1 ☐ **ทางเลือก 2 (ยุติการสัมภาษณ์)**

ข้อที่ 4

☐ สถานการณ์เดิม ☐ ทางเลือก 1 ☐ ทางเลือก 2

ข้อที่ 5

☐ สถานการณ์เดิม ☐ ทางเลือก 1 ☐ ทางเลือก 2

3.2 **สาเหตุที่ผู้ให้ข้อมูลไม่เต็มใจจ่ายในชุดตัวเลือก**

<u>สำหรับผู้สัมภาษณ์</u> **ให้ผู้สัมภาษณ์ตรวจสอบผลตอบในแบบสอบถามทั้ง 5 ข้อ หากข้อใดที่ผู้ให้ <u>ข้อมูลเลือกทางเลือกไม่ทำการรักษา</u> (ไม่เลือกทั้งทางเลือกที่ 1 และทางเลือกที่ 2) ให้สอบถามเหตุผลทีละข้อจนครบ โดยแสดงเครื่องมือ 3.2 ประกอบ**

ข้อที่ 1 **เลือกไม่ทำการรักษาเพราะเหตุผลในข้อ**_____

อื่น ๆ ระบุ_____

ข้อที่ 2 **เลือกไม่ทำการรักษาเพราะเหตุผลในข้อ**_____

อื่น ๆ ระบุ_____

ข้อที่ 3 **เลือกไม่ทำการรักษาเพราะเหตุผลในข้อ**_____

อื่น ๆ ระบุ_____

ข้อที่ 4 **เลือกไม่ทำการรักษาเพราะเหตุผลในข้อ**_____

อื่น ๆ ระบุ_____

ข้อที่ 5 **เลือกไม่ทำการรักษาเพราะเหตุผลในข้อ**_____

อื่น ๆ ระบุ_____

3.3 จำนวนเงินที่เต็มใจต่อเดือน (คำถามปลายเปิด)

<u>สำหรับผู้สัมภาษณ์</u> ให้ผู้สัมภาษณ์ถามถึงจำนวนเงินที่ผู้ให้ข้อมูลเต็มใจจ่ายเงินเพื่อการรักษาตามสถานการณ์ที่กำหนดให้ โดยแสดงเครื่องมือ 3.3 ประกอบ

จำนวนเงินที่เต็มใจจ่ายต่อเดือน_____บาทต่อเดือน

3.4 เหตุผลที่ไม่เต็มใจจ่ายเงินเพื่อการรักษาในข้อ 3.3

<u>สำหรับผู้สัมภาษณ์</u> ให้ผู้สัมภาษณ์ถามสาเหตุที่ผู้ให้ข้อมูลไม่เต็มใจจ่ายเงินเพื่อการรักษา โดยแสดงเครื่องมือ 3.4 ประกอบ

เพราะเหตุผลในข้อ_____

อื่นๆ ระบุ_____

ส่วนที่ 4 แบบสรุปการสัมภาษณ์

<u>สำหรับผู้สัมภาษณ์</u>

ให้ผู้สัมภาษณ์สรุปผลการสัมภาษณ์ ในกรณีที่ผู้ให้ข้อมูลตอบแบบสอบถามไม่ครบให้ระบุเหตุผลด้วย

สรุปผลการสัมภาษณ์

☐ ผู้ให้ข้อมูลตอบแบบสอบถามจนครบ

☐ ผู้ให้ข้อมูลตอบแบบสอบถามไม่ครบ เพราะ

- ☐ ขอยุติการสัมภาษณ์เนื่องจาก_____
- ☐ ตอบข้อทดสอบความเข้าใจผิด (ข้อที่ 3 ของชุดตัวเลือก)
- ☐ อื่นๆ_____

Appendix IV Invitation detail

คำชี้แจงโครงการวิจัยเรื่องความเต็มใจจ่ายต่อหนึ่งปีสุขภาวะ

เรียนอาสาสมัครผู้เข้าร่วมในการศึกษา

การวิจัยนี้มีจุดประสงค์เพื่อศึกษาความเต็มใจจ่ายต่อปีสุขภาวะโดยใช้วิธีการสร้างชุดคำถามแบบ ผลการวิจัยที่ได้จะสะท้อนถึงความคิดเห็นของประชาชนต่อความเต็มใจจ่ายเงินเพื่อสุขภาพ และจะถูกนำไปใช้เป็นข้อมูลประกอบการพิจารณาคัดเลือกยาเข้าสู่รายการยาบัญชียาหลักแห่งชาติสำหรับมาใช้ในการดูแลรักษาประชาชนในประเทศ แบบสอบถามประกอบด้วย 3 ส่วน คือ ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม การประเมินค่าสุขภาพที่สถานการณ์ต่างๆ และประเมินความเต็มใจจ่ายต่อสุขภาพ โดยใช้เวลาการตอบแบบสอบถามใช้เวลาไม่เกิน 30 นาที การตอบแบบสอบถามของท่านจะไม่ส่งผลต่อสิทธิการรักษา ข้อมูลของท่านจะถูกเก็บเป็นความลับ ผู้วิจัยจะวิเคราะห์และสรุปผลภาพรวมโดยไม่มีการระบุชื่อหรืออ้างอิงถึงตัวบุคคลแต่ประการใด ในระหว่างดำเนินการสัมภาษณ์หากท่านมีข้อสงสัยสามารถสอบถามผู้สัมภาษณ์ได้ และท่านสามารถยุติการให้สัมภาษณ์ก่อนที่การสัมภาษณ์จะสิ้นสุดได้ ท่านจะได้ค่าตอบแทน 100 บาท เมื่อท่านตอบแบบสอบถามสมบูรณ์

คณะผู้วิจัย
คณะเภสัชศาสตร์ มหาวิทยาลัยสงขลานครินทร์
อ.หาดใหญ่ จ.สงขลา โทร. 074-288908

Appendix V EQ-5D-3L tool

เครื่องมือ EQ-5D
(สำหรับการสัมภาษณ์ข้อ 2.1)

การเคลื่อนไหว

ข้าพเจ้าไม่มีปัญหาในการเดิน ❑

ข้าพเจ้ามีปัญหาในการเดินบ้าง ❑

ข้าพเจ้าไม่สามารถไปไหนได้ และจำเป็นต้องอยู่บนเตียง ❑

การดูแลตนเอง

(เช่นการอาบน้ำแต่งตัว)

ข้าพเจ้าไม่มีปัญหาในการดูแลตนเอง ❑

ข้าพเจ้ามีปัญหาในการอาบน้ำหรือการแต่งตัวบ้าง ❑

ข้าพเจ้าไม่สามารถอาบน้ำหรือแต่งตัวด้วยตนเองได้ ❑

<u>กิจกรรมที่ทำเป็นประจำ</u>

(เช่น การทำงาน, การเรียนหนังสือ, การทำงานบ้าน, การทำกิจกรรมในครอบครัว หรือการทำกิจกรรมยามว่าง)

ข้าพเจ้าไม่มีปัญหาในการทำกิจกรรมที่ทำเป็นประจำ ❑

ข้าพเจ้ามีปัญหาในการทำกิจกรรมที่ทำเป็นประจำอยู่บ้าง ❑

ข้าพเจ้าไม่สามารถทำกิจกรรมที่ทำเป็นประจำได้ ❑

ความเจ็บปวด/ความไม่สุขสบาย

ข้าพเจ้าไม่มีอาการเจ็บปวดหรืออาการไม่สุขสบาย ❑

ข้าพเจ้ามีอาการเจ็บปวดหรืออาการไม่สุขสบายปานกลาง ❑

ข้าพเจ้ามีอาการเจ็บปวดหรืออาการไม่สุขสบายมากที่สุด ❑

ความวิตกกังวล/ ความซึมเศร้า

ข้าพเจ้าไม่รู้สึกวิตกกังวลหรือซึมเศร้า ❑

ข้าพเจ้ารู้สึกวิตกกังวลหรือซึมเศร้าปานกลาง ❑

ข้าพเจ้ารู้สึกวิตกกังวลหรือซึมเศร้ามากที่สุด ❑

Appendix VI Interview photos