COST-EFFECTIVENESS ANALYSIS OF ARIPIPRAZOLE COMPARE WITH RISPERIDONE IN

PATIENT WITH AUTISM SPECTRUM DISORDERS

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การวิเคราะห์ต้นทุนประสิทธิผลของยาอะริพิพราโซลเปรียบเทียบกับยาริสเพอริโดนในผู้ป่วยกลุ่ม
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กฤษฎาดนุเดช วงศ์เวชวิวัฒน์ : การวิเคราะห์ต้นทุนประสิทธิผลของยาอะริพิพราโซลเปรียบเทียบกับยาริสเพอริโดนในผู้ป่วยกลุ่มอาการออทิซึม (COST-EFFECTIVENESS ANALYSIS OF ARIPIPRAZOLE COMPARE WITH RISPERIDONE IN PATIENT WITH AUTISM SPECTRUM DISORDERS) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร.กรรณิการ์ ดำรงค์พลาสิทธิ์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ศ. ดร.ศิริเพ็ญ ศุภกาญจนกันติ, 99 หน้า.

กลุ่มอาการออทิซึมสเปกตรัมเป็นกลุ่มของความผิดปกติในการปฏิสัมพันธ์และการสื่อสารกับสังคม (สมาคมจิตเวชแห่งอเมริกา, 2556) ผลของการศึกษาในประเทศไทยพบว่าจำนวนของผู้ดูแล ต้นทุนทางอ้อม และต้นทุนรวมจะเพิ่มขึ้นหากผู้ป่วยกลุ่มอาการออทิซึมสเปกตรัมไม่สามารถช่วยเหลือตนเองได้ (นฤมล จุนสมุทร, 2557) ยาริสเพอริโดนและยาอะริพิพราโซลมีประสิทธิผลในการรักษาอาการหงุดหงิดและก่อกวนของผู้ป่วยได้ (ลีเคลิคและอีสลีย์, 2558) การศึกษานี้จัดทำขึ้นเพื่อการประเมินต้นทุนประสิทธิผลของยาอะริพิพราโซลเปรียบเทียบกับยาริสเพอริโดนในการรักษาผู้ป่วยกลุ่มอาการออทิซึมสเปกตรัม โดยวิธีทบทวนวรรณกรรมอย่างเป็นระบบและการวิเคราะห์อนุมานโดยมีการศึกษาทั้งหมด 7 การศึกษาที่ได้รับการคัดเลือกและรวมไว้ในการวิเคราะห์ผลลัพธ์ด้านประสิทธิผล โดยใช้ Aberrant Behavior Checklist (ABC) เป็นเครื่องมือในการสะท้อนประสิทธิผลดังกล่าว อาการของผู้ป่วยที่ดีขึ้นจะส่งผลให้ระดับคะแนน ABC ลดลง ผลการศึกษาพบว่าคะแนนเฉลี่ย ABC-I ของกลุ่มยาริสเพอริโดนมีค่าต่ำกว่ากลุ่มยาอะริพิพราโซล (mean difference 0.41) แต่ไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ (95%CI: -5.53, 6.36) ผลการวิเคราะห์ต้นทุนต่อ 1 หน่วยที่ลดลงของคะแนน ABC-I ในมุมมองของผู้ให้บริการพบว่าผลการวิเคราะห์ต้นทุนต่อ 1 หน่วยที่ลดลงของคะแนน ABC-I ในกลุ่มยาริสเพอริโดนเท่ากับ 981.04 บาทและ ในกลุ่มยาอะริพิพราโซลเท่ากับ 423.54 บาท จากผลการศึกษาจะเห็นได้ว่าเมื่อพิจารณาจากมุมมองของผู้ให้บริการ ในกลุ่มยาริสเพอริโดนผู้ให้บริการจะเป็นผู้รับผิดชอบต้นทุนการรักษาเป็นหลัก

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KRIDSADADANUDEJ WONGWEJWIWAT: COST-EFFECTIVENESS ANALYSIS OF ARIPIPRAZOLE COMPARE WITH RISPERIDONE IN PATIENT WITH AUTISM SPECTRUM DISORDERS. ADVISOR: ASST. PROF.KANNIKA DAMRONGPLASIT, Ph.D., CO-ADVISOR: PROF.SIRIPEN SUPAKANKUNTI, Ph.D., 99 pp.

Autism spectrum disorders (ASD) are a group of deficits in social interaction and social communication (American Psychiatric Association, 2013). The result of a study in Thailand found that ASD patients with less self-reliance increased the number of caregivers, indirect costs and total costs (Naruemol Junsamut, 2014). Risperidone and aripiprazole showed the effectiveness for treating irritability/disruptive behavior in ASD (LeClerc & Easley, 2015). The objective of this research was to estimate the cost-effectiveness of aripiprazole compared with risperidone for treating ASD patient. Seven studies were selected to analyze the outcomes of effectiveness utilizing network meta-analysis. The number of improving symptoms that was evaluated via Aberrant Behavior Checklist (ABC), and the lower score is the better. Result of this study revealed that average ABC-I scores of risperidone group were considerably lower than aripiprazole group (mean difference 0.41). Given both active agents were compared, there was no statistical significance reached in the network meta-analysis (95%CI: -5.53, 6.36). The results of unit cost analysis were presented the cost per 1 decreasing ABC-I score of risperidone by provider perspective was 981.04 Baht and aripiprazole was 423.54 Baht. As a result of cost-effectiveness ratio, it was clear that in the risperidone group, the provider was responsible more for the cost of treatment.

Field of Study: Health Economics and	Student's Signature	_____
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Academic Year: 2017	Co-Advisor's Signature	_____

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LIST OF ABBREVIATIONS

ASD	Autism Spectrum Disorders
ABC	Aberrant Behavior Checklists
ABC-H	Aberrant Behavior Checklists-Hyperactivity/Non-compliance subscale
ABC-I	Aberrant Behavior Checklists-Irritability subscale
ABC-IS	Aberrant Behavior Checklists-Inappropriate Speech subscale
ABC-L	Aberrant Behavior Checklists-Lethargy/Social Withdrawal subscale
ABC-S	Aberrant Behavior Checklists-Stereotypic Behavior subscale
CEA	Cost-Effectiveness Analysis
CER	Cost-Effectiveness Ratio
MD	Mean Difference
NMA	Network Meta-Analysis
NPS	Non-Patient Service
NRPCC	Non-Revenue Producing Cost Center
OPD	Out Patient Department
PS	Patient Service
RCT	Randomized Controlled Trial
RPCC	Revenue-Producing Cost Center
SD	Standard Deviation
SE	Standard Error
TMT	Thai Medicines Terminology

CHAPTER I

INTRODUCTION

1.1. Motivation and significance

Autism spectrum disorders (ASD) are a group of deficits in social interaction and social communication across three main deficits as represented by the following deficits in social-emotional reciprocity, deficits in nonverbal communicative behaviors and deficits in developing, maintaining, and understanding relationships (American Psychiatric Association, 2013). Patients with this disease are often referred to as autistic patients. Symptoms usually appear in infants before the age of 3 years (American Psychiatric Association, 2000). In addition, there are social and communication disorders in the ASD group, including Asperger syndrome (Myers SM, 2007). Autism is very genetically related. Although genetic inheritance is complex and it is not possible to describe ASD as a result of multiple genes or mutations (Abrahams BS, 2008). Small numbers of patients are found to be associated with the substance. Some sources offer a variety of causes of autism, such as childhood immunization. The hypothesis is that there is a lack of reliable scientific evidence (Rutter, 2005). The causes of ASD are unclear but scientific evidence found that they are related with many factors including genetic and environmental factors. Many previously epidemiological studies since about 50 years ago have been indicating the prevalence of ASD appears to be increasing each year. The current estimated prevalence of ASD was approximately 1 in 160 children (Christensen et al., 2016; World Health Organization, 2017). The prevalence of ASD in boys is four times as high as girls. The number of patients with autism has increased dramatically since the 1980s, partly due to the advancement in diagnosis (Newschaffer et al., 2007).

Autism patients have multiple brain disorders that are not known. Parents often notice symptoms during the first 2 years of life, although behavioral and cognitive therapy by young physiotherapists and clinical psychologists will help to develop self-care and communication and social interactions. Children with this disease are less

likely to live independently after adulthood (Akshoomoff, Pierce, & Courchesne, 2002; Stone, Coonrod, & Ousley, 2000).

The Aberrant Behavior Checklist (ABC) was developed for assessing the treatment effects in patient with developmental disabilities. ABC was derived yielding five subscales: Irritability, Lethargy/Social Withdrawal, Stereotypic Behavior, Hyperactivity/Non-compliance and Inappropriate Speech. The number of improving symptoms that were evaluated via ABC, and the lower number is the better (Aman, Singh, Stewart, & Field, 1985).

Risperidone and aripiprazole are antipsychotics approved by FDA for ASDs' patient treatment (LeClerc & Easley, 2015). Risperidone is a medicinal antidepressant used primarily for the treatment of schizophrenia, bipolar mood disorder and the frustration of patients with autism. Common side effects include motion problems, sedation, vision problems, constipation, and weight gain (Hasnain, Vieweg, & Hollett, 2012; The American Society of Health-System Pharmacists, 2015). Side-effects may include permanent disability, tardive dyskinesia, neuroleptic malignant syndrome, increased risk of suicide and hyperglycemia (Hamilton, 2015). In older adults with psychosis, dementia may increase the risk of death. It is unclear whether the drug is safe to use during pregnancy. Drug research began in the late 1980s and was authorized for sale in the United States in 1993 (The American Society of Health-System Pharmacists, 2015). It is a compulsory drug of the World Health Organization. It is the most essential drug in the basic health care system(World Health Organization, 2013). It is currently being sold in generic form (Hamilton, 2015). Wholesale prices range from $0.01 to $0.60 per day in 2014 (Management Sciences for Health, 2016). In the United States, the annual cost of the drug is between $100 and $200 per month (Hamilton, 2015).

Aripiprazole is an atypical antipsychotic. It is recommended and primarily used in the treatment of schizophrenia and bipolar disorder (The American Society of Health-System Pharmacists, 2017). Other uses include as an add-on treatment in major depressive disorder, tic disorders, and irritability associated with autism. Side effects

include neuroleptic malignant syndrome, a movement disorder known as tardive dyskinesia, and high blood sugar in those with diabetes. In the elderly, there is an increased risk of death. It is thus not recommended for use in those with psychosis due to dementia. It is pregnancy category C in the United States and category C in Australia, meaning that there is possible evidence of harm to the fetus (The American Society of Health-System Pharmacists, 2017; The Therapeutic Goods Administration Australian Government, 2018). It is also not recommended for women who are breastfeeding. It is unclear whether the drug is safe or effective in people less than 18 years old (The American Society of Health-System Pharmacists, 2017). Aripiprazole was developed by Otsuka in Japan. In the United States, Otsuka America markets it jointly with Bristol-Myers Squibb. From April 2013 to March 2014, sales of aripiprazole amounted to almost $6.9 billion (Michaelson, 2014).

According to annual cost studies of attention deficit hyperactivity disorder (ADHD) in the United States, the cost of illness was about 14,600 US dollars each year (Pelham, Foster, & Robb, 2007). A UK study found that the cost for caring for children with autism was estimated at £ 16,200-63,000 each year (Foundation for People with Learning Disabilities, 2007). The cost of children living with parents is less than that of children living at health care facilities. Most expenses are in the household sector, such as parenting and hiring a baby-sitter. Undoubtedly, the cost of care for those with such impairment was high (Jarbrink & Knapp, 2001). There was a study in ASD at Yuwaprasart Waithayopathum Child Psychiatric Hospital, Thailand, which found that patients who were diagnosed with ASD had a greater degree of disease severity, resulting in higher indirect costs and higher total costs than those diagnosed as pervasive developmental disorder-not otherwise specified (PDD-NOS). Patients with severe autism who were unable to go to school were more likely to have indirect costs than those who were eligible for school attendance. Patients with ASD may be less self-reliant which affects the increasing number of caregivers, and the higher indirect and total costs (Naruemol Junsamut, 2014). There is a recent reports from Fiscal Management, the Department of Mental Health Ministry of Public Health which found that the Yuwaprasart

Waithayopathum Child psychiatric Hospital received a budget from the Department of Mental Health of 30,159,400.00 Baht per month in February 2015.

As described above, the incidence of autism is growing each year and affects the cost of treatment. There has been no cost study for autism patients in Thailand. The cost-effectiveness of using risperidone and aripiprazole which are the only two US-FDA approved drugs for ASD does not exist in Thailand. Therefore, cost-effectiveness analysis by comparing the above two drugs is necessary to define the cost-effectiveness in considering the treatment and developing relevant policies for ASD patient.

1.2. Research questions

Is it cost-effectiveness to use aripiprazole in patient with Autism Spectrum Disorders when compared to risperidone?

1.3. Objectives

1.3.1. Main objective: To estimate the cost-effectiveness of aripiprazole compared with risperidone for treating patient with ASD from a provider perspective.

1.3.2. Specific objectives:

1.3.2.1. To define the effectiveness of risperidone compared with aripiprazole by using network meta-analysis and ABC-Irritability scores as a measurement.

1.3.2.2. To define the effectiveness of risperidone compared with aripiprazole by using network meta-analysis and other ABC subscale scores as a measurement.

1.3.2.3. To calculate the cost of ASD in provider perspective.

1.3.2.4. To estimate the cost per one reduced of ABC-Irritability scores from risperidone and aripiprazole treatment.

1.3.2.5. To estimate the cost per one reduced of other ABC subscale scores from risperidone and aripiprazole treatment.

1.4. Possible benefits

1.4.1. The data from this study can be used to make decisions for the choice of treatment options for ASD patients in Thailand.

1.4.2. The information obtained from this study can help in deciding on the choice of drugs into the hospital drug lists in Thailand.

1.5. Scope of research work

Cost effectiveness analysis of aripiprazole compared with risperidone in ASDs' patient was conducted in both children and adolescence. First, the study selected the effectiveness data by using ABC-Irritability scores as a measurement from primary resources. Then, the cost data at Yuwaprasart Waithayopathum Child Psychiatric Hospital were used to calculate relevant cost. This hospital is the appropriate hospital for this research because it is the child psychiatric hospital with the highest number of ASD patients in Thailand.

1.6. Research hypothesis

Risperidone has more cost effectiveness than aripiprazole when comparing cost and effectiveness over 8 weeks.

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CHAPTER II

BACKGROUND AND LITERATURE REVIEW

2.1. ASD diagnosis and treatment

ASD diagnosis criteria that were consider for indication criteria of this study as follow by two versions of the Diagnostic and Statistical Manual of Mental Disorders (DSM). The treatment approach published by the American Psychiatric Association. The current version is the Diagnostic and Statistical Manual of Mental Disorders – 5 (DSM-5). However, this study needs to collect data on the efficacy of ASD treatment from the past to the present, so it is important to understand the therapeutic approach that historical research will take. Some of them used DSM – IV for doing the research.

2.1.1. DSM-IV criteria (American Psychiatric Association, 2000)

Diagnostic Criteria for Autistic Disorder

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

(1) Qualitative impairment in social interaction, as manifested by at least two of the following:

(a) Marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction.

(b) Failure to develop peer relationships appropriate to developmental level.

(c) A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people.

(d) Lack of social or emotional reciprocity.

(2) Qualitative impairments in communication, as manifested by at least one of the following:

(a) Delay in, or total lack of, the development of spoken language.

(b) In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others.

(c) Stereotyped or repetitive use of language or idiosyncratic language.

(d) Lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level.

(3) Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:

(a) Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus.

(b) Apparently inflexible adherence to specific, non-functional routines or rituals.

(c) Stereotyped and repetitive motor mannerisms.

(d) Persistent preoccupation with parts of objects.

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

2.1.2. DSM-5 criteria (American Psychiatric Association, 2013)

A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history:

1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affection; to failure to initiate or respond to social interactions.

2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures: to a total lack of facial expressions and nonverbal communication.

3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers. Specify current severity: Severity is based on social communication impairments and restricted, repetitive patterns of behavior.

B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history:

1. Stereotyped or repetitive motor movements, use of objects, or speech.

2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior.

3. Highly restricted, fixated interests that are abnormal in intensity or focus.

4. Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment. Specify current severity: Severity is based on social communication impairments and restricted, repetitive patterns of behavior.

C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).

D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual disability, so social communication should be below that expected for general developmental level.

Note: Individuals with a well-established DSM-IV diagnosis of autistic disorder, Asperger's disorder, or pervasive developmental disorder not otherwise specified should be given the diagnosis of autism spectrum disorder. Individuals who have marked deficits in social communication, but whose symptoms do not otherwise meet criteria for autism spectrum disorder, should be evaluated for social (pragmatic) communication disorder.

2.1.3. Treatment guideline of Yuwaprasart Waithayopathum Child Psychiatric Hospital (Yuwaprasart Waithayopathum Child Psychiartric Hospital, 2014).

The hospital has developed a treatment guideline for ASD patients. The treatment goal was divided into three groups: irritability, inattention and repetitive behavior. In the treatment guidelines, it is recommended that drugs be administered to each symptomatic group, divided into two groups: low level of evidence's drugs and high level of evidence's drugs. The content are shown in Table 1.

Pharmacological treatment for Autism Spectrum Disorder (ASD)

Risperidone is a second-generation antipsychotic drug. Consider this drug as the first choice for ASD patients with aggressive, self-destructive analgesia because of its safety and less side effects in comparison to other conventional antipsychotic drugs.

It should be used cautiously as it is prescribed. Side effects of risperidone are metabolic and extrapyramidal side effects. Risperidone is also on national drug lists.

Aripiprazole is a second-generation antipsychotic drug. Consider this drug as a second choice for ASD patients with aggressive, self-destructive aggression because of its safety and side effects less than conventional antipsychotic drugs. It should be used with caution. Side effects of aripiprazole consist of patient weight gain and neurological side effect.

Table 1 Level of evidence of pharmacotherapy in patients with ASD

Behavioral targets	Medicines that are specifically used in Thailand	
	Low level of evidence	High level of evidence
Aggression/irritability	Clozapine+ Olanzapine+ Divalproex sodium+ Levetiracetam+ Escitalopram+	Risperidone+++ Aripiprazole+++ Topiramate++
Hyperactivity/inattention	Guanfacine+ Topiramate+	Methylphenidate+++ Risperidone+++ Aripiprazole+++ Atomoxetine++
Stereotypy/repetitive behaviors	Divalproex sodium+ Citalopram+ Escitalopram+	Risperidone+++ Aripiprazole+++ Fluoxetine++

+++ 	Broad reports of efficacy or extensive clinical experience (two or more statistically significant RCTs)

++ 	Modest report of efficacy or moderate clinical experience (one statistically significant RCT)

+ 	Rare report of efficacy or minimal clinical experience (on RCT or not statistically significant result)

2.2. Aberrant behavior checklist (ABC)

The Aberrant Behavior Checklist (ABC) was developed for assessment of treatment effects in patient with developmental disabilities. The ABC has been used in more than 300 studies and it has been translated into more than 30 languages (Aman, 2012b). The ABC consist of five subscales: Irritability, Lethargy/Social Withdrawal, Stereotypic Behavior, Hyperactivity/Noncompliance, and Inappropriate Speech. Although scores on some of the subscales (especially Irritability and Hyperactivity/Noncompliance) are moderately correlated, use of the total score lacks construct validity and is strongly discouraged in the ABC manual (Aman et al., 1985) and elsewhere (Aman, 2012a).

Later, the ABC was revised to eliminate references to residential terminology and more explicitly to allow use in children. This led to two versions, one called the ABC Residential (Marshburn & Aman, 1992). Most of the research between children and adolescents has had parents rate the ABC. However, teachers have completed the ABC for some psychometric evaluations (Freund & Reiss, 1991; Marshburn & Aman, 1992), and drug studies by other raters who know the patient well may also complete the ABC. (Aman et al., 1985).

The amount of ABC use has significantly grown over the years, especially between children and adolescents with intellectual disability (ID) and/or with ASD (Aman, 2012b). The Irritability subscale was the primary outcome measure the efficacy of risperidone and aripiprazole in pivotal large multi-site studies in ASD (McCracken et al., 2002; Research Units on Pediatric Psychopharmacology Autism, 2005) (Marcus et al., 2009; Owen et al., 2009), which led to FDA clinical indications.

2.3. Previous study

2.3.1. Effectiveness study of risperidone compare with placebo.

2.3.1.1. Risperidone improved behavioral symptoms in children with autism in a randomized, double-blind, placebo-controlled trial.

Subgroup analysis was performed on 55 patients (aged 5–12 years) with autism enrolled in an 8-week, double-blind, randomize, placebo-controlled trial of risperidone for pervasive developmental disorders. The primary outcome measure was the ABC-I subscale. This study separated the patient into two groups, the first group was given risperidone (n = 27) and the second group was given placebo (n = 28); mean baseline ABC-I (SD) was 20.6 (8.1) and 21.6 (10.2) respectively. Risperidone [mean dose (SD): 1.37 mg/day (0.7)] resulted in significantly greater reduction from baseline to endpoint in ABC-I versus placebo [mean change (SD): −13.4 (1.5) vs. −7.2 (1.4), P < 0.05]. Risperidone treatment was well tolerated and significantly improved behavioral problems associated with autism (Pandina et al., 2007).

2.3.1.2. Double-blind, placebo-controlled study of risperidone for the treatment of disruptive behaviors in children with sub-average intelligence.

The study of short-term efficacy and safety of risperidone in the treatment of disruptive behaviors was examined in a well-characterized cohort of patients with sub-average intelligence. The study period of this study was 6-weeks, and it was a multicenter, double-blind, parallel-group study of 118 patients (aged 5–12 years) with severely disruptive behaviors and sub-average intelligence, in which the subjects received risperidone oral solution 0.02–0.06 mg/kg per day or placebo. The outcome of Aberrant Behavior Checklist subscales were recorded for irritability, lethargy/social withdrawal, and hyperactivity; the Behavior Problems Inventory aggressive/ destructive behavior subscale; a visual analogue scale of the most troublesome symptom; and the Clinical Global Impression change score (Aman et al., 2002).

2.3.1.3. Risperidone in the treatment of disruptive behavioral symptoms in children with autistic and other pervasive developmental disorders.

The objectives of this study was to investigate the efficacy and safety of risperidone for the treatment of disruptive behavioral symptoms in patients with ASD and other pervasive developmental disorders (PDD). The study period

enrolled in an 8-weeks, It was a randomized, double-blind, placebo-controlled trial. The study separated the patients into two groups, for 79 patients (aged 5-12 years) given risperidone or placebo solution (0.01– 0.06 mg/kg/day). Behavioral symptoms assessment were carried out using the Aberrant Behavior Checklist (ABC), Nisonger Child Behavior Rating Form, and Clinical Global Impression-Change. The primary endpoint of this study, patients who were taking risperidone had decreased the ABC-irritability subscale compared with those who were taking placebo. By study endpoint, risperidone-treated subjects exhibited a 64% improvement over baseline in the ABC-irritability subscale score almost double that of placebo-treated subjects (31%). Risperidone-treated subjects also exhibited significantly greater decreases on the other 4 subscales of the ABC; on the conduct problem, insecure/anxious and hyperactive (Shea et al., 2004).

2.3.1.4. Risperidone in children with autism and serious behavioral problems.

This study conducted a multisite, randomized, double-blind trial of risperidone as compared with placebo for the treatment of ASD accompanied by severe tantrums, aggression, or self-injurious behavior in patients 5 to 17 years old. The study period was 8-weeks. The primary outcome measures were the score on the Irritability subscale of the Aberrant Behavior Checklist (ABC) and the rating on the Clinical Global Impressions — Improvement (CGI-I). For the results of study, a total of 101 patients (82 boys and 19 girls; mean [±SD] age, 8.8±2.7 years) were randomly assigned to receive risperidone (n = 49) or placebo (n = 52). Risperidone dose range, 0.5 to 3.5 mg per day resulted in a 56.9 percent reduction in the Irritability score, as compared with a 14.1 percent decrease in the placebo group (P<0.001). The rate of a positive response, defined as at least a 25 percent decrease in the Irritability score and a rating of much improved or very much improved on the CGI-I scale, was 69 percent in the risperidone group (34 of 49 patients had a positive response) and 12 percent in the placebo group (6 of 52, P<0.001) (McCracken et al., 2002).

2.3.2. Effectiveness study of Aripiprazole compare with placebo

2.3.2.1. A placebo-controlled, fixed-dose study of aripiprazole in children and adolescents with irritability associated with autistic disorder.

The study included 218 patients (aged 6-17 years) with a diagnosis of ASD, and with behaviors such as tantrums, aggression, self-injurious behavior, or a combination of these symptoms. They were randomized 1:1:1:1 to aripiprazole (5, 10, or 15 mg/day) or placebo in this 8-week double-blind, randomized, placebo-controlled, parallel-group study. The primary outcome was evaluated using the caregiver-rated Aberrant Behavior Checklist Irritability subscale and the secondary was measured using the clinician-rated Clinical Global Impressions-Improvement score. The result at week 8, all aripiprazole doses shown significantly greater improvement than placebo in mean Aberrant Behavior Checklist Irritability subscale scores (5 mg/day, -12.4; 10 mg/day, -13.2; 15 mg/day, -14.4; versus placebo, -8.4; all p < .05). All aripiprazole doses demonstrated significantly greater improvements in mean Clinical Global Impressions-Improvement score than placebo at week 8 as well. Aripiprazole was efficacious and generally safe and well tolerated in the treatment of patients with irritability associated with ASD (Marcus et al., 2009).

2.3.2.2. Aripiprazole in the treatment of irritability in children and adolescents with autistic disorder.

This study was to evaluate short-term efficacy and safety of aripiprazole in the treatment of irritability in patients with ASD who were clinically presenting behaviors such as tantrums, aggression, self-injurious behavior, or a combination of these. The study period of this study was 8-weeks. A double-blind, randomized, placebo-controlled, parallel-group study was conducted of patients (aged 6 –17 years) with ASD. Patients were randomly assigned (1:1) to flexibly dosed aripiprazole (target dosage: 5, 10, or 15 mg/day) or placebo. Efficacy outcome measures included the Aberrant Behavior Checklist irritability subscale and the Clinical Global Impression–Improvement score (CGI-I). The

results of study, 98 patients were randomly assigned to receive placebo (n = 51) or aripiprazole (n = 47). Mean improvement in Aberrant Behavior Checklist irritability subscale score was significantly greater with aripiprazole than with placebo from week 1 through week 8. Aripiprazole demonstrated significantly greater global improvements than placebo, as assessed by the mean CGI-I score from week 1 through week 8, although, clinically significant residual symptoms may still persist for some patients (Owen et al., 2009).

2.3.2.3. Aripiprazole in the treatment of irritability in children and adolescents with autism spectrum disorder in Japan: a randomized, double-blind, placebo-controlled study

The study evaluated the efficacy and safety of aripiprazole in the treatment of irritability in patients (6–17 years) with ASD in a double-blind, randomized, placebo-controlled 8-week study in Japan. Patients received flexibly dosed aripiprazole (1–15 mg/day) (n = 45) or placebo (n = 47). Aripiprazole shown a significant improvement in the mean parent/caregiver-rated Aberrant Behavior Checklist Japanese (ABC-J) Version ABC-irritability subscale score relative to placebo from week 3 through week 8. Administration of aripiprazole provided significantly greater improvement in the mean clinician-rated Clinical Global Impression-Improvement scores than placebo from week 2 through week 8. All patients who were randomized to aripiprazole completed the study, and no serious adverse events were reported. Three patients in placebo group discontinued. Aripiprazole was effective and generally safe and well-tolerated in the treatment of irritability associated with ASD in Japanese children and adolescents. Patients who received aripiprazole demonstrated significant improvement versus placebo on the mean ABC-J hyperactivity subscale score. Subjects treated with aripiprazole demonstrated statistically significant improvement compared to placebo in the mean CGI-S score from week 2 through week 8 and the CGAS score at weeks 4 and 8. There was no significant difference between aripiprazole group and the placebo group in the mean ABC-J stereotypy, inappropriate speech and lethargy/social

withdrawal subscale scores, as well as ABC-J response rate (Ichikawa et al., 2017).

2.3.3. Effectiveness study of risperidone compared with aripiprazole

2.3.3.1. A head-to-head comparison of aripiprazole and risperidone for safety and treating autistic disorders, a randomized double blind clinical trial.

This study was the first prospective randomized clinical trial which compared the safety and efficacy of these two medications in 59 patients with ASD for 2 months. The primary outcome measure was change in Aberrant Behavior Checklist (ABC) scores. The mean baseline ABC irritability subscale (p = 0.06), hyperactivity and noncompliance (p = 0.8), stereotypic behavior (p = 0.8), lethargy and social withdrawal (p = 0.3), and inappropriate speech scores (p = 0.8) were not different between the two groups. However, there was a non-significant statistical trend for higher baseline Irritability subscale scores in the aripiprazole group at baseline. The choice between these two medications should be on the basis of clinical equipoise considering the patient's preference and clinical profile (Ghanizadeh et al., 2014).

2.3.4. Safety studies of risperidone and aripiprazole

The major side effects of the both drugs are weight gain, diabetes mellitus type 2, dyslipidemia, cardiovascular safety and level of prolactin change. For weight gain, risperidone affects to weight gain more than aripiprazole. However, in some studies, the results did not differ in the long run. It is clear that risperidone is associated with diabetes mellitus type 2, which is partly due to the effect of weight gain. However, the effect of aripiprazole on diabetes mellitus type 2 only shows that it cannot reduce risk factors for diabetes. Risperidone has been shown to produce dyslipidemia, especially elevated cholesterol and triglyceride levels, which rapidly increase in the first year of treatment. The aripiprazole does not show any association with the occurrence of dyslipidemia. However, it is possible that aripiprazole is a new drug and information on this is still not enough (Pisano et al., 2016). The effect

of drugs on prolactin levels in blood is clearly different between risperidone and aripiprazole. Several studies have reported that risperidone has an effect on blood levels of prolactin. Raises in prolactin (PRL) levels may cause gynecomastia, galactorrhea, irregular menses, and amenorrhea in women, sexual dysfunction (decreased sexual desire, erectile-ejaculatory dysfunction, orgasmic dysfunction, vaginal dryness), and reduced fertility (Biller, 1999; Pisano et al., 2016). Aripiprazole has been shown to reduce prolactin levels. In addition, the decrease in prolactin levels has been associated with higher doses of aripiprazole and longer duration of use (Safer, Calarge, & Safer, 2013). Safety effects on the cardiovascular system. The study found that aripiprazole showed greater cardiovascular safety than risperidone (Pisano et al., 2016).

2.4. Criteria for cost data collection and cost allocation of hospitals under the Department of Mental Health 2013-2014.

Cost allocation in this section was provided by the Department of Mental Health which the researcher used to conduct this study.

The total cost group can be classified into 4 groups.

Group 1: Non-Revenue Producing Cost Center (NRPCC): Unit cost code starting with A in the raw data file refers to the unit of cost support as defined by the Comptroller-General's Department. These are costs that have the characteristic of managing or supporting the performance of other agencies without charge directly from the patient or by itself not generating revenue, such as the general administration, warehousing and maintenance, nursing department, human resources department, finance and accounting, strategic and information division, social welfare and health insurance, laundry and so on.

Group 2: Revenue-Producing Cost Center (RPCC): Unit cost code starting with B in the raw data file refers to the main unit of cost, defined by the Comptroller-General's Department, as the unit of cost that provides services to patients and generates revenues from the services, such as the radiology department, medical technology department, pathology department, pharmacy department and so on.

Group 3: Patient Service (PS): In the case of an OPD, the costing code begins with C and in the case of an IPD, the unit cost code begins with D in the raw data file. Patient service cost is the unit cost of direct patient care, such as outpatient services and inpatient services, defined by the Comptroller-General's Department.

Group 4: Non-Patient Service (NPS): Unit cost code starting with E refers to the primary cost center as defined by the Comptroller-General's Department. It does not directly serve the patient's health care services, and includes health promotion agencies, disease prevention and control and so on.

2.4.1. Direct cost determination

This section, we talk about the column number (i) in Figure 1. The total direct cost of each unit consists of the labor cost (LC), the material cost (MC), and the capital cost (CC).

$$\text{Total Direct Cost} = \text{Labor Cost} + \text{Material Cost} + \text{Capital Cost}$$

Labor cost (LC) is an individualized data by organization, which is then taken to the total annual budget. The source is the month budget disbursement report from the finance department. Labor cost includes salaries and wages, position allowances, extra money, non-medical compensations and overtime compensation, extra payment for top payers, top executives, money annual awards for health care, late night payment, social security contributions for employer, accommodation compensation, payment for special skill position and child care allowance.

Material Cost (MC) includes medications, medical supplies, office supplies, dental materials, foods and nutritions, cleaning supplies, kitchenware, construction materials, electrical materials, fuel and vehicles, maintenance fee and utility bills

Capital Cost (CC) consists of the annual capital depreciation cost of equipment and buildings in accordance with the regulations of the Comptroller General's Department. Capital Cost was calculated by used Simple Straight Line Depreciation.

$$\text{Depreciation Cost} = \frac{Cost\ of\ construction}{Lifetime}$$

All 3 categorical costs, labor cost, material cost and capital cost, will be shared into 4 groups of hospital costs by using an appropriated method e.g. allocation by full time equivalence (FTE), human resources or working area, etc. This paragraph discussed the cost-sharing from column number (i) to (ii) of Figure 1.

2.4.2. Determined allocation of direct cost to NRPCC and PRCC

In order to ultimately allocate direct cost of NRPCC and PRCC to the service unit (PS and NPS), NRPCC and RPCC cost have to be allocated within the unit of their own by determining costing criteria for unit costs NRPCC and RPCC. Different criteria for allocating costs have been identified.

2.4.2.1. In normal cases, the services under the NRPCC or the RPCC that need to be allocated to other cost services have to be identified. Cost sharing to other cost units within NRPCC and RPCC will be done by using certain factors, therefore the initial direct cost of NRPCC and RPCC will diminish or only minimally remaining. The allocated cost from one cost unit to the other cost units, which are still the units with in NRPCC and RPCC will be called indirect costs. The factor used for allocation is dependent on the hospital database in term of workloads, area, workforce and revenue. (Figure 1, the cost were allocated from column number (ii) to (iii))

2.4.2.2. In case, if the services in the cost centers cannot be categorized to NRPCC and RPCC, then its information regarding time, service fee and material cost of that service will be directly allocated to PS and NPS, proportionally. Any cost center that involves human workforce, the FTE are applied for cost allocation percent of time appointment in each service is also considered. (Figure 1, the cost were allocated from LC, MC and CC in column number (i) to NPS and PS in column number (ii))

2.4.3. Allocation of indirect and direct cost from NRPCC and RPCC to NPS and PS.

This section, we discussed about the cost-allocating from column number (iii) to column number (iv) in Figure 1. The unit cost of NPS and PS is calculated from their own direct costs and the allocated cost from NRPCC and RPCC. The simultaneous allocation method is used in this scenario.

The initial allocation of direct costs in NRPCC and RPCC cost is resulted in the indirect costs with minimal of initial direct cost of that cost center, which is called temporary cost center (TCC). The TCC will be then allocated to actual cost center (ACC), using matrix equations number 1 and 2.

Create a linear equation, assuming that the cost has been passed back within the TCC group. Therefore, the total cost of the TCC was equal to the direct cost of the unit combined with the cost of other TCCs.

Full Cost of each TCC = Direct Cost of TCC + Indirect Cost of TCC

The equation has a number of variables and the equation was equal to the number of TCCs. Then the equation was converted to the same equation in the form of a matrix. The equation was solved by the matrix method to find the total cost of each TCC unit from the cost allocation.

Matrix equation 1

$$[A] * [X] = [B]$$

[A] = Matrix of coefficients of coefficients is the matrix of proportion that sends the cost to each other.

[B] = Constant Matrix is the direct cost matrix of TCC.

[X] = The variable matrix is the total cost matrix of the TCC.

Solve the matrix equation, by using the Excel for Windows program to calculate [A] and [B]. Use [A] to find the inverse matrix ($[A]^{-1}$) using the MINVERSE function in Microsoft Excel. Both matrix equations above were provided by Department of Mental Health.

Matrix equation 2

$$[X] = [A]^{-1} * [B]$$

Bring the inverse matrix derived to the matrix B. The total cost of TCC (Matrix X or Matrix of TCC Full Cost) using the MMULT statement in Microsoft Excel was Matrix of TCC Full Cost. It is the total cost within the TCC unit that delivers the cost, before sending the cost to ACC. In which ACC contains only indirect cost from NRPCC and RPCC. Then, the ACC full cost will be calculated by summation of ACC to PS or NPS cost. ACC full cost of each PS is the OPD unit cost per visit that was used to calculate direct medical cost (inside hospital) in this study.

ACC Full Cost of PS = Direct Cost of PS + Indirect Cost from NRPCC & RPCC
ACC Full Cost of NPS = Direct Cost of NPS + Indirect Cost from NRPCC & RPCC
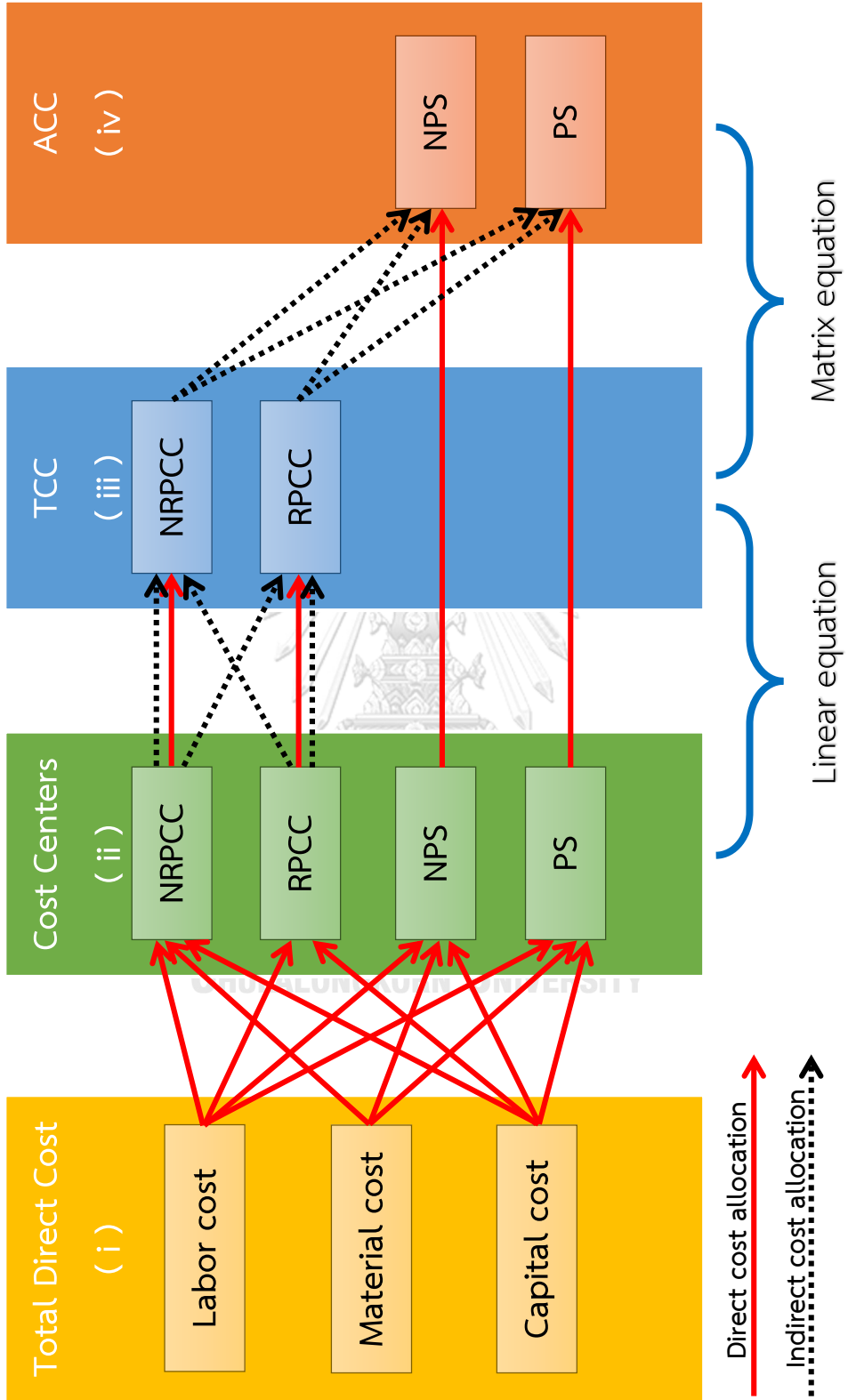
Figure 1 The cost center and cost allocation process

CHAPTER III

RESEARCH METHODOLOGY

3.1. Operational definitions

3.1.1. Direct medical costs (inside hospital)

Costs incurred in Yuwaprasart Waithayopathum Child Psychiatric Hospital included two main components: patient services costs and drug costs. There were two types of drug costs that can be divided into two categories: 1) the cost of drugs in the essential drug lists that the provider was responsible for, and the cost of drugs out of the essential drug lists that the caregivers were responsible for.

3.1.2. Direct medical costs (outside hospital)

All direct medical costs incurred outside Yuwaprasart Waithayopathum Child Psychiatric Hospital, which the caregiver is responsible for. These included the costs incurred by the clinic or the drug store and also included dental costs.

3.1.3. Direct non-medical costs

This cost was the cost of travel, accommodation, education, and household expenses that the caregivers were responsible for.

3.1.4. Indirect costs

This cost was an opportunity cost for caregivers who were absent to care for ASD patients. The cost calculation in this section depends on the type of income and the education level of care the caregiver had.

Data of this study were divided into two main parts: effectiveness measurement and costing. The effectiveness were measured by doing Network meta-analysis (NMA) that used data from gathered studies. Whilst costing data were took from Yuwaprasart Waithayopathum Child Psychiatric Hospital. The number of visit of patients were taken from medical records that were collected over one year and converted the time to 8 weeks. The sample consists of the number of visits a patient came to see a psychiatrist

at Psychiatric OPD, the number of visits a patient came to see a dentist at dental unit, et cetera. Results obtained from the both main parts were used to measure the cost-effectiveness analysis.

3.2. Network meta-analysis

According to the research question, we want to know the effectiveness of risperidone and aripiprazole to evaluate the cost-effectiveness analysis (CEA) with cost consideration. Previous studies selected into this study, were those that measured efficacy with Aberrant Behavior Checklist (ABC) scores. ABC was developed for assessing the treatment effects in patient with developmental disabilities. Reporting in, the number of improving symptom. The lower ABC score reflected is the better symptoms of patients. Network meta-analysis (NMA) was selected as the tool to estimate the effectiveness of both drugs, in which it can combine the results of many studies and generate the new result. This study compared the effectiveness of both drugs by using indirect comparison technique. Because generally randomized controlled trials (RCTs) were a comparison study of active agent versus placebo or another active agent. Therefore, we compared risperidone with aripiprazole using placebo as a standard comparator to evaluate the effectiveness between both drugs. The result of indirect comparison technique were calculated using STATA program. The results were displayed in terms of the reduced ABC scores coefficient, which can be classified into three categories: 1) the coefficient of decrease of the ABC score between risperidone and placebo, 2) the coefficient of decrease of the ABC score between aripiprazole and placebo and 3) the coefficient of decrease of the ABC score between risperidone and aripiprazole.

RCTs were gathered from original researches in secondary resources using systematic reviews, the way to gather RCTs from secondary resources. Based on the search via three databases: pubmed, cochrane and google scholar. The terms for conducting the search were risperidone, aripiprazole, autism spectrum disorders, effectiveness and aberrant behavior checklist as well as "Risperidone + autism spectrum disorders + effectiveness", "Aripiprazole + autism spectrum disorders + effectiveness", "Risperidone + autism spectrum disorders + aberrant behavior

checklist", and "Aripiprazole + autism spectrum disorders + aberrant behavior checklist". Potential relevant studies were preliminary selected based on the titles. The reference lists of the selected articles were also reviewed to look for other relevant articles. No language limitation was imposed.

This study included the original articles using inclusion criteria a follows:

3.2.1.   RCTs in patients with autistic disorders (DSM-IV) or ASD (DSM-5). In this study, only RCTs were included since it can ensure that the results are only the effect of drug, without the effect of alternative therapy.

3.2.2.   Patients in the RCTs receiving risperidone or aripiprazole and placebo or comparable active agents.

3.2.3.   Duration of RCTs of at least 8 weeks. Duration for risperidone to take full effect was 8-12 weeks and for aripiprazole was 4-8 weeks to get the full benefit of aripiprazole (College of Psychiatric and Neurologic Pharmacists, 2016; HeadMeds powered by YoungMinds, 2018).

3.2.4.   The outcomes of RCTs using reliable measurement as ABC-I score or other sub-scales.

The data obtained from all gathered studies were taken into account for similarity and differentiation. The study primarily used a reading method by the researcher, and then testing with the STATA program. The inconsistency of selected studies were tested by STATA and new outcomes were analyzed. This method is called NMA

The effectiveness of risperidone and aripiprazole was derived from gathered original research papers after doing meta-analysis measure by using aberrant behavior checklist scores. In addition to considering the effectiveness of the ABC-I scores, the other four sub-scales of the ABC scores. ABC's sub-scales including irritability, lethargy / social withdrawal, stereotypic behavior, hyperactivity / noncompliance, and inappropriate speech was also considered.

However, the results from the meta-analysis were efficacy results, in which it should be reduce the effective of the results by ten percent to obtain the results of effectiveness. The percent reduction was recommended by experts.

3.3. Costing

According to cost allocation in chapter II, the hospital cost can divided into four groups: 1) NRPCC, 2) RPCC, 3) NPS and 4) PS. The cost allocation started with cost of NRPCC and RPCC were allocated to NRPCC, RPCC, NPS and PS. Then the costs from NRPCC and RPCC, which have already been allocated, were allocated again to NPS and PS. This study obtained the data of PS units cost to calculate direct medical cost (inside hospital). However, we could not applied original PS unit cost data from the hospital because the original data included hospital drug costs which include all kinds of drugs that the patients in this hospital use in 2014 not just risperidone and aripiprazole. Therefore, all hospital drug costs from pharmacy department were deducted from RPCC before allocating to each 4 groups of hospital costs. Final PS unit costs without hospital drug costs were obtained. The cost of the medication of the patient who specifically use risperidone (n=22) and aripiprazole (n=1) was later added to the direct medical costs to calculate direct medical cost (inside hospital). The costs of the medication were calculated according to the amount of drugs consumed over a period of 8 weeks.

The cost of this study was calculated from four cost components: 1) direct medical costs (inside hospital), 2) direct medical costs (outside hospital), 3) direct non-medical costs and 4) indirect costs. Cost components can be calculated in two perspectives: provider and caregiver perspective. The cost data incurred in the hospital were based on data collected from medical records and unit cost studies for 2014 by the hospital.

3.3.1. Direct medical costs (inside hospital)

Direct medical costs consist of four costs as follows:

3.3.1.1. Drug costs were collected from the hospital's drug cost database, based on the psychiatric drug costs and other drug costs associated with ASD. The costs were presented in terms of cost per patient per year. Therefore, such costs must be calculated for a period of 8 weeks. Drug costs comes from medical record of 22 patients in risperidone group and 1 patient in aripiprazole group.

3.3.1.2. The cost of medical services was based on data collected from the cost per unit of service in 2014 of the hospital, combined with the visits from medical record of 23 patients. The Costs were calculated based on the following calculation formula.

[Cost of medical services excluding drugs (Baht / time) x Number of visits per 8 weeks]

The data on cost of medical services excluding drugs was part of ACC Full Cost of PS in sub-section 2.4.3 of Chapter II.

The cost of medical services excluding drugs consists of psychiatric OPD, part time clinic, continuing drug services, social therapy, psychological diagnosis, individual psychotherapy and family therapy clinic. Total cost of medical services could be calculated by the following formula.

[[psychiatric OPD unit cost per visit x Number of visits per 8 weeks]+[part time clinic unit cost per visit x Number of visits per 8 weeks]+ [continuing drug services unit cost per visit x Number of visits per 8 weeks]+[social therapy unit cost per visit x Number of visits per 8 weeks]+[psychological diagnosis unit cost per visit x Number of visits per 8 weeks]+[individual psychotherapy unit cost per visit x Number of visits per 8 weeks]+[family therapy clinic unit cost per visit x Number of visits per 8 weeks]]

3.3.1.3. Costs for rehabilitation or enhancement activities

Costs incurred in the hospital were based on data collected from medical records and unit cost studies for 2014 by the hospital. The costs were calculated based on the following calculation formula.

[Cost of rehabilitation or enhancement activities (Baht / time) x Number of visits per 8 weeks]

The data on cost of rehabilitation or enhancement activities was part of ACC Full Cost of PS in sub-section 2.4.3 of Chapter II.

The cost of rehabilitation or enhancement activities consists of activity therapy, speech and language therapy, occupational therapy, special education, physical rehabilitation and promote development. Total cost of rehabilitation or enhancement activities could be calculated by the following formula.

[[activity therapy x Number of visits per 8 weeks]+[speech and language therapy x Number of visits per 8 weeks]+[occupational therapy x Number of visits per 8 weeks]+[special education x Number of visits per 8 weeks]+[physical rehabilitation x Number of visits per 8 weeks]+[promote development x Number of visits per 8 weeks]]

3.3.1.4. Dental Costs

Costs incurred in the hospital were collected from medical records and unit cost studies in 2014 of the hospital. The Costs were calculated based on the following calculation formula.

[Dental cost in hospital (Baht / time) x Number of visits per 8 weeks]

The data on dental cost in hospital was part of ACC Full Cost of PS in sub-section 2.4.3 of Chapter II.

3.3.2. Direct medical costs (outside hospital)

Direct medical costs consist of four costs as follows:

3.3.2.1. Out-of-hospital treatment costs were collected from the interviews and then analyzed for average cost per unit of Baht per 8 weeks based on two cost components as follows.

3.3.2.1.1. In cases where patients were treated for ASD at other medical facilities, the cost calculation was the sum of the 8 weeks treatment costs actually paid by the patients' families.

3.3.2.1.2. In case of ASD patients who treated non-ASD diseases at other hospitals, the costs were calculated from the costs that the ASD patients actually paid for the treatment. These were as follows: treatment costs at the other hospital, treatment costs at the clinic and the service costs at the drug store.

3.3.2.2. Costs for rehabilitation or enhancement activities

In case of cost incurred outside the hospital, the data collected from the interview form was analyzed to find the average cost per unit of Baht per 8 weeks. The costs actually were paid by the patients' families.

3.3.2.3. Alternative Medical Costs

Costs incurred outside the hospital could be obtained from interview data. The data was analyzed to determine the average cost of alternative medicine. The costs were calculated based on the sum of all alternative medical costs per 8 weeks.

3.3.2.4. Dental Costs

Costs incurred outside the hospital were collected from interview data computed from dental cost of autism patients outside the hospital. The costs were actually paid by the patients' families.

3.3.3. Direct non-medical costs

Direct non-medical costs consist of four costs as follows:

3.3.3.1. The cost of traveling to a hospital or other hospital was based on interview data. Travel expenses were calculated as average travel expenses in Baht per 8 weeks. Cost was calculated from total travel expenses to hospital or health center or special events for patients with ASD. The costs were actually paid by the patients' family.

3.3.3.2. Costs related to accommodation were collected from the interview form. Cost was calculated for average cost per unit of 8 weeks. Costs

were calculated based on the following formula. The costs were actually paid by the patients' family.

[Rental fee (Baht per night) × Number of days or number of visits needed to go to hospital per 8 weeks]

3.3.3.3. The cost of education was based on interview data. The above cost was calculated as the average cost of education unit in Baht per year. Then, costs were calculated based on the cost of tuition for ASD patients per 8 weeks. The costs were actually paid by the patients' family.

3.3.3.4. The cost of household expenditures was based on interview data. Costs were analyzed to find the average cost per unit per year, and then calculated as the sum of the household cost of the household over 8 weeks. Costs of household expenditures were as follows.

3.3.3.4.1. Food and non-alcoholic beverages costs

3.3.3.4.2. Housing and home furnishings costs

3.3.3.4.3. Cost of clothing

3.3.3.4.4. Cost of personal expenses

3.3.3.4.5. Entertainment costs

3.3.3.4.6. Communication costs

The costs were actually paid by the patients' family.

The cost of caregiver employment was based on interview data. The cost was calculated as the average of the costs associated with the caregiver unemployment for patients with ASD per year, and then was calculated for a period of 8 weeks.

3.3.4. Indirect costs

The cost of the caregiver's opportunity cost was collected from the interview form. The data was analyzed for the unit cost per year, after which the cost was calculated as 8 weeks.

3.3.4.1. If the caregiver had no income and had a degree lower than bachelor's degree, the annual cost of income was calculated based on the following calculation formula:

[Minimum wage is 300 baht per day x number of working days per year (260 days)]

Then, the cost was calculated for 8 weeks.

3.3.4.2. In case the caregiver has no income and had bachelor's degree or higher, the annual cost of income was calculated based on the following calculation formula:

[Minimum salary is 15,000 baht per month x 12 months]

Then, the cost was calculated for 8 weeks.

3.3.4.3. If the caregiver earned monthly income and the caregiver took leave for patient care, the costs were analyzed for the expected annual income cost which can calculate by three ways. The way to calculate the costs were depended on the caregiver situations.

3.3.4.3.1. In the absence of a days off, the cost of care that the caregiver should receive per year can be calculated using the following calculation formula:

[(Actual salary of caregiver (Baht per month) / Number of working days per month (22 days)) x Time off (days)]

Then, the cost was calculated for 8 weeks.

3.3.4.3.2. In the absence of an hours off, the cost of care that the caregiver should receive per year was calculated using the following calculation formula:

[(Actual salary of caregiver (Baht per day) / Number of working hours per day) x Time off (hours)]

Then, the cost was calculated for 8 weeks.

3.3.4.3.3. In cases where the caregiver lost long-term care income, so patient care was analyzed for the expected cost of income, calculated from the following calculation formula.

$$P_n = P_0 (1+ i)^n$$

P_n is the salary that the caregiver should receive if s/he is still working.

P_0 is the last salary the caregiver should receive prior to taking leave.

i is the inflation rate (3 percent)

n is the number of months or years the caregiver stopped working for taking care of the patient.

Therefore, the cost of care that the caregiver should receive per year is P_n x 12 months per year. Then, the cost was calculated for 8 weeks.

3.3.4.4. If the caregiver earned by hourly or daily incomes, it was calculated for the expected annual revenue costs, in three categories as follows.

3.3.4.4.1. Absence of a daily job, the cost of care that the caregiver should receive per year was calculated using the following calculation formula.

[Revenue per day of caregiver x Time spent by caregiver (day)]

Then, the cost was calculated for 8 weeks.

3.3.4.4.2. Absence of an hourly job, the cost of care that the caregiver should receive per year was calculated using the following calculation formula:

[(Caregiver income per day / number of hours the caregiver worked) x Time off (hours)]

Then, the cost was calculated for 8 weeks.

3.3.4.4.3. In case the caregiver lost a long-term leave income for patient care, the cost of income was calculated based on two components as follows:

3.3.4.4.3.1. If the caregiver's income was less than or equal to the minimum income, it was calculated from the following calculation formula:

[Minimum wage is 300 baht per day x Number of working days per year (260 days)]

Then, the cost was calculated for 8 weeks.

3.3.4.4.3.2. If the caregiver's income over the minimum income was calculated from the following calculation formula:

[Earned income per day x number of working days per year (260 days)]

Then, the cost was calculated for 8 weeks.

Cost calculation of provider perspective was calculated by direct medical cost (inside hospital) that was calculated by the following formula:

Direct medical cost (inside hospital) = [[OPD unit cost without medications x Number of visits] + Drug costs over 8 weeks]

According to drug cost, costs of non-essential drugs were not included in direct medical cost (inside hospital).

Cost calculation of caregiver perspective can calculate from four components: 1) direct medical cost (inside hospital), 2) direct medical cost (outside hospital), 3) direct non-medical cost and 4) indirect cost. However, direct medical cost (inside hospital) in caregiver perspective was calculated only non-essential drugs prices because the previous study (Naruemol Junsamut, 2014) include only patient whom had universal coverage (UC) scheme. Most patients who came to this hospital had UC scheme. The data of UC patients were easily categorized costs and analyzed data. In case of the patient was covered by CSMBS, when the data was analyzed for costs, it was necessary to review the reimbursement information again because some drugs

were outside national essential drug lists could be reimbursable, but some drugs could not be reimbursable. The rule differed from UC patients. If the UC patients were receiving non-essential drugs, the caregiver must paid for drug costs to the hospital. It means that main cost of these patients group were non-essential drugs cost. This is the main reason for including only UC patients in this study as well.

3.4. Drug price information

The direct medical cost (inside hospital) were calculated by two components: 1) cost of patient services and 2) drug costs. In the cost allocation process, the hospital's drug cost were deleted from RPCC. Therefore, the costs of patient services that were calculated in each patient, it did not contain drug costs. We have to calculate the drug costs over 8 weeks depending on amount of used drugs in each patient. Then the drug costs were combined together with the cost of patient services.

Drug price information was obtained from Yuwaprasart Waithayopathum Child Psychiatric Hospital. Drug prices was divided into categories based on the names of medication and dosage forms (regimens) available in the hospital. Each drug price was calculated in the form of price (baht) per mg of each drug and dosage forms (regimens). In addition, sensitivity analysis used data from Thai Medicines Terminology (TMT) to access central national drug prices from The Food and Drug Administration Ministry of Public Health, Thailand.

Drug price information for the purpose of calculated costs for this research was determined by the use of Thai Medicines Terminology (TMT), a drug code used to link data from each government agency, to ensure that the price to be calculated is the prices of the same drugs. TMT ID of risperidone are shown in table 2 and aripiprazole are shown in table 3.

3.4.1. Drug price information by Thai Medicines Terminology (TMT)

Table 2 Thai Medicines Terminology ID of risperidone.

No.	TMTID	Trade names (Generic names and strength), dosage forms
1	877107	NEURIS (Risperidone 1 mg) film-coated tablet, 1 tablet
2	388446	NEURIS (Risperidone 2 mg) film-coated tablet, 1 tablet
3	430624	RISDAL (Risperidone 2 mg) film-coated tablet, 1 tablet
4	634033	RISPEL (Risperidone 1 mg/1 mL) oral solution, 30 mL bottle
5	430939	RISPERDAL (Risperidone 1 mg) film-coated tablet, 1 tablet
6	430956	RISPERDAL (Risperidone 2 mg) film-coated tablet, 1 tablet
7	430757	RISPERDAL (Risperidone 1 mg) film-coated tablet, 1 tablet
8	634051	RISPERDAL (Risperidone 1 mg/1 mL) oral drops, solution, 30 mL bottle (invalid)
9	1025175	RISPERDAL (Risperidone 1 mg/1 mL) oral solution, 100 mL bottle
10	661344	RISPERDAL (Risperidone 1 mg/1 mL) oral solution, 30 mL bottle
11	430790	RISPERDAL (Risperidone 2 mg) film-coated tablet, 1 tablet
12	430863	RISPERDAL (Risperidone 3 mg) film-coated tablet, 1 tablet

Table 2 Thai Medicines Terminology ID of risperidone. (Continue)

No.	TMTID	Trade names (Generic names and strength), dosage forms
13	430918	RISPERDAL (Risperidone 4 mg) film-coated tablet, 1 tablet
14	430774	RISPERDAL (Risperidone 1 mg) film-coated tablet, 1 tablet
15	430816	RISPERDAL (Risperidone 2 mg) film-coated tablet, 1 tablet
16	578152	RISPERDAL CONSTA (Risperidone 25 mg) powder for solution for injection, 25 mg vial
17	578229	RISPERDAL CONSTA (Risperidone 37.5 mg) powder for solution for injection, 37.5 mg vial
18	578293	RISPERDAL CONSTA (Risperidone 50 mg) powder for solution for injection, 50 mg vial
19	578134	RISPERDAL CONSTA (Risperidone 25 mg) powder for solution for injection, 25 mg vial
20	578201	RISPERDAL CONSTA (Risperidone 37.5 mg) powder for solution for injection, 37.5 mg vial
21	578272	RISPERDAL CONSTA (Risperidone 50 mg) powder for solution for injection, 50 mg vial
22	675251	RISPERDAL QUICKLET (Risperidone 1 mg) orodispersible tablet, 1 tablet
23	675298	RISPERDAL QUICKLET (Risperidone 2 mg) orodispersible tablet, 1 tablet
24	431005	RISPERDAL QUICKLET (Risperidone 500 mcg) orodispersible tablet, 1 tablet
25	737238	RISPERIDONE GPO (Risperidone 1 mg) film-coated tablet, 1 tablet
26	737255	RISPERIDONE GPO (Risperidone 2 mg) film-coated tablet, 1 tablet

Table 3 Thai Medicines Terminology ID of aripiprazole.

No.	TMTID	Trade names (Generic names and strength), dosage forms
1	540863	ABILIFY (Aripiprazole 100 mg/100 mL) solution for injection, 150 mL vial
2	590993	ABILIFY (Aripiprazole 1 mg/1 mL) oral solution, 150 mL bottle
3	1004467	ABILIFY (Aripiprazole 1 mg/1 mL) oral solution, 150 mL bottle
4	227535	ABILIFY (Aripiprazole 10 mg) tablet, 1 tablet
5	227601	ABILIFY (Aripiprazole 15 mg) tablet, 1 tablet
6	1020656	ABILIFY (Aripiprazole 2 mg) tablet, 1 tablet
7	227557	ABILIFY (Aripiprazole 10 mg) tablet, 1 tablet
8	227629	ABILIFY (Aripiprazole 15 mg) tablet, 1 tablet
9	227664	ABILIFY DISCMELT (Aripiprazole 10 mg) orodispersible tablet, 1 tablet
10	227705	ABILIFY DISCMELT (Aripiprazole 15 mg) orodispersible tablet, 1 tablet
11	1004856	ABILIFY DISCMELT (Aripiprazole 10 mg) orodispersible tablet, 1 tablet
12	1004873	ABILIFY DISCMELT (Aripiprazole 15 mg) orodispersible tablet, 1 tablet
13	780252	APALIFE 10 (Aripiprazole 10 mg) film-coated tablet, 1 tablet
14	780299	APALIFE 15 (Aripiprazole 15 mg) film-coated tablet, 1 tablet
15	994014	APALIFE 5 (Aripiprazole 5 mg) film-coated tablet, 1 tablet
16	249498	ARIPIPRAZOLE ABILIFY (Aripiprazole 5 mg) tablet, 1 tablet

3.4.2. Drug price information by Yuwaprasart Waithayopathum Child Psychiatric Hospital

Table 4 Drug prices risperidone and aripiprazole in Yuwaprasart Waithayopathum Child Psychiatric Hospital.

TMT ID	Drug Names	Contain	Prices (Baht)
877107	NEURIS (risperidone 1 mg) film-coated tablet, 1 tablet	500 tab	1,150.00
634033	RISPEL (risperidone 1 mg/1 mL) oral solution, 30 mL bottle	30 ml	150.00
634051	RISPERDAL (JANSSEN PHARMACEUTICA, BELGIUM) (risperidone 1 mg/1 mL) oral drops, solution, 30 mL bottle (invalid)	30 ml	941.60
1025175	RISPERDAL (JANSSEN PHARMACEUTICA, BELGIUM) (risperidone 1 mg/1 mL) oral solution, 100 mL bottle	100 ml	941.60
661344	RISPERDAL (JANSSEN PHARMACEUTICA, BELGIUM) (risperidone 1 mg/1 mL) oral solution, 30 mL bottle	30 ml	941.60
737238	RISPERIDONE GPO (risperidone 1 mg) film-coated tablet, 1 tablet	30 tab.	144.00
737255	RISPERIDONE GPO (risperidone 2 mg) film-coated tablet, 1 tablet	30 tab.	228.00
540863	ABILIFY (BRISTOL-MYERS SQUIBB MANUFACTURING, U.S.A.) (aripiprazole 100 mg/100 mL) solution for injection, 150 mL vial	150 ml	2,568.00
590993	ABILIFY (BRISTOL-MYERS SQUIBB PHARMA, U.S.A.) (aripiprazole 1 mg/1 mL) oral solution, 150 mL bottle	150 ml	2,568.00
1004467	ABILIFY (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 1 mg/1 mL) oral solution, 150 mL bottle	150 ml	2,568.00
1004856	ABILIFY DISCMELT (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 10 mg) orodispersible tablet, 1 tablet	30 tab.	4,700.51

Table 4 Drug prices risperidone and aripiprazole in Yuwaprasart Waithayopathum Child Psychiatric Hospital. (Continue)

TMT ID	Drug Names	Contain	Prices (Baht)
1004873	ABILIFY DISCMELT (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 15 mg) orodispersible tablet, 1 tablet	30 tab	4,800.02
780252	APALIFE 10 (aripiprazole 10 mg) film-coated tablet, 1 tablet	30 tab.	2,100.00
249498	ARIPIPRAZOLE ABILIFY (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 5 mg) tablet, 1 tablet	30 tab.	2,407.50

3.5. Cost-effectiveness ratio

Cost-effectiveness ratio was based on direct medical cost (inside hospital) of both risperidone and aripiprazole groups that were divided by effectiveness results of the both groups. Because autism is a disease that cannot be cured, it is necessary to define the term treatment. In this study, the treatment course is for a period of 8 weeks after the patient starts taking any type of medication. The drugs used in this study have many dosage forms, so the calculation of drug consumption per course of treatment was calculated based on the amount of drug in milligrams. Then the milligrams were converted back to actual quantities in each dosage forms.

Cost-effectiveness ratio was calculated by the following formula:

$$Cost-effectiveness\ ratio$$
$$= \frac{Average\ direct\ medical\ cost\ (inside\ hospital)}{Effectiveness\ results\ (coefficient\ was\ reduced\ by\ ten\ percent.)}$$

3.6. Sensitivity analysis

Category 1: Increased cost of both drugs to maximum prices

Category 2: Decreased cost of both drugs to minimum prices

Category 3: Changed cost of both drugs to central drugs' prices of Thailand

The central drugs' prices of Thailand used for this study is based on the central drug pricing notice issued by the National Drug Development Board, the Thai Food and Drug Administration, which was published on December 8, 2017. The central drug price of both risperidone and aripiprazole are as follows.

1. Risperidone tab 1 mg 1 tablet = 2.24 Baht

2. Risperidone tab 2 mg 1 tablet = 3.30 Baht

3. Risperidone orodispersible tab 0.5 mg 1 tablet = 12.19 Baht

4. Risperidone orodispersible tab 1 mg 1 tablet = 17.64 Baht

5. Risperidone orodispersible tab 2 mg 1 tablet = 34.56 Baht

6. Risperidone oral sol 1 mg/ml (30 ml) 1 tablet = 149.53 Baht

7. Aripiprazole tab 5 mg 1 tablet = 33.64 Baht

8. Aripiprazole tab 10 mg 1 tablet = 65.42 Baht

9. Aripiprazole tab 15 mg 1 tablet = 70.09 Baht

10. Aripiprazole orodispersible tab 10 mg 1 tablet = 119.00 Baht

11. Aripiprazole orodispersible tab 15 mg 1 tablet = 119.00 Baht

12. Aripiprazole oral sol 1 mg/ml (150 ml) 1 bottle = 2,160.00 Baht

3.7. Sub-analysis

This study analyzed the direct effects of drug efficacy in the term of reduced ABC scores (coefficient). In order to calculate the cost-effectiveness ratio, it is necessary to reduce the effect of the efficacy by ten percent. However, the efficacy results obtained from the meta-analysis were consistent with the efficacy of the drug. The price of the drug was calculated based on the amount consumed in 8 weeks. The sub-analysis was done to show the effect of the drug compared to the price calculated by the following formula.

$$The\ price\ of\ drug\ per\ 1\ reduced\ ABC\ score = \frac{Price\ of\ the\ drug}{Efficacy\ results\ (coefficient)}$$

3.6. Conceptual framework
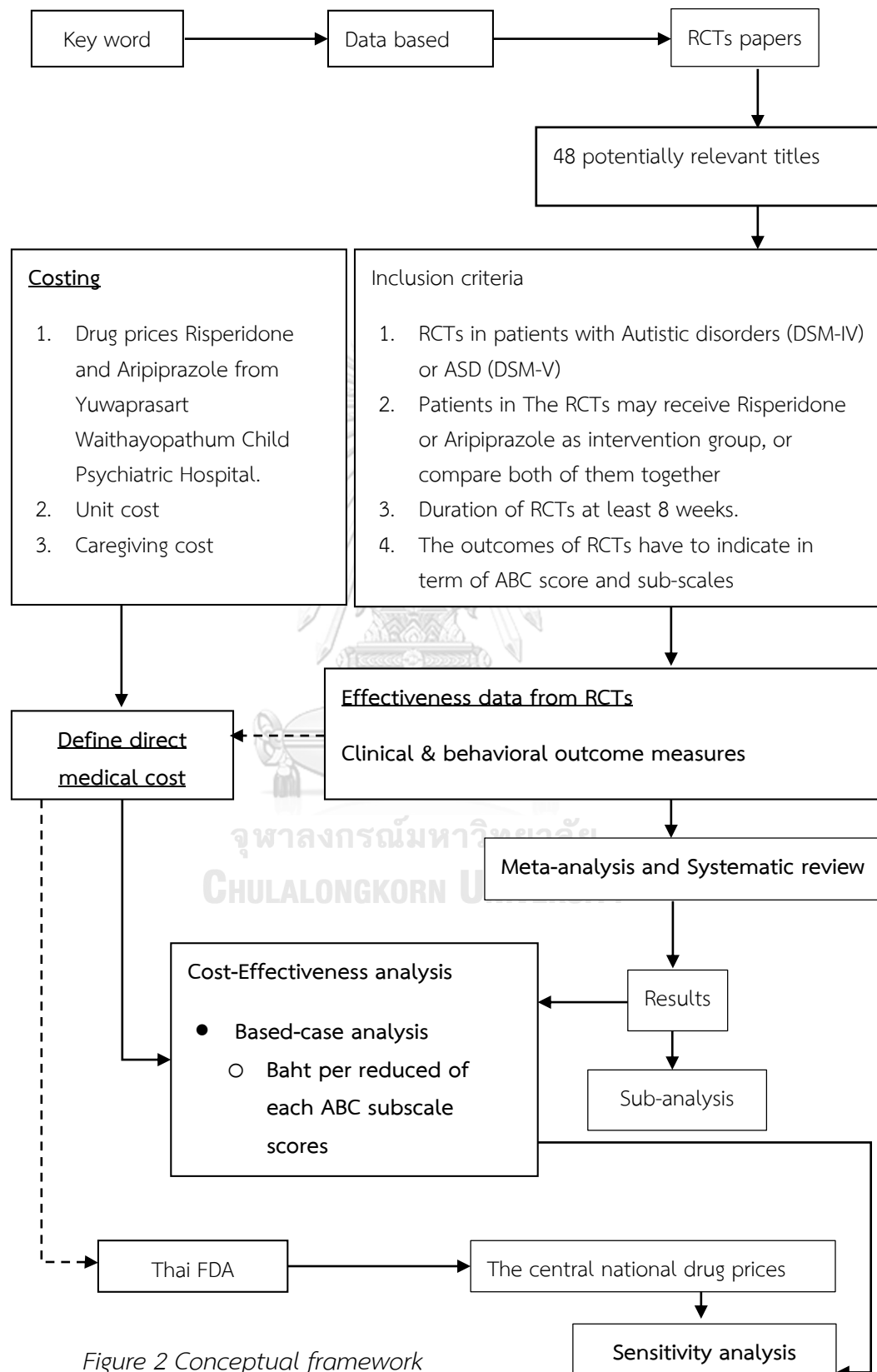
Figure 2 Conceptual framework

CHAPTER IV

RESULTS

4.1. Systematic review and meta-analysis

The number of selected articles by potentially relevant titles was 48 (Figure 3.). Of these, 39 were found to be irrelevant. Some of these studies had not examined the effectiveness of risperidone and aripiprazole on aberrant behavior checklists in ASD. The other reasons for exclusion were as follows: not a clinical trial, not double blind trials, no control group, case reports, and retrospective studies. The number of relevant article was 9 which were retrieved for more detailed evaluation. Two studies were further excluded because their follow-up times were less than or more than 8 weeks. Only 7 articles were met the inclusion criteria. A total of 430 children and adolescents contributed to the effectiveness data used in this study. The age range of the sample was between 4 and 18 years old. The number of patients in the risperidone group was 145, and most of them were male (n = 109; 75.2%), and in the aripiprazole group there was 285, and most of them also were male (n = 248; 87%). In these trials, the effectiveness of risperidone and aripiprazole on patients with ASD was investigated by aberrant behavior checklists. The details of these studies are presented in the Table 5.

```
┌─────────────────────────────┐        ┌─────────────────────────────┐
│ 48 potentially relevant     │───────▶│ Excluded: 39 irrelevant,    │
│ titles                      │        │ because the content of the  │
└──────────────┬──────────────┘        │ research was not related to │
               │                       │ the purpose of this         │
               ▼                       │ research.                   │
┌─────────────────────────────┐        └─────────────────────────────┘
│ 9 retrieved for more        │        
│ detailed evaluation         │        ┌─────────────────────────────┐
└──────────────┬──────────────┘───────▶│ Excluded: 2 irrelevant,     │
               │                       │ because 1 study took more   │
               ▼                       │ than 8 weeks to complete,   │
┌─────────────────────────────┐        │ and 1 study completed       │
│ 7 articles with randomized  │        │ research in 6 weeks.        │
│ control clinical trials     │        └─────────────────────────────┘
│ meeting inclusion criteria  │
└─────────────────────────────┘
```

Figure 3 Flowchart of trial selection process.

Before analyzing Network meta-analysis (NMA), new standard deviations (SD) were generated from mean difference (MD) and number of samples in each groups. SDs were obtained from standard errors, t values or P values which related to the differences between means in two groups. The mean difference was required in the calculations from the t value or the P value. An assumption that the standard deviations of outcome measurements are the same in both groups was required in all cases, and the standard deviation would then be used for both intervention groups. We describe first how a t value can be obtained from a P value, then how a standard error can be obtained from a t value, and finally how a standard deviation is obtained from the standard error.

Where actual P values obtained from t-tests are quoted, the corresponding t value may be obtained from a table of the t distribution. The sample size was small (say less than 60 in each group), so confidence intervals were calculated using a t distribution. The number representing the p value can be obtained from the t distribution with degrees of freedom equal to number of sample minus 1. For example in study number 1, the t value for a 95% confidence interval from a comparison of a risperidone group of 27 with a placebo group of 28 can be obtained by typing =tinv(1-0.95,27-1) in a cell in a Microsoft Excel spreadsheet for risperidone group and typing =tinv(1-0.95,28-1) in a cell in a Microsoft Excel spreadsheet for placebo group. The result was equal to 2.06 and 2.05 respectively. Difficulties are encountered when levels of significance are reported (such as P<0.05 or even P=NS which usually implies P>0.05) rather than exact P values. A conservative approach would be to take the P value at the upper limit (e.g. for P<0.05 take P=0.05, for P<0.01 take P=0.01 and for P<0.001 take P=0.001). The t value is the ratio of the difference in means to the standard error of the difference in means. The standard error of the difference in means can be obtained by dividing the difference in means (MD) by the t value:

$$SE = \frac{MD}{t\ value}$$

In the example, the standard error of the difference in means is obtained by dividing 13.4 by 2.06 in risperidone group and dividing 7.5 by 2.05 in placebo group,

which gives 6.52 and 3.66 respectively. The within-group standard deviation can be obtained from the standard error of the difference in means using the following formula:

$$SD = \frac{SE}{\sqrt{\frac{1}{Ne} + \frac{1}{Nc}}}$$

Where Ne and Nc are the sample sizes in the experimental (risperidone) and control (placebo) groups.

Risperidone group   Placebo group

$$SD = \frac{6.52}{\sqrt{\frac{1}{27} + \frac{1}{28}}} \qquad\qquad SD = \frac{3.66}{\sqrt{\frac{1}{27} + \frac{1}{28}}}$$

SD of risperidone group was equal to 24.17 and SD of placebo group was equal to 13.55. All raw data must be calculated in this way and analyzed NMA in the next step. This calculation was appropriate for this data analysis because some of the 7 previous studies did not show p-value. Tables 5 and 6 show the data in the symbol N/A. The p-value indicates difference in MD between intervention group and placebo or comparison group. The results of all calculations are shown in Table 6 as well.

We focused on ABC-Irritability (ABC-I) scores as a primarily effective outcome and other ABC subscale scores as secondary effective outcomes. The results of the NMA showed that no inconsistency was found in each study (X^2 = 0.55; Prob. > X^2 = 0.46). It implied that all 7 studies were not different in terms of MDs, sample sizes and SDs, and were able to evaluate by consistency model. The study indicated that risperidone group did not significantly reduce ABC-I scores when compared with aripiprazole group. In particular, the mean difference of the ABC-I score between those who use risperidone and aripiprazole was 0.41, meaning that aripiprazole was less effective in reducing ABC-I score relative to risperidone. However, this MD was found to be statistically insignificant because there was zero within the 95% confidence interval -5.53, 6.36. As compared with placebo, for both risperidone and aripiprazole

groups the MDs of the ABC-I score was -6.35 and -5.94 respectively, meaning that both risperidone and aripiprazole were more effective in reducing ABC-I score relative to placebo. These MDs were found to be statistically significant because there was zero outside the 95% confidence interval -11.50, -1.20 and -10.18, -1.70 respectively.

On the other hand, the study indicated risperidone group did not significantly reduce other ABC subscale scores when compared with aripiprazole group. For ABC-Lethargy and Social Withdrawal (ABC-L) scores, the mean difference of the ABC-L score between two groups was 1.89, which MD was found to be statistically insignificant when considered the mean difference together with its 95 % confidence interval (-2.22, 6.00). When each group was compared with placebo, the MD of the ABC-L score in risperidone group was -2.89 and in aripiprazole group was -1.00. Although both risperidone and aripiprazole were more effective in reducing ABC-L score relative to placebo, the differences were found to be statistically insignificant within the 95% confidence interval -6.47, 0.69 and -3.40, 1.40 respectively with mean difference of 0.

Average ABC-Stereotypic behavior (ABC-S) scores of risperidone group were lower than aripiprazole group (mean difference 0.09) which was the same as average ABC-Hyperactivity (ABC-H) (mean difference 1.08) and ABC-Inappropriate speech (ABC-IS) (mean difference 0.01). From the three ABC subscales above, risperidone compared with aripiprazole was non-statistically significant. As compared with placebo, both risperidone and aripiprazole groups had more effectiveness than placebo and were found to be statistically significant, meaning that both risperidone and aripiprazole were more effective in reducing ABC-S, ABC-H and ABC-IS scores relative to placebo. Statistical results were shown in Table 7.

Based on the ABC score, baseline ABC score of risperidone group was 18.9-26.2. Baseline ABC score of aripiprazole group was 26.2-29.6. Compared to the placebo group, Baseline ABC score was 21.2-30.8. The baseline ABC score for the placebo group was slightly higher than the baseline ABC score for both drug groups. However, the results of the NMA shown that no inconsistency found in each study

Table 5 The details of seven studies that are included by systematic review.

1. Pandina (2007)

Study (year) and population:
- Subject received risperidone
- n = 27 (M = 19, F = 8)
- Subject received placebo
- n = 28 (M = 24, F = 4)
- Age range = 5-12 years
- (Pandina, Bossie, Youssef, Zhu, & Dunbar, 2007)

Intervention: Risperidone oral solution (1.0 mg/ml); Day 1-2 = 0.01 mg/kg/day; Day 3-7 = 0.02 mg/kg/day; From day 8 onwards = 0.02 – 0.06 mg/kg/day; **Mean daily dose of risperidone = 1.37 mg (SD 0.7)**

	Risperidone BL (SD)	Risperidone EP (SD)	Placebo BL (SD)	Placebo EP (SD)	P value
I	20.6(8.1)	7.2(5.9)	21.6(10.2)	14.1(11.3)	0.002
L	14.0(6.8)	4.7(4.4)	13.6(8.6)	8.2(8.9)	0.020
S	8.4(5.8)	3.9(4.2)	9.4(5.5)	6.9(6.9)	0.053
H	29.2(9.5)	13.3(8.7)	33.6(6.8)	26.4(12.8)	0.001
IS	4.5(3.7)	1.9(2.2)	4.5(3.7)	3.1(3.5)	0.058

2. Shea (2004)

Study (year) and population:
- Subject received risperidone
- n = 40 (M = 29, F = 11)
- Subject received placebo
- n = 39 (M = 32, F = 7)
- Age range = 5-12 years
- (Shea et al., 2004)

Intervention: Risperidone oral solution (1.0 mg/ml); Day 1-2 = 0.01 mg/kg/day; Day 3-7 = 0.02 mg/kg/day; From day 8 onwards = 0.02 – 0.06 mg/kg/day; **Mean daily dose of risperidone = 1.48 mg**

	Risperidone BL (SD)	Risperidone EP (SD)	Placebo BL (SD)	Placebo EP (SD)	P value
I	18.9(8.8)	6.8(5.8)	21.2(9.7)	14.7(8.4)	≤0.001
L	13.7(7.0)	5.1(5.9)	14.3(8.2)	8.6(6.9)	≤0.001
S	7.9(5.0)	3.6(3.8)	8.1(5.6)	5.7(4.0)	≤0.05
H	27.3(9.7)	12.4(6.7)	30.9(8.8)	23.5(9.7)	≤0.01
IS	4.6(3.4)	2.0(2.6)	4.8(3.7)	3.2(3.0)	≤0.05

3. RUPPAN (2002)

Study (year) and population:
- Subject received risperidone
- n = 49 (M = 39, F = 10)
- Subject received placebo
- n = 52 (M = 43, F = 9)
- Age range = 5-12 years
- (McCracken et al., 2002)

Intervention: Risperidone oral; Day 1-3 = 0.5 mg/day; Day 4-28 = 1 mg/day; From day 29 onwards = 2.5 mg/day for patients with 20 – 45 kg; 3.5 mg/day for patients with > 45 kg; 0.25 mg/day for patients with < 20 kg; **Mean daily dose of risperidone = 1.8 mg (SD 0.7)**

	Risperidone BL (SD)	Risperidone EP (SD)	Placebo BL (SD)	Placebo EP (SD)	P value
I	26.2(7.9)	11.3(7.4)	25.5(6.6)	21.9(9.5)	<0.001
L	16.4(8.2)	8.9(6.4)	16.1(8.7)	12.0(8.3)	0.03
S	10.6(4.9)	5.8(4.6)	9.0(4.4)	7.3(4.8)	<0.001
H	31.8(9.6)	17.0(9.7)	32.3(8.5)	27.6(10.6)	<0.001
IS	4.8(4.1)	3.0(3.1)	6.5(3.6)	5.9(3.8)	0.03

BL = Average ABC score at baseline, EP = Average ABC score at endpoint (8 weeks), SD = Standard deviation

ABC was derived yielding five subscales: Irritability (I), Lethargy/Social Withdrawal (L), Stereotypic Behavior (S), Hyperactivity/Non-compliance (H) and Inappropriate Speech (IS).

Table 5 The details of seven studies that are included by systematic review. (Continuous)

4. Ghanizadeh (2014)

Study (year) and population:
- Subject received risperidone
- n = 29 (M = 22, F = 7)
- Subject received aripiprazole
- n = 27 (M = 23, F = 4)
- Age range = 4-18 years
- (Ghanizadeh, Sahraeizadeh, & Berk, 2014)

Intervention:
Risperidone, Initial dosage at 0.25 mg/day,
Target dosage of 2 mg/day for patients with 10 – 40 kg.
Target dosage of 3 mg/day for patients with ≥ 40 kg.
Mean daily dose of risperidone = 1.12 mg (0.9)
Aripiprazole , Initial dosage at 1.25 mg/day,
Target dosage of 10 mg/day for patients with < 40 kg.
Target dosage of 15 mg/day for patients with > 40 kg.
Mean daily dose of aripiprazole = 5.5 mg (SD 2.2)

Outcomes:

	Risperidone		Aripiprazole		P value
	BL (SD)	EP (SD)	BL (SD)	EP (SD)	
I	21.5(7.4)	12.5(5.4)	26.2(4.1)	14.6(5.5)	0.5
L	25.3(8.9)	16.1(6.9)	27.5(8.4)	17.3(7.4)	0.5
S	13.2(4.2)	7.4(3.9)	13.6(5.7)	8.2(5.0)	0.6
H	36.0(6.2)	19.1(6.1)	37.1(7.0)	21.1(9.0)	0.06
IS	8.9(3.6)	5.7(3.1)	8.6(3.1)	4.9(2.3)	0.3

5. Ichikawa (2017)

Study (year) and population:
- Subject received aripiprazole
- n = 47 (M = 39, F = 8)
- Subject received placebo
- n = 45 (M = 36, F = 9)
- Age range = 6-17 years
- (Ichikawa et al., 2017)

Intervention:
Aripiprazole oral
Week 1 = 1 mg/day, Week 2 = 3 mg/day
Week 3 = 6 mg/day, Week 4 = 9 mg/day
Week 5 = 12 mg/day
From week 6 onwards = 15 mg/day
Mean daily dose of aripiprazole = 5.7 mg (SD 2.7)

Outcomes:

	Aripiprazole		Placebo		P value
	BL (SD)	EP (SD)	BL (SD)	EP (SD)	
I	26.9(1.0)	15.5(1.3)	26.1(1.0)	18.6(1.4)	0.044
L	15.0(1.4)	9.8(1.0)	14.8(1.4)	10.1(1.1)	0.768
S	8.2(1.0)	4.9(0.6)	7.7(1.0)	5.1(0.6)	0.450
H	29.6(1.5)	16.6(1.4)	26.8(1.6)	21.3(1.5)	<0.001
IS	7.6(0.5)	5.4(0.4)	7.3(0.6)	5.8(0.4)	0.197

6. Owen (2009)

Study (year) and population:
- Subject received aripiprazole
- n = 47 (M = 42, F = 5)
- Subject received placebo
- n = 51 (M = 44, F = 7)
- Age range = 6-17 years
- (Owen et al., 2009)

Intervention:
Aripiprazole oral, Initial dosage at 2 mg/day,
Target dosage of 5, 10, or 15 mg/day (maximum dosage: 15 mg/day; dosage level: 2, 5, 10, or 15 mg/day).
The distribution of aripiprazole dosing during the last week of treatment (n = 39) was as follows: 2 mg/day, n = 2 (5%); 5 mg/day, n = 13 (33%); 10 mg/day, n = 16 (41%); and 15 mg/day, n =8 (21%).
Mean daily dose of aripiprazole = 8.95 mg

Outcomes:

	Aripiprazole		Placebo		P value
	BL	EP	BL	EP	
I	29.6	16.7	30.8	25.8	<0.001
L	19.9	12.0	18.1	11.9	N/A
S	11.9	7.1	10.7	8.7	<0.001
H	34.1	21.4	34.7	31.9	<0.001
IS	7.0	4.5	7.0	6.6	<0.001

BL = Average ABC score at baseline, EP = Average ABC score at endpoint (8 weeks), SD = Standard deviation

ABC was derived yielding five subscales: Irritability (I), Lethargy/Social Withdrawal (L), Stereotypic Behavior (S), Hyperactivity/Non-compliance (H) and Inappropriate Speech (IS).

Table 5 The details of seven studies that are included by systematic review. (Continuous)

7. Marcus (2009)

7.1. Aripiprazole 5 mg/day versus placebo

Intervention:
Aripiprazole oral
The subjects meeting criteria for inclusion at baseline were then randomized to receive aripiprazole (5, 10, or 15 mg/day) or placebo in a 1:1:1 ratio.
Week 1 = 2 mg/day
From week 2 onwards = 5 mg/day
Mean daily dose of aripiprazole = 5 mg

Population:
Subject received aripiprazole
n = 52 (M = 44, F = 8)
Subject received placebo
n = 49 (M = 48, F = 1)
(Marcus et al., 2009)

	Aripiprazole		Placebo		P
	BL (SE)	EP (SE)	BL (SE)	EP (SE)	value
I	28.6(7.6)	16.2	28.0(6.9)	19.6	0.032
L	17.7(1.4)	11.9(1.2)	18.0(1.5)	12.8(1.2)	N/A
S	11.4(0.8)	6.9(0.68)	10.7(0.8)	9.1(0.69)	≤0.005
H	33.1(1.4)	19.1(1.6)	31.0(1.4)	23.3(1.7)	≤0.005
IS	5.8(0.6)	3.8(0.5)	5.9(0.6)	4.8(0.5)	N/A

7.2. Aripiprazole 10 mg/day versus placebo

Intervention:
Aripiprazole oral
Week 1 = 2 mg/day
Week 2 = 5 mg/day
From week 3 onwards = 10 mg/day
Mean daily dose of aripiprazole = 10 mg

Population:
Subject received aripiprazole
n = 59 (M = 50, F = 9)
Subject received placebo
n = 49 (M = 48, F = 1)
(Marcus et al., 2009)

	Aripiprazole		Placebo		P
	BL (SE)	EP (SE)	BL (SE)	EP (SE)	value
I	28.2(7.4)	15.0	28.0(6.9)	19.6	0.008
L	16.8(1.3)	11.9(1.1)	18.0(1.5)	12.8(1.2)	N/A
S	11.6(0.8)	7.4(0.63)	10.7(0.8)	9.1(0.69)	≤0.05
H	33.7(1.3)	20.4(1.5)	31.0(1.4)	23.3(1.7)	≤0.05
IS	6.8(0.5)	5.0(0.4)	5.9(0.6)	4.8(0.5)	N/A

7.3. Aripiprazole 15 mg/day versus placebo

Intervention:
Aripiprazole oral
Week 1 = 2 mg/day
Week 2 = 5 mg/day
Week 3 = 10 mg/day
From week 4 onwards = 15 mg/day
Mean daily dose of aripiprazole = 15 mg

Population:
Subject received aripiprazole
n = 53 (M = 50, F = 3)
Subject received placebo
n = 49 (M = 48, F = 1)
Age range = 6 – 17 years
(Marcus et al., 2009)

	Aripiprazole		Placebo		P
	BL (SE)	EP (SE)	BL (SE)	EP (SE)	value
I	28.9(6.4)	14.5	28.0(6.9)	19.6	0.001
L	18.9(1.4)	11.0(1.1)	18.0(1.5)	12.8(1.2)	N/A
S	11.6(0.8)	7.1(0.66)	10.7(0.8)	9.1(0.69)	≤0.05
H	32.2(1.4)	15.9(1.6)	31.0(1.4)	23.3(1.7)	≤0.001
IS	6.3(0.5)	4.0(0.4)	5.9(0.6)	4.8(0.5)	≤0.05

BL = Average ABC score at baseline, EP = Average ABC score at endpoint (8 weeks), SE = Standard error

ABC was derived yielding five subscales: Irritability (I), Lethargy/Social Withdrawal (L), Stereotypic Behavior (S), Hyperactivity/Non-compliance (H) and Inappropriate Speech (IS).

Table 6 Preparing for data analysis of Network meta-analysis by used STATA programe

Study	Interventions	n	ABC-I MD	SD	P value	ABC-L MD	SD	P value	ABC-S MD	SD	P value	ABC-H MD	SD	P value	ABC-IS MD	SD	P value
1	Placebo	28	-7.5	13.55		-5.4	9.76		-2.5	4.52		-7.2	13.01		-1.4	2.53	
	Risperidone	27	-13.4	24.17	0.002	-9.3	16.77	0.020	-4.5	8.12	0.053	-15.9	28.68	0.001	-2.6	4.69	0.058
2	Placebo	39	-6.5	14.27		-5.7	12.51		-2.4	5.27		-7.4	16.24		-1.6	3.51	
	Risperidone	40	-12.1	26.58	≤0.001	-8.6	18.89	≤0.001	-4.3	9.45	≤0.05	-14.9	32.73	≤0.01	-2.6	5.71	≤0.05
3	Placebo	52	-3.6	9.01		-4.1	10.26		-1.7	4.25		-4.7	11.76		-0.6	1.50	
	Risperidone	49	-14.9	37.22	<0.001	-7.5	18.74	0.03	-4.8	11.99	<0.001	-14.8	36.97	<0.001	-1.8	4.50	0.03
4	Risperidone	29	-9	16.43		-9.2	16.79		-5.8	10.59		-16.9	30.85		-3.2	5.84	
	Aripiprazole	27	-11.6	21.10	0.5	-10.2	18.56	0.5	-5.4	9.82	0.6	-16	29.11	0.06	-3.7	6.73	0.3
5	Placebo	45	-7.5	17.84		-4.7	11.18		-2.6	6.19		-5.5	13.08		-1.5	3.57	
	Aripiprazole	47	-11.4	27.15	0.044	-5.2	12.39	0.768	-3.3	7.86	0.450	-13	30.97	<0.001	-2.2	5.24	0.197
6	Placebo	51	-5	12.31		-6.2	15.27		-2	4.92		-2.8	6.89		-0.4	0.98	
	Aripiprazole	47	-12.9	31.69	<0.001	-7.9	19.41	N/A	-4.8	11.79	<0.001	-12.7	31.20	<0.001	-2.5	6.14	<0.001
7 (1)	Placebo	49	-8.4	20.98		-5.2	12.99		-1.6	4.00		-7.7	19.24		-1.1	2.75	
	Aripiprazole	52	-12.4	31.02	0.032	-5.8	14.51	N/A	-4.5	11.26	≤0.005	-14	35.03	≤0.005	-2	5.00	N/A
7 (2)	Placebo	49	-8.4	21.62		-5.2	13.38		-1.6	4.12		-7.7	19.81		-1.1	2.83	
	Aripiprazole	59	-13.2	34.12	0.008	-4.9	12.67	N/A	-4.2	10.86	≤0.05	-13.3	34.38	≤0.05	-1.8	4.65	N/A
7 (3)	Placebo	49	-8.4	21.08		-5.2	13.05		-1.6	4.02		-7.7	19.32		-1.1	2.76	
	Aripiprazole	53	-14.4	36.21	0.001	-7.9	19.87	N/A	-4.5	11.32	≤0.05	-16.3	40.99	≤0.001	-2.3	5.78	≤0.05

Table 7 The result of each ABC sub-scale scores' mean differences was analyzed by network meta-analysis (consistency model).

	Mean differences (95% confidence interval)		
Subscale	Aripiprazole versus Risperidone	Risperidone versus Placebo	Aripiprazole versus Placebo
Irritability	0.41 (-5.53,6.36)	-6.35 (-11.50,-1.20)	-5.94 (-10.18,-1.70)
Lethargy	1.89 (-2.22,6.00)	-2.89 (-6.47,0.69)	-1.00 (-3.40,1.40)
Stereotypic behavior	0.09 (-2.14,2.32)	-2.36 (-4.24,-0.48)	-2.26 (-3.64,-0.88)
Hyperactivity	1.08 (-6.04,8.21)	-8.78 (-14.85,-2.71)	-7.70 (-12.15,-3.25)
Inappropriate speech	0.01 (-1.13,1.16)	-1.11 (-2.05,-0.17)	-1.10 (-1.82,-0.38)

The results from the meta-analysis were only effective results, which must reduce the effective of the results by ten and five percent to obtain the results of the analysis as effectiveness. The percent reduction was a recommendation of experts. The scenarios were created to obtain effectiveness (Table 8).

Table 8 The Mean differences, which is calculated as a result of effectiveness.

Subscale	Mean differences 10% reduced of efficacy		Mean differences 5% reduced of efficacy	
	Risperidone group	Aripiprazole group	Risperidone group	Aripiprazole group
Irritability	-5.72	-5.35	-6.03	-5.64
Lethargy	-2.60	-0.90	-2.75	-0.95
Stereotypic behavior	-2.12	-2.03	-2.24	-2.15
Hyperactivity	-7.90	-6.93	-8.34	-7.32
Inappropriate speech	-1.00	-0.99	-1.05	-1.05

4.2. Costing

The information obtained from the patient's caregiver interview was derived from previous studies (Naruemol Junsamut, 2014). For comparison of the costs of risperidone and aripiprazole, the patients whose caregivers were selected for the study and provided information on the cost of patients were divided into two groups, 22 patients receiving risperidone and one patient receiving aripiprazole.

Table 9 Baseline characteristics

Characteristic	Risperidone group = n (%)	Aripiprazole group = n (%)
Sample	22	1
Average age, years (SD)	10.06 (2.43)	15.50 (0.00)
Sex		
Male (%)	20 (90.91)	1 (100.00)
Female (%)	2 (9.09)	-
Medications		
Methylphenidate (%)	9 (40.91)	-
Valproic acid (%)	8 (36.36)	-
Sodium valproate (%)	3 (13.64)	-
Fluoxetine (%)	2 (9.09)	1 (100.00)
Carbamazepine (%)	-	1 (100.00)
Sertaline (%)	1 (4.55)	-
Average number of caregiver	2.19 (0.51)	2 (0.00)

To calculate the cost for cost-effectiveness analysis, use the cost data, which consists of four costs: direct medical cost (inside hospital: from hospital data), direct medical cost (outside hospital: from caregiver interview), direct non-medical cost (from caregiver interview) and indirect cost (from caregiver interview). The source and method of calculating the four costs were shown in Chapter III. We have accessed inside-hospital and outside-hospital drug cost information, as well as other cost data, which had implications for cost calculations, in particular drug price data. In this study, cost was calculated in two forms: all costs that were included the cost of the all drugs that patient used, and all costs that were calculated using the above two drug prices only. This study used cost data and cost allocation from Yuwaprasart Waithayopathum Child Psychiatric hospitals, where drug price data were taken from the hospital cost and replaced by the prices of risperidone and aripiprazole to calculate the cost. Table 10 indicated the OPD unit cost both before and after the cost of medicines have been removed. Both columns of costs in Table 10 represent the difference in outpatient services unit costs per visit. Costs that were identified as unit cost including drug costs

are the cost of outpatient services, which includes all drug costs incurred in the hospital for one year, and then all cost data was passed through the cost allocation process. Costs identified as unit cost excluding drug costs were hospital costs, which were subtracted from total cost of drug costs prior to cost allocation. Details of the cost allocation were presented in Chapter II.

Table 10 OPD unit cost per visit with and without cost of medications

OPD unit cost	Unit cost with medications (Baht)	Unit cost without medications (Baht)
Psychiatric OPD, children and adolescent	1,452.87	747.78
Psychiatric OPD, general	623.96	276.66
Psychiatric OPD, elderly	593.60	311.40
Part time clinic	1,552.04	522.73
Continuing drug services	1,371.59	221.41
Dentistry	930.83	880.40
Social therapy	90,928.47	87,461.98
Psychological diagnosis	820.31	797.86
Individual psychotherapy	3,935.38	3,748.82
Family therapy clinic	2,004.45	1,977.55
Activity therapy	750.84	727.32
Speech and language therapy	673.22	652.63
Occupational therapy	4,301.43	4,146.32
Special education	1,179.70	1,140.49
Physical rehabilitation	636.82	627.17
Promote development	471.02	455.97

The cost of provider perspective were the direct medical cost (inside hospital), which were deleted the non-essential drugs cost. Unit costs in this study used the data from unit of patient services costs of the hospital which was calculated from cost allocation process (the details were showed in Chapter III). The unit costs were deleted cost of medications before cost allocation process. Then, the unit costs were used to calculate direct medical cost (inside hospital) that were multiplied by number of

patient services' visits of each patients. Table 10 showed the original OPD unit cost of each patient services that included the cost of medications compared with the unit costs. These were deleted the cost of medications. This study got the data of PS units cost to calculate direct medical cost (inside hospital). However, we could not applied original data from the hospital because the original data that included hospital drug costs in 2014. Therefore, we have to delete the all drug costs of pharmacy department in RPCC. Then, the costs were reallocated in the same way. Finally, we can get the PS units costs without medication cost. The cost of the medication was added to the direct medical costs again by calculating the cost of the medication according to the amount consumed over a period of 8 weeks.
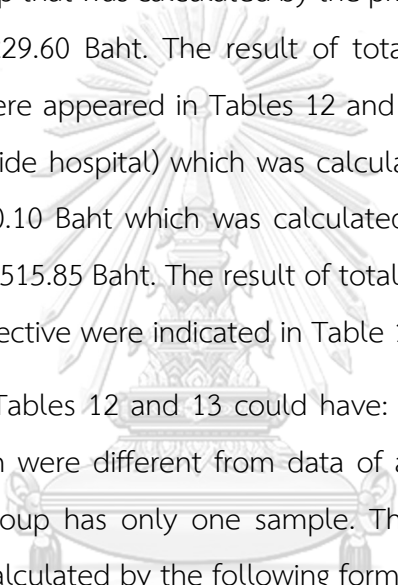
Table 11 Average number of visits in both groups over 8 weeks.

OPD unit	Risperidone group (Number of visits)	Aripiprazole group (Number of visits)
Psychiatric OPD, children and adolescent	0.59	0.46
Psychiatric OPD, general	0.00	0.00
Psychiatric OPD, elderly	0.00	0.00
Part time clinic	0.00	0.00
Continuing drug services	0.25	0.62
Dentistry	0.10	0.00
Social therapy	0.02	0.00
Psychological diagnosis	0.01	0.46
Individual psychotherapy	0.50	0.15
Family therapy clinic	0.11	0.00
Activity therapy	0.16	0.00
Speech and language therapy	0.26	0.00
Occupational therapy	0.00	0.00
Special education	0.60	0.00
Physical rehabilitation	0.17	0.00
Promote development	0.08	0.00

The average number of visits were indicated in Table 11 which were used to calculate the average of direct medical costs (inside hospital). Data of general OPD psychiatric and elderly OPD psychiatric, which in this study must be 0, because only children and adolescents were included.

Provider perspective, this study considered only direct medical cost (inside hospital) and the cost was provided by hospital. Cost of risperidone group was calculated by the prices of all drugs, with average direct medical cost 6,707.77 Baht. Cost of risperidone group that was calculated by the prices of risperidone, with average direct medical cost 6,229.60 Baht. The result of total cost of risperidone group in provider perspective were appeared in Tables 12 and 13. For aripiprazole group, the direct medical cost (inside hospital) which was calculated by the prices of all drugs, with average cost 2,580.10 Baht which was calculated by the prices of aripiprazole, with the average cost 2,515.85 Baht. The result of total and other costs of aripiprazole group in provider perspective were indicated in Table 14.

The data from Tables 12 and 13 could have: maximum cost, minimum cost and average cost which were different from data of aripiprazole group in Table 14, because aripiprazole group has only one sample. The average direct medical cost (inside hospital) were calculated by the following formula:

Average direct medical cost (inside hospital) = [[OPD unit cost without medications (each patient service) x Number of visits (from each patient in 8 weeks)] + Drug costs (from each patient in 8 weeks)] / 22 patients

The difference between Tables 12 and 13 was drug costs. Table 12, drug costs were calculated from all drugs prices that were used by 22 patents in risperidone group. In Table 13, we calculated drug costs from only risperidone costs. Each patient in this group used it for 8 weeks. The maximum and minimum costs were calculated by the highest and the lowest cost of each cost category that was represented from 22 patients.

Total cost in provider perspective was calculated by the following formula:

Total cost = Direct medical cost (inside hospital)

Table 12 Cost of risperidone group that was calculated by the prices of all drugs (provider perspective).

Category of cost	Maximum cost (Baht)	Minimum cost (Baht)	Average cost (SD) (Baht)	
Direct medical cost (Inside hospital)	19,301.48	1,686.53	6,707.77	(5,315.70)
Total cost	19,301.48	1,686.53	**6,707.77**	**(5,315.70)**

Table 13 Cost of risperidone group that was calculated by the prices of risperidone (provider perspective).

Category of cost	Maximum cost (Baht)	Minimum cost (Baht)	Average cost (SD) (Baht)	
Direct medical cost (Inside hospital)	18,855.63	1,596.53	6,229.60	(5,152.86)
Total cost	18,855.63	1,596.53	**6,229.60**	**(5,152.86)**

Table 14 Cost of aripiprazole group (provider perspective).

Category of cost	Cost with price of all drugs (Baht)	Cost with price of aripiprazole (Baht)
Direct medical cost (Inside hospital)	2,580.10	2,515.85
Total cost	**2,580.10**	**2,515.85**

Caregiver perspective, the way to calculate cost by caregiver perspective was different between risperidone and aripiprazole groups. For risperidone group, the total

cost was calculated by direct medical cost (outside hospital), direct non-medical cost and indirect cost. For aripiprazole group, the total cost was calculated from 4 components: direct medical cost (inside hospital), direct medical cost (outside hospital), direct non-medical cost and indirect cost. In this group we had to include the cost inside hospital as the one cost component in caregiver perspective because the caregivers have to provide aripiprazole cost by themselves. The costs of caregiver perspective were calculated by the cost that were supported by only caregiver. The way to calculate cost by caregiver perspective was a different from provider perspectives which was the cost of risperidone group. Provider perspectives had to calculate the total cost of risperidone group by separating into two groups: costs were calculated by all drug prices and by only risperidone price. For caregiver perspective no need to calculate total cost in the same way as provider perspectives, because the caregiver in risperidone group did not bear even one Baht of direct medical cost inside hospital. The average total cost of risperidone group was 47,385.59 Baht and the average total cost of aripiprazole group was 99,417.25 Baht. However, this cost was not calculated from the cost of patients in the aripiprazole group, because only one patient in the group could not be represented in the cost data. Therefore, some cost data for patients in the aripiprazole group was replaced by household expenditure data and medical cost data from Thailand statistical data in 2014. Other details are show in Tables 15 and 16.

Total cost in caregiver perspective was calculated by the following formula:

Total cost (risperidone group) = Direct medical cost (outside hospital) + Direct non-medical cost + Indirect cost

Total cost (aripiprazole group) = Direct medical cost (inside hospital) + Direct medical cost (outside hospital) + Direct non-medical cost + Indirect cost

Table 15 Cost of risperidone group by caregiver perspective.

Category of cost	Maximum cost (Baht)	Minimum cost (Baht)	Average cost (SD) (Baht)	
Direct medical cost (Outside hospital)	3,115.38	0.00	512.61	(723.46)
Direct non-medical cost	80,124.62	15,012.77	37,347.73	(17,539.18)
Indirect cost	36,323.08	96.00	9,525.25	(10,101.29)
Total cost	85,752.31	15,398.62	**47,385.59**	**(19,461.25)**

Table 16 Cost of aripiprazole group by caregiver perspective.

Category of cost	Cost with price of all drugs (Baht)	Cost with price of aripiprazole (Baht)
Direct medical cost (Inside hospital)	4,553.86	4,553.86
Direct medical cost (Outside hospital)	153.85	153.85
Direct non-medical cost	90,272.62	90,272.62
Indirect cost	4,436.92	4,436.92
Total cost	**99,417.25**	**99,417.25**

4.3. Cost-effectiveness ratio

Cost-effectiveness ratio was considered by the cost per one reduced ABC score of risperidone and aripiprazole group. Considerations were determined by the type of ABC subscale scores. The calculation was based on costs that included all drug prices and based on costs that included only risperidone and aripiprazole prices. The CEA in this study was analyzed by only provider perspective.

The result in each columns of Tables 17, 18 and 19 were calculated by the following: column numbers i and ii are effectiveness of risperidone and aripiprazole groups that gathered up the data from the results of ABC scores by NMA. Column numbers iii and iv are the average costs of risperidone group that were divided into

two groups: the average costs that were calculated by using the prices of all drugs (iii) and by using the prices of only risperidone (iv). Column numbers vii and viii are the average costs of aripiprazole group. The average costs were calculated by the different way. The column number vii were calculated by used all drug prices and the column number viii were calculated by using only aripiprazole prices. The data were contained in columns number iii, iv, vii and viii which were gathered from Tables 12 to 16 which were differentiated by each perspective. The results of cost per 1 reduced ABC score of both groups were indicated in column numbers v, vi, ix and x, respectively.

The cost per 1 reduced ABC score of both groups were performed by the following formula:

Risperidone group

$$column\ (v)(all\ drugs) = \left|\frac{column\ (iii)}{column\ (i)}\right|$$

$$column\ (vi)(only\ risperidone) = \left|\frac{column\ (iv)}{column\ (i)}\right|$$

Aripiprazole group

$$column\ (ix)(all\ drugs) = \left|\frac{column\ (vii)}{column\ (ii)}\right|$$

$$column\ (x)(only\ risperidone) = \left|\frac{column\ (viii)}{column\ (ii)}\right|$$

Provider perspective, the cost per one reduced ABC-I score of risperidone was 1,056.34 Baht, when the cost was calculated with all drug prices and it was 981.04 Baht when calculated the cost with only risperidone prices. The cost per one reduced ABC-I score of aripiprazole was 434.36 Baht, when the cost was calculated with all drug prices and it was 423.54 Baht when calculated the cost with only aripiprazole prices. The cost per one reduced other ABC subscale score are showed in Table 17.

The results from the meta-analysis were only efficacy results, therefore, the simulations were created to test the difference in effectiveness by reducing the efficacy of the five and ten percent, respectively. The scenario (reduced 10% of efficacy) were created to obtain effectiveness the cost per one reduced ABC-I score of risperidone with all drug prices was 1,172.69 Baht and with only risperidone prices was 1,089.09 Baht. The cost per one reduced ABC-I score of aripiprazole was 482.26 Baht when the cost was calculated with all drug prices and it was 470.25 Baht when calculated the cost with only aripiprazole prices. The cost per one reduced other ABC subscale score are showed in Table 18. Table 19 were indicated the scenario that was reduced 5% of efficacy.

Table 17 Cost per 1 unit of reduced ABC subscale scores by provider perspective.

ABC	(i) Efficacy of risperidone group	(ii) Efficacy of aripiprazole group	Average cost of risperidone group (Baht)		Cost per 1 reduced ABC score of risperidone group (Baht)		Average cost of aripiprazole group (Baht)		Cost per 1 reduced ABC score of aripiprazole group (Baht)	
			(iii) All drugs	(iv) Only risperidone	(v) All drugs	(vi) Only risperidone	(vii) All drugs	(viii) Only aripiprazole	(ix) All drugs	(x) Only aripiprazole
I	-6.35	-5.94	6,707.77	6,229.60	1,056.34	981.04	2,580.10	2,515.85	434.36	423.54
L	-2.89	-1	6,707.77	6,229.60	2,321.03	2,155.57	2,580.10	2,515.85	2,580.10	2,515.85
S	-2.36	-2.26	6,707.77	6,229.60	2,842.28	2,639.66	2,580.10	2,515.85	1,141.64	1,113.21
H	-8.78	-7.7	6,707.77	6,229.60	763.98	709.52	2,580.10	2,515.85	335.08	326.73
IS	-1.11	-1.1	6,707.77	6,229.60	6,043.04	5,612.25	2,580.10	2,515.85	2,345.55	2,287.14

Table 18 CEA in which the effectiveness was calculated by 10% reduction of efficacy

ABC	(i) Effectiveness of risperidone group	(ii) Effectiveness of aripiprazole group	Average cost of risperidone group (Baht)		Cost per 1 reduced ABC score of risperidone group (Baht)		Average cost of aripiprazole group (Baht)		Cost per 1 reduced ABC score of aripiprazole group (Baht)	
			(iii) All drugs	(iv) Only risperidone	(v) All drugs	(vi) Only risperidone	(vii) All drugs	(viii) Only aripiprazole	(ix) All drugs	(x) Only aripiprazole
I	-5.72	-5.35	6,707.77	6,229.60	1,172.69	1,089.09	2,580.10	2,515.85	482.26	470.25
L	-2.60	-0.90	6,707.77	6,229.60	2,579.91	2,396.00	2,580.10	2,515.85	2,866.78	2,795.39
S	-2.12	-2.03	6,707.77	6,229.60	3,164.04	2,938.49	2,580.10	2,515.85	1,270.99	1,239.33
H	-7.90	-6.93	6,707.77	6,229.60	849.08	788.56	2,580.10	2,515.85	372.31	363.04
IS	-1.00	-0.99	6,707.77	6,229.60	6,707.77	6,229.60	2,580.10	2,515.85	2,606.16	2,541.26

Table 19 CEA in which the effectiveness was calculated by 5% reduction of efficacy

ABC	(i) Effectiveness of risperidone group	(ii) Effectiveness of aripiprazole group	Average cost of risperidone group (Baht)		Cost per 1 reduced ABC score of risperidone group (Baht)		Average cost of aripiprazole group (Baht)		Cost per 1 reduced ABC score of aripiprazole group (Baht)	
			(iii) All drugs	(iv) Only risperidone	(v) All drugs	(vi) Only risperidone	(vii) All drugs	(viii) Only aripiprazole	(ix) All drugs	(x) Only aripiprazole
I	-6.03	-5.64	6,707.77	6,229.60	1,112.40	1,033.10	2,580.10	2,515.85	457.46	446.07
L	-2.75	-0.95	6,707.77	6,229.60	2,439.19	2,265.31	2,580.10	2,515.85	2,715.89	2,648.26
S	-2.24	-2.15	6,707.77	6,229.60	2,994.54	2,781.07	2,580.10	2,515.85	1,200.05	1,170.16
H	-8.34	-7.32	6,707.77	6,229.60	804.29	746.95	2,580.10	2,515.85	352.47	343.70
IS	-1.05	-1.05	6,707.77	6,229.60	6,388.35	5,932.95	2,580.10	2,515.85	2,457.24	2,396.05

4.4. Sensitivity analysis

Sensitivity analysis in this study was divided into 4 types: increased cost of both drugs to maximum prices, decreased cost of both drugs to minimum prices, changed cost of both drugs to central drugs' prices of Thailand and changed average cost of aripiprazole group to actual cost of patient in this group. However, when starting the study and collecting data for analysis, it was found that only one sample was found in the aripiprazole group. Therefore, the sensitivity analysis could not be performed by changing the cost of the drug group to the highest cost and lowest cost in aripiprazole group. In category 1 and 2 sensitivity analysis, only risperidone group analyzes were performed.

4.4.1. Category 1: Increased cost of risperidone group to maximum cost

Cost per 1 unit of reduced ABC subscale scores of risperidone group was calculated by increased cost of both drugs to maximum cost. (Table 20)

The category 1 of cost per 1 reduced ABC score of risperidone groups were performed by the following formula:

$$column\ (iv)(all\ drugs) = \left|\frac{column\ (ii)}{column\ (i)}\right|$$

$$column\ (v)(only\ risperidone) = \left|\frac{column\ (iii)}{column\ (i)}\right|$$

Table 20 Category 1: Increased cost of risperidone group to maximum cost.

ABC	(i) effectiveness of risperidone group	Maximum cost of risperidone group (Baht)		Cost per 1 reduced ABC score of risperidone group (Baht)	
		(ii) All drugs	(iii) Only risperidone	(iv) All drugs	(v) Only risperidone
I	-5.72	19,301.48	18,855.63	3,374.38	3,296.44
L	-2.60	19,301.48	18,855.63	7,423.65	7,252.17
S	-2.12	19,301.48	18,855.63	9,104.47	8,894.17
H	-7.90	19,301.48	18,855.63	2,443.23	2,386.79
IS	-1.00	19,301.48	18,855.63	19,301.48	18,855.63

4.4.2. Category 2: Decreased cost of risperidone group to minimum prices

Cost per 1 unit of reduced ABC subscale scores of risperidone group was calculated by decreased cost of both drugs to minimum cost (Table 21).

The category 2 of cost per 1 reduced ABC score of risperidone groups was calculated by the following formula:

$$column\ (iv)(all\ drugs) = \left|\frac{column\ (ii)}{column\ (i)}\right|$$

$$column\ (v)(only\ risperidone) = \left|\frac{column\ (iii)}{column\ (i)}\right|$$

Table 21 Category 2: Decreased cost of risperidone group to minimum cost.

ABC	(i) Effectiveness of risperidone group	Minimum cost of risperidone group (Baht)		Cost per 1 reduced ABC score of risperidone group (Baht)	
		(ii) All drugs	(iii) Only risperidone	(iv) All drugs	(v) Only risperidone
I	-5.72	1,686.53	1,596.53	294.85	279.11
L	-2.60	1,686.53	1,596.53	648.67	614.05
S	-2.12	1,686.53	1,596.53	795.53	753.08
H	-7.90	1,686.53	1,596.53	213.48	202.09
IS	-1.00	1,686.53	1,596.53	1,686.53	1,596.53

4.4.3. Category 3: Changed cost of both drugs to central drugs' prices of Thailand

Cost per 1 unit of reduced ABC subscale scores was calculated by changing cost of both drugs to central drugs' prices of Thailand. (Table 22)

The category 3 of cost per 1 reduced ABC score of risperidone groups were performed by the following formula:

Risperidone group

$$column\ (iv) = \left|\frac{column\ (iii)}{column\ (i)}\right|$$

Aripiprazole group

$$column\ (vi) = \left|\frac{column\ (v)}{column\ (ii)}\right|$$

Table 22 Category 3: Changed cost of both drugs to central drugs' prices of Thailand

ABC	(i) Effectiveness of risperidone group	(ii) Effectiveness of aripiprazole group	(iii) Average cost of risperidone group (Baht)	(iv) Cost per 1 reduced ABC score of risperidone group (Baht)	(v) Average cost of aripiprazole group (Baht)	(vi) Cost per 1 reduced ABC score of aripiprazole group (Baht)
I	-5.72	-5.35	5,768.52	1,008.48	2,515.85	470.25
L	-2.60	-0.90	5,768.52	2,218.66	2,515.85	2,795.39
S	-2.12	-2.03	5,768.52	2,721.00	2,515.85	1,239.33
H	-7.90	-6.93	5,768.52	730.19	2,515.85	363.04
IS	-1.00	-0.99	5,768.52	5,768.52	2,515.85	2,541.26

4.4.4. Category 4: Changed average cost of aripiprazole group to actual cost of patient in this group.

The result of cost in aripiprazole group was not calculated from the cost of patients in the aripiprazole group, because aripiprazole group had only one patient that could not be represented in the cost data. Therefore, some cost data for patients in the aripiprazole group was replaced by average household expenditure data and medical cost data from Thailand statistical data in 2014 (The data was showed in column number (iii)). The results of category 4 are the sensitivity analysis of the calculated results using the average cost and the calculated results using the actual costs (column number (v)) from patient in aripiprazole group.

Table 23 Category 4: Changed average cost of aripiprazole group to actual cost of patient in this group.

ABC	(ii) Effectiveness of aripiprazole group	(iii) Average cost of aripiprazole group (Baht)	(iv) Average cost per 1 reduced ABC score of aripiprazole group (Baht)	(v) Actual cost of aripiprazole group (Baht)	(vi) Actual cost per 1 reduced ABC score of aripiprazole group (Baht)
I	-5.35	99,417.25	18,582.66	157,421.55	29,424.59
L	-0.90	99,417.25	110,463.61	157,421.55	174,912.83
S	-2.03	99,417.25	48,974.01	157,421.55	77,547.56
H	-6.93	99,417.25	14,345.92	157,421.55	22,715.95
IS	-0.99	99,417.25	100,421.46	157,421.55	159,011.67

The last part of results showed comparison of Cost per 1 reduced ABC score of both risperidone and aripiprazole group that was calculated by average cost of each group. The average cost of risperidone group was calculated with only risperidone prices in provider perspective. Then the cost was compared with cost per 1 reduced ABC score of category 1, 2 and 3 sensitivity analysis. The average cost of aripiprazole group was calculated with only aripiprazole prices in provider perspective as well. Then the cost was compared with cost per 1 reduced ABC score of category 3 sensitivity analysis. (Table 24)

Table 24 Comparison of cost per 1 reduced ABC score of both risperidone and aripiprazole group

ABC	Risperidone group				Aripiprazole group	
	Provider perspective	Maximum prices	Minimum prices	Central price	Provider perspective	Central price
I	1,089.09	3,296.44	279.11	1,008.48	470.25	470.25
L	2,396.00	7,252.17	614.05	2,218.66	2,795.39	2,795.39
S	2,938.49	8,894.17	753.08	2,721.00	1,239.33	1,239.33
H	788.56	2,386.79	202.09	730.19	363.04	363.04
IS	6,229.60	18,855.63	1,596.53	5,768.52	2,541.26	2,541.26

4.5. Sub-analysis

        Table 25 presented sub-analysis of risperidone and aripiprazole. In the first three column contained (1) drug names, (2) Packing size and (3) Prices (Bath). All of these data are the data of drugs from Yuwaprasart Waithayopathum Child Psychiatric Hospital. For column number (4), we used the data from each selected studies to calculate weight mean dose in 8 weeks of both risperidone and aripiprazole. We used those data to calculate drug prices in 8 weeks shown in column number (5) by used rule of three. The efficacy results from NMA were placed in column number (6). These data shown decreasing ABC-I score of those two drugs when compared to placebo. The last column presented absolute unit cost that calculating via column number (5) divided column number (6). The result of unit cost analysis were presented the lowest cost of risperidone per 1 reduced ABC-I score was 32.43 Baht and the highest cost of risperidone per 1 reduced ABC-I score was 442.57 Baht. In another part, the lowest cost of aripiprazole per 1 reduced ABC-I score was 537.62 Baht and the highest cost of aripiprazole per 1 reduced ABC-I score was 1,314.87 Baht.

Table 25 Sub-analysis of risperidone and aripiprazole compared with drug prices

(1) Drug Names	(2) Packing size	(3) Prices (Bath)	(4) Drug amount in 8 weeks (mg.)	(5) Prices in 8 weeks (Bath)	(6) Coef.	(7) Unit cost (Bath /reduced of ABC-I)
NEURIS (Kenyaku) (risperidone 1 mg.) film-coated tablet, 1 tablet	500 tab.	1,150.00	83.76	192.64	-5.94	32.43
RISPEL (Medicpharma) (risperidone 1 mg./1 ml.) oral solution, 30 ml. bottle	30 ml.	150.00	83.76	418.78	-5.94	70.50
RISPERDAL (JANSSEN PHARMACEUTICA, BELGIUM) (risperidone 1 mg./1 ml.) oral drops, solution, 30 ml. bottle (invalid)	30 ml.	941.60	83.76	2,628.84	-5.94	442.57
RISPERDAL (JANSSEN PHARMACEUTICA, BELGIUM) (risperidone 1 mg./1 ml.) oral solution, 100 ml. bottle	100 ml.	941.60	83.76	788.65	-5.94	132.77
RISPERDAL (JANSSEN PHARMACEUTICA, BELGIUM) (risperidone 1 mg./1 ml.) oral solution, 30 ml. bottle	30 ml.	941.60	83.76	2,628.84	-5.94	442.57
RISPERIDONE GPO (risperidone 1 mg.) film-coated tablet, 1 tablet	30 tab.	144.00	83.76	402.03	-5.94	67.68
RISPERIDONE GPO (risperidone 2 mg.) film-coated tablet, 1 tablet	30 tab.	228.00	83.76	318.28	-5.94	53.58
ABILIFY (BRISTOL-MYERS SQUIBB MANUFACTURING, U.S.A.) (aripiprazole 100 mg./100 mL) solution for injection, 150 ml. vial	150 ml.	2,568.00	487.70	8,349.44	-6.35	1,314.87
ABILIFY (BRISTOL-MYERS SQUIBB PHARMA, U.S.A.) (aripiprazole 1 mg./1 ml.) oral solution, 150 ml. bottle	150 ml.	2,568.00	487.70	8,349.44	-6.35	1,314.87
ABILIFY (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 1 mg./1 ml.) oral solution, 150 ml. bottle	150 ml.	2,568.00	487.70	8,349.44	-6.35	1,314.87
ABILIFY DISCMELT (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 10 mg.) orodispersible tablet, 1 tablet	30 tab.	4,700.50	487.70	7,641.46	-6.35	1,203.38
ABILIFY DISCMELT (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 15 mg.) orodispersible tablet, 1 tablet	30 tab	4,800.00	487.70	5,202.14	-6.35	819.24
APALIFE 10 (Unison) (aripiprazole 10 mg.) film-coated tablet, 1 tablet	30 tab.	2,100.00	487.70	3,413.91	-6.35	537.62
ARIPIPRAZOLE ABILIFY (KOREA OTSUKA PHARMACEUTICAL, KOREA) (aripiprazole 5 mg.) tablet, 1 tablet	30 tab.	2,407.50	487.70	7,827.60	-6.35	1,232.69

Legend: Local made risperidone | Original risperidone | Local made aripiprazole | Original aripiprazole

CHAPTER V

DISCUSSIONS

5.1. Finding of systematic review and meta-analysis

This study used ACB-I as a main outcome because antipsychotic drugs particularly risperidone and aripiprazole are preferred to control irritability and agitation (LeClerc & Easley, 2015). The use of ABC scores in evaluating outcomes is an appropriate tool because ABC is recommended for evaluating patients under 18 years of age (Kaat, Lecavalier, & Aman, 2014) and this study also included only studies that had patients not more than 18 years old. Based on the results of risperidone and aripiprazole comparisons by NMA, it was found that both drugs significantly reduced ABC-I scores when compared to placebo. However, when risperidone was compared with aripiprazole, it appeared that there was no difference in reducing the ABC-I score (95% CI -5.53, 6.36). A previous study which showed risperidone group did not significantly reduce ABC-I scores when compared with aripiprazole group (p = 0.5) (Ghanizadeh et al., 2014).

The results from the meta-analysis were only effective results, therefore, the simulations were created to test the difference in effectiveness by reducing the effectiveness of the five and ten percent, respectively.

Although the 8-week duration of each study was assessed by systematic analysis, which may indicate the effectiveness of the drug and some common side-effect, some serious side-effect may require more than 8 weeks to be detected. Hyperprolactinemia is a serious side-effect of risperidone which affects to increase risk for osteoporosis and decrease bone mineral density (Biller, 1999). The level of prolactin will return to normal level within 12 to 20 weeks (Findling et al., 2003) after stopping risperidone treatment. Therefore, the effectiveness of the drug may also include side effects to calculate total outcomes which was beyond the scope of this study.

5.2. Finding of costing and cost-effectiveness ratio

Based on the cost calculation results, addition in the cost of both drugs to calculate in conjunction with the cost of the outpatient service unit may result in costs that are not the actual costs due to the cost allocation method. It was also allocated to other parts such as inpatient services. Cost calculation with provider perspective was calculated from direct medical cost (inside hospital) that contained two components: 1) costs of patient services and 2) essential drugs prices over 8 weeks of using. The result showed that in the risperidone group, the provider bore the cost about 2.5 times more than aripiprazole group. Although in the short run, the provider bore the cost of the risperidone less than the aripiprazole, in the long term, risperidone had a clinical study that showed a higher incidence of chronic disease than aripiprazole. At present, the chronic disease is a very common disease and has a negative impact on health system expenditure. Therefore, in provider perspective, it was necessary to consider the long-term effectiveness results together with the costs to conclude the economic value clearly. In the aripiprazole group, the calculated costs were very close between the cost with prices of all drug and the cost with prices of aripiprazole only. Because aripiprazole was out of the national essential drug lists, that means the caregiver has to bear all costs from aripiprazole that affects to the cost of the drug when calculating from caregiver perspective. The direct medical costs (inside hospital) of aripiprazole group included two parts: provider and caregiver because the patients in this study used 3 medications. Two of the medications were in the national essential drug lists which were provided by the hospital. For aripiprazole cost, the caregivers must provide the cost by themselves.

From the reasons above, when calculated the cost by caregiver perspective, the cost of aripiprazole group was 2 times higher than risperidone group. The main reason is from two parts. The first reason is the prices of risperidone is so much lower than the price of aripiprazole. The second reason, risperidone is in the national essential drug lists, meaning that we have calculated the cost of risperidone under the provider responsibility.

The result of costing affects to cost per one unit of reduced ABC subscale scores. For provider perspective, it is the most important part that we have to concern. The result of this perspective showed the difference between cost per 1 reduced ABC-I score of risperidone group which was calculated by all drug prices and only risperidone prices. The difference in these risperidone costs between different drug prices was 478.17 Baht (prices of all drugs = 6,707.77 Baht, only risperidone price = 6,229.60 Baht). The results were similar in the aripiprazole group when the cost per 1 reduced ABC-I score was calculated by all drug prices. The cost was equal to 2,580.10 Baht. The cost was calculated by only aripiprazole price which was equal to 2,515.85. The difference in these aripiprazole costs between different drugs prices was 64.25 Baht. However, the cost per 1 reduced ABC-I score of aripiprazole was also lower than risperidone group about 2.5 times. The results of the cost were close to the results of CER when we consider only the cost without the effectiveness.

The highest cost of risperidone group to reduce one unit of score was ABC-IS difference from aripiprazole group in which the highest cost was ABC-L. Compared with the cost on provider perspective was found that ABC-H was the lowest cost to reduce one unit of the score in both risperidone and aripiprazole groups. The cost per 1 reduced ABC-H score was interesting. Although both drugs were mainly approved for irritability, these drugs were used to treat hyperactivity at low cost. Therefore, we should try to compare the two drugs with methylphenidate because it is a prominent drug for treatment of hyperactivity.

5.3. Finding of sensitivity analysis

Due to the aripiprazole group had only one sample, so that category 1 of sensitivity analysis were not performed. For the category 1, the costs were changed to maximum cost. The cost per 1 reduced ABC-I score of risperidone group were higher than the average cost per 1 reduced ABC-I score about 3 times. For other sub-scale scores, sensitivity analysis results in the same way as ABC-I score. For the category 2, the results were lower than the average cost per 1 reduced ABC score about 4 times

of each sub-scale scores. Category 3, the costs were near to the average cost per 1 reduced ABC score of each sub-scale in the both groups. Category 4 showed that caregivers of aripiprazole group who were selected for this study had 1.5 times higher expenditure than normal households.

5.4. Finding of sub-analysis

The analysis of this section clearly shows that risperidone local made were 6-14 times cheaper than risperidone original. On the other hand, aripiprazole, which was produced locally, was cheaper than aripiprazole original about 2.5 times. Therefore, it was evident that even today aripiprazole were produced in the country but its price was still expensive, which the caregiver bear the cost of the drug.

5.4. Limitations

In this study, the researcher used the data from the previous studies to find out the effectiveness and cost. Therefore, both of the data used in this study were limited. The effectiveness of the study was only for the efficacy of risperidone and aripiprazole over a period of 8 weeks. However, effectiveness data over an 8-week period may not be sufficient to demonstrate overall effectiveness. In order to reflect the effectiveness of the drug, the efficacy and safety of the both drugs should be analyzed together. The safety data for the both drugs are important in the analysis because autism is a disease that cannot be cured, and patients with autism need long-term use. While cost data were limited in the number of patients, the number of patients in the risperidone group was 22 and in the aripiprazole group was only one patient. In addition, genetic and national factors influenced the efficacy of the drug because of the gathered study. There was no study in Thailand, so the information in this section was another important part to use to support the results of this study.

CHAPTER VI

CONCLUSIONS

6.1. Conclusions

Risperidone group did not significantly reduce ABC-I scores when compared with aripiprazole group. The result of unit cost analysis showed the cost per one decreasing ABC-I score of risperidone by provider perspective was 981.04 Baht and aripiprazole was 423.54 Baht. As a result of each cost calculation, it was clear that in the risperidone group, the provider was responsible for the cost of treatment.

Sensitivity analysis, when the cost were changed to the maximum cost (i.e. Category 1), the cost per 1 reduced ABC score of risperidone group were higher than the average cost per 1 reduced ABC score about 2 times of each sub-scale score. Whilst the cost were changed to the minimum cost (i.e. Category 2), the cost per 1 reduced ABC score of risperidone group were lower than the average cost per 1 reduced ABC score about 3 times of each sub-scale score. For sensitivity analysis of both drugs compared with central drug prices (i.e. Category 3), the costs were near to the average cost per 1 reduced ABC score of each sub-scale in the both groups.

In conclusion, risperidone group showed the higher cost than aripiprazole group, when considered from provider perspective. For the use of drugs to control irritability and aggression of ASD in the short term, risperidone was less expensive than aripiprazole. However, those who bear the cost of aripiprazole were the caregivers.

6.2. Recommendations and policy implications

This study investigated the effectiveness of both drugs in only eight weeks. Policy-based use may be useful for short-term irritability and agitation. However, in this study, one of the most important considerations for the treatment of ASD was when patients were given aripiprazole. This drug is expensive and the caregiver will need to pay for the drug cost. Understanding and providing information on efficacy, safety and cost (price) is an important part of planning decisions between the medical staff and the patient's family. This is to prevent any burden falling on either side without the consideration of all parties involved in the care of the patient. The results of this study may be part of a number of important information that medical professional and patients' family should be aware of.

In context of Yuwaprasart Waithayopathum Child Psychiatric Hospital, Patients with aggressive and irritated symptoms may use the data from this study, along with the hospital's treatment guidelines, in deciding whether to use drugs to control irritability and aggression in the short term.

6.3. Suggestions for future study

6.3.1. In the next study, the number of patients in each group should be calculated prior to commencement of the study in order to obtain the number that makes the study credible.

6.3.2. Research on the effectiveness of drugs should focus on both efficiency and safety.

6.3.3. The use in policy setting for long-term usage in patients with ASD should study more about long-term side effects.

6.3.4. If possible, the ABC score should be evaluated in the same patient group as the patients who were included into the study of cost.

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APPENDIX

SIAMPY-IRB 2017/003

Documentary Proof of Faculty of Pharmacy Siam University
Institutional Review Board

Title of Project: Cost-effectiveness analysis is of Aripiprazole compare
                         with Risperidone in patient with autism spectrum disorders

Principle Investigator: Mr.Kridsadadanudej Wongwejwiwat

Name of Institution: Faculty of Pharmacy, Siam University

Approval includes: 1) Submission form
                          2) Proposal & Protocol

Faculty of Pharmacy, Siam University Institutional Review Board is in full compliance with International Guidelines for Human Research Protection such as Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Approval: 10 April 2018
Date of Expiration: 10 April 2019

Signature of Secretary.................. *R. Watanalai* ....
                                                            (Dr.Ruxjinda Wattanalai)

Signature of Chairman .... *C. Pummangura* ....
                                            (Associate Professor Dr.Charlermsri Pummangura)
                                            Dean, Faculty of Pharmacy
                                            Siam University

๖๓ ถนนสุขุมวิท ตำบลปากน้ำ
อำเภอเมือง จังหวัดสมุทรปราการ ๑๐๒๗๐

โทร. ๐๒ ๓๘๔ ๓๓๔๑-๓ ต่อ ๗๑๑๐๖
โทรสาร. ๐๒ ๓๘๐ ๐๖๙๖
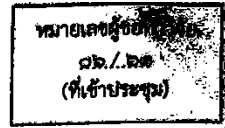
คณะกรรมการจริยธรรมในงานวิจัยโรงพยาบาลยุวประสาทไวทโยปถัมภ์
เอกสารรับรองโครงการ

ชื่อโครงการ (ภาษาไทย)   การวิเคราะห์ต้นทุนประสิทธิผลของยาอะริพิพราโซลเปรียบเทียบกับยาริสเพอริโดน

_____ ในผู้ป่วยกลุ่มอาการออทิซึม

ชื่อโครงการ (ภาษาอังกฤษ)   Cost-effectiveness analysis is of Aripiprazole compare

_____ with Risperidone in patient with autism spectrum disorders.

หัวหน้าโครงการ / หน่วยงานสังกัด   เภสัชกร กฤษฎาดนุเดช วงศ์เวชวิวัฒน์ คณะเภสัชศาสตร์ มหาวิทยาลัยสยาม

สถานที่ทำวิจัย _____ โรงพยาบาลยุวประสาทไวทโยปถัมภ์

เอกสารที่รับรอง

๑. แบบเสนอโครงการวิจัยเพื่อขอรับการพิจารณาจากคณะกรรมการจริยธรรมในงานวิจัย

วันหมดอายุ :   ๒๕   พฤษภาคม ๒๕๖๒

คณะกรรมการจริยธรรมการในงานวิจัย โรงพยาบาลยุวประสาทไวทโยปถัมภ์ กรมสุขภาพจิต กระทรวงสาธารณสุข ดำเนินการ
ให้การรับรองโครงการวิจัย ตามแนวทางหลักจริยธรรมการวิจัยในคนที่เป็นสากล ได้แก่ Declaration of Helsinki , The
Belmont . CIOMS Guidelines และ The International Conference on Harmonization in good Clinical
Practice (ICH – GCP)

ลงนาม_____

(นางรินสุข องอาจสกุลมั่น)
ประธานคณะกรรมการจริยธรรมในงานวิจัย

(_____ พฤษภาคม _____ ๒๕๖๑ _____)
วันที่

ลงนาม_____

(นางนพวรรณ ศรีวงศ์พานิช)
นายแพทย์เชี่ยวชาญ รักษาการในตำแหน่ง
ผู้อำนวยการโรงพยาบาลยุวประสาทไวทโยปถัมภ์

(_____ พฤษภาคม _____ ๒๕๖๑ _____)
วันที่

ชื่อเล่น...................   วันเก็บข้อมูล......./........./...........

แบบเก็บข้อมูลต้นทุนทางการแพทย์
เรื่อง การวิเคราะห์ต้นทุนของผู้ป่วยกลุ่มอาการออทิซึมสเปกตรัมดิสออเดอร์ (เอเอสดี)

สิทธิ์	☐ บัตร ท74 ☐ ประกันสุขภาพฯ ☐ ข้าราชการ ☐ จ่ายเอง	เพศ (M , F) อายุ.......ปี น้ำหนัก.........kg ส่วนสูง.........cm วันเดือนปีเกิด ..../................./.............
ชื่อ-สกุล		**HN**

วันเข้ารักษาแรกรับ........./........./.........   ☐ หอผู้ป่วย 3   ☐ หอผู้ป่วย 4   ☐ OPD
   Dx .... ICD-10 ....

IPD จำนวน.......ครั้ง/ปี	ครั้งที่..... visit......./........../....... D/C ..../........../....... AN...................... ครั้งที่..... visit......./........../....... D/C ..../........../....... AN...................... ครั้งที่..... visit......./........../....... D/C ..../........../....... AN...................... ครั้งที่..... visit......./........../....... D/C ..../........../....... AN...................... ครั้งที่..... visit......./........../....... D/C ..../........../....... AN......................

IPD

DATE																						
− กิจกรรมบำบัด																					
− แก้ไขการพูด (อรรถบำบัด)																					
− สมรรถภาพทางกาย																					
− จิตวิทยา																					
− ฟื้นฟูการศึกษา (การศึกษาพิเศษ)																					
− อาชีวบำบัด																					
− กระตุ้นพัฒนาการการเรียนรู้																					
− พฤติกรรมบำบัด																					
− HEG																					
− ธาราบำบัด																					
− กิจกรรมการเล่นบำบัด																					
− Early intervention																					
− การปรับพฤติกรรมในการทำงาน และทำกิจกรรมในการดำเนินชีวิต																					
− การบูรณาการประสาทความรู้สึก																					
− อื่นๆ																					
−																					
−																					
−																					
การรักษาด้วยยา	☐ ไม่มี ☐ มี

สรุป จำนวนวันที่มาโรงพยาบาลยุวประสารทฯ.............................วัน/ปี

OPD			
☐ คลินิกยาเดิม	ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../.......	☐ ด้านทันตกรรม จำนวน.......ครั้ง/ปี	ครั้งที่...... Visit ..../........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../.......
		☐ การบำบัดทางสังคม/ การวินิจฉัยและการบำบัด ทางสังคม จำนวน.......ครั้ง/ปี	ครั้งที่...... Visit ..../........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../.......
☐ จิตเวชชุมชน (เยี่ยมบ้าน) จำนวน.......ครั้ง/ปี	ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../.......	☐ คลินิกนอกเวลา จำนวน.......ครั้ง/ปี	ครั้งที่...... Visit ..../........../....... ครั้งที่..... visit......./........../....... ครั้งที่..... visit......./........../.......

OPD																								
DATE																								
Treatment																								
— จิตบำบัดรายบุคคล																								
— ครอบครัวบำบัด																								
— พฤติกรรมบำบัด																								
— ฟื้นฟูสมรรถภาพ																								
▪ การศึกษาพิเศษ																								
▪ ฝึกพูด																								
▪ กิจกรรมบำบัด																								
▪ สมรรถภาพทางกาย																								
▪ ศิลปะบำบัด																								
— กระตุ้นพัฒนาการการเรียนรู้																								
— ทดสอบเชาว์ปัญญา																								
Investigation																								
— Lab (เจาะเลือด)																								
— EEG=1 หรือ Chloral hydrate=2 (ระบุ)																								
— จิตวิทยา Test																								
Consult																								
— แพทย์ counseling																								
— พยาบาล counseling																								
— อื่นๆ																								
▪ ทำบัตรใหม่																								
▪																								
▪																								

วันที่สัมภาษณ์........./........./.........

☐ OPD   ☐ Ward.......

แบบสัมภาษณ์โครงการสารนิพนธ์

"การวิเคราะห์ต้นทุนของผู้ป่วยกลุ่มอาการออทิซึมสเปกตรัมดิสออเดอร์ (เอเอสดี):

การศึกษานำร่อง ณ โรงพยาบาลยุวประสาทไวทโยปถัมภ์"

ส่วนที่ 1 ข้อมูลเกี่ยวกับผู้ป่วย

HN.. เพศ   ☐ ชาย   ☐ หญิง   วันเดือนปีเกิด......./......./......

1. ชื่อ... นามสกุล ....

   ชื่อเล่น...อายุ....................ปี น้ำหนัก................กก

2. ภูมิลำเนา...

3. ที่อยู่ปัจจุบัน ....

4. โรคประจำตัวอื่นๆ   ☐ ไม่มี   ☐ มี

   (ถ้ามี)   (1) โรคลมชัก

               (2) โรคหอบหืด

               (3) โรคอื่นๆ โปรดระบุ (..

               ....

ชื่อเล่น..............................

HN.............................

ส่วนที่ 2 ข้อมูลเกี่ยวกับผู้ดูแลผู้ป่วย

ผู้ดูแลคนที่..............

1. ความเกี่ยวข้องกับผู้ป่วย

(1) บิดา   (2) มารดา   (3) พี่

(4) น้อง   (5) ญาติ

(6) ลูกจ้างประจำ เงินเดือน ....บาทต่อ วัน/เดือน

(7) อื่นๆ โปรดระบุ (....................................)

2. อายุ......................... ปี

3. เพศ   ☐ ชาย   ☐ หญิง

4. เบอร์โทรศัพท์ติดต่อ..

5. วุฒิการศึกษา   (1) ต่ำกว่าปริญญาตรี

                 (2) ปริญญาตรี

                 (3) สูงกว่าปริญญาตรี

6. หน้าที่ในการดูแลผู้ป่วยของผู้ดูแล

(1) ดูแลผู้ป่วยตลอดเวลา

(2) ดูแลผู้ป่วยเฉพาะคราว

(3) ดูแลผู้ป่วยเฉพาะเมื่อมาพบแพทย์ตามนัด

(4) อื่นๆ โปรดระบุ (..)

7. ปัจจุบันผู้ดูแล

☐ มีอาชีพ โปรดระบุ (..)

    ทำงาน...............วัน/เดือน ทำงาน.............ชม.ต่อวัน

    รายได้ปกติ ....บาทต่อ ชั่วโมง/วัน/ เดือน

    รายได้เสริม ....บาทต่อ ชั่วโมง/วัน/ เดือน

☐ ไม่มีอาชีพ   เคยมีอาชีพ ....

    หยุดงานมาแล้วเป็นเวลา ....เดือน/ปี

    รายได้ครั้งสุดท้ายที่ได้รับ ....บาทต่อ วัน / เดือน

ผู้ดูแลคนที่..............

1. ความเกี่ยวข้องกับผู้ป่วย

(1) บิดา   (2) มารดา   (3) พี่

(4) น้อง   (5) ญาติ

(6) ลูกจ้างประจำ เงินเดือน ....บาทต่อ วัน/เดือน

(7) อื่นๆ โปรดระบุ (....................................)

2. อายุ......................... ปี

3. เพศ   ☐ ชาย   ☐ หญิง

4. เบอร์โทรศัพท์ติดต่อ..

5. วุฒิการศึกษา   (1) ต่ำกว่าปริญญาตรี

                 (2) ปริญญาตรี

                 (3) สูงกว่าปริญญาตรี

6. หน้าที่ในการดูแลผู้ป่วยของผู้ดูแล

(1) ดูแลผู้ป่วยตลอดเวลา

(2) ดูแลผู้ป่วยเฉพาะคราว

(3) ดูแลผู้ป่วยเฉพาะเมื่อมาพบแพทย์ตามนัด

(4) อื่นๆ โปรดระบุ (..)

7. ปัจจุบันผู้ดูแล

☐ มีอาชีพ โปรดระบุ (..)

    ทำงาน...............วัน/เดือน ทำงาน.............ชม.ต่อวัน

    รายได้ปกติ ....บาทต่อ ชั่วโมง/วัน/ เดือน

    รายได้เสริม ....บาทต่อ ชั่วโมง/วัน/ เดือน

☐ ไม่มีอาชีพ   เคยมีอาชีพ ....

    หยุดงานมาแล้วเป็นเวลา ....เดือน/ปี

    รายได้ครั้งสุดท้ายที่ได้รับ ....บาทต่อ วัน / เดือน

ชื่อเล่น.............................

HN.............................

| ส่วนที่ 3 ต้นทุนทางตรงทางการแพทย์ |

<u>กรณีรักษากลุ่มอาการเอเอสดี ที่ รพ.ยุวประสาทไวทโยปถัมภ์</u>   จำนวนครั้งที่มา รพ. ....ครั้ง/ปี

☐ เหมือนกัน.......ครั้ง   ☐ ไม่เหมือนกัน .... ครั้ง

<u>ครั้งที่ 1</u> การเดินทางมา รพ.ยุวประสาทไวทโยปถัมภ์ (ไป - กลับ)

        (1) รถยนต์ส่วนตัว   (2) แท็กซี่   (3) โดยสารสาธารณะ

        (4) เดินเท้า   (5) เครื่องบิน   (6) อื่นๆ โปรดระบุ (.............................)

        ระยะทาง .... กิโลเมตร ค่าใช้จ่าย...บาท/ครั้ง

        -ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่   ☐ ไม่มี   ☐ มี ค่าจ้างคนขับรถ.............................. บาท/ครั้ง

        (2) จำนวนผู้ดูแลผู้ป่วย   ระบุ ...... คน

            ☐ ลูกจ้างประจำ   ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..........................บาทต่อครั้ง/.........

        <u>คนที่1</u> ผู้ดูแล.........   การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

        <u>คนที่2</u> ผู้ดูแล.........   การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

        <u>คนที่3</u> ผู้ดูแล.........   การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

        -ผู้ดูแลต้องเสียค่าที่พักอาศัยนอกสถานที่หรือไม่   ☐ ไม่มี   ☐ มี จำนวน............ครั้ง/ปี

        (ถ้ามี)   ค่าใช้จ่าย.........................บาท / คืน   จำนวนวันที่พักค้างคืน.....................คืน

<u>ครั้งที่ 2</u> การเดินทางมา รพ.ยุวประสาทไวทโยปถัมภ์ (ไป - กลับ)

        (1) รถยนต์ส่วนตัว   (2) แท็กซี่   (3) โดยสารสาธารณะ

        (4) เดินเท้า   (5) เครื่องบิน   (6) อื่นๆ โปรดระบุ (.............................)

        ระยะทาง .... กิโลเมตร ค่าใช้จ่าย...บาท/ครั้ง

        -ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่   ☐ ไม่มี   ☐ มี ค่าจ้างคนขับรถ.............................. บาท/ครั้ง

        (2) จำนวนผู้ดูแลผู้ป่วย   ระบุ ...... คน

            ☐ ลูกจ้างประจำ   ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..........................บาทต่อครั้ง/.........

        <u>คนที่1</u> ผู้ดูแล.........   การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

        <u>คนที่2</u> ผู้ดูแล.........   การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

        <u>คนที่3</u> ผู้ดูแล.........   การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

        -ผู้ดูแลต้องเสียค่าที่พักอาศัยนอกสถานที่หรือไม่   ☐ ไม่มี   ☐ มี จำนวน............ครั้ง/ปี

        (ถ้ามี)   ค่าใช้จ่าย.........................บาท / คืน   จำนวนวันที่พักค้างคืน.....................คืน

ชื่อเล่น.............................

HN...............................

กรณีรักษาโรคประจำตัว การเจ็บป่วย ทันตกรรม ที่สถานพยาบาลอื่นๆ

จำนวนครั้งที่มาสถานพยาบาลอื่น.......................ครั้ง/ปี   <u>สิทธิ์การรักษา</u> ⌐ จ่ายเอง ¬ ใช้สิทธิ.........

1. สถานพยาบาล (1) คลินิกเอกชน ....   (2) รพ.เอกชน ....   (3) รพ.รัฐบาล ....

2. เหตุผลที่มารักษาที่โรงพยาบาล

(1) โรคประจำตัวอื่นๆ.........ครั้ง/ปี

<u>ครั้งที่ 1</u> โรค..

-ผ่าตัดหรือไม่   □ ไม่ผ่าตัด   □ ผ่าตัด (..)

-ต้องนอนรักษาตัวที่โรงพยาบาลหรือไม่   □ ไม่ได้นอน   □ นอน   จำนวนวันที่พักรักษาตัว ....วัน

ค่าใช้จ่ายในการเข้ารักษา .... บาท/ครั้ง

-สาเหตุการ D/C: (1) แพทย์อนุญาตให้กลับ   (2) หนีกลับบ้าน   (3) ส่งต่อ   (4) อื่นๆ (...)

-การเดินทาง (ไป - กลับ)

(1) รถยนต์ส่วนตัว   (2) แท็กซี่   (3) โดยสารสาธารณะ

(4) เดินเท้า   (5) เครื่องบิน   (6) อื่นๆ โปรดระบุ (...)

ระยะทาง .... กิโลเมตร ค่าใช้จ่าย..บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่   □ ไม่มี   □ มี ค่าจ้างคนขับรถ............................. บาท/ครั้ง

-จำนวนผู้ดูแลผู้ป่วย   ระบุ ...... คน □ ลูกจ้างประจำ   □ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

<u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>ครั้งที่ 2</u> โรค..

-ผ่าตัดหรือไม่   □ ไม่ผ่าตัด   □ ผ่าตัด (..)

-ต้องนอนรักษาตัวที่โรงพยาบาลหรือไม่   □ ไม่ได้นอน   □ นอน   จำนวนวันที่พักรักษาตัว ....วัน

ค่าใช้จ่ายในการเข้ารักษา .... บาท/ครั้ง

-สาเหตุการ D/C: (1) แพทย์อนุญาตให้กลับ   (2) หนีกลับบ้าน   (3) ส่งต่อ   (4) อื่นๆ (...)

-การเดินทาง (ไป - กลับ)

(1) รถยนต์ส่วนตัว   (2) แท็กซี่   (3) โดยสารสาธารณะ

(4) เดินเท้า   (5) เครื่องบิน   (6) อื่นๆ โปรดระบุ (...)

ระยะทาง .... กิโลเมตร ค่าใช้จ่าย..บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่   □ ไม่มี   □ มี ค่าจ้างคนขับรถ............................. บาท/ครั้ง

-จำนวนผู้ดูแลผู้ป่วย   ระบุ ...... คน □ ลูกจ้างประจำ   □ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

<u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

ชื่อเล่น...............................

HN...............................

(2) ทันตกรรม ....ครั้ง/ปี แต่ละครั้ง ☐ เหมือนกัน ....บาท ☐ ไม่เหมือน

<u>ครั้งที่ 1</u> ☐ ถอนฟัน.......ครั้ง ☐ อุดฟัน.......ครั้ง ☐ ตรวจฟัน ....ครั้ง ☐ ขูดหินปูน.......ครั้ง ☐ ฟันปลอม.......ครั้ง

☐ อื่นๆ(..) ราคา............................บาท

<u>ครั้งที่ 2</u> ☐ ถอนฟัน.......ครั้ง ☐ อุดฟัน.......ครั้ง ☐ ตรวจฟัน ....ครั้ง ☐ ขูดหินปูน.......ครั้ง ☐ ฟันปลอม.......ครั้ง

☐ อื่นๆ(..) ราคา............................บาท

<u>ครั้งที่ 3</u> ☐ ถอนฟัน.......ครั้ง ☐ อุดฟัน.......ครั้ง ☐ ตรวจฟัน ....ครั้ง ☐ ขูดหินปูน.......ครั้ง ☐ ฟันปลอม.......ครั้ง

☐ อื่นๆ(..)

(3) การเจ็บป่วยอื่นๆ .... ครั้ง/ปี

<u>ครั้งที่ 1</u> โรค...

-ผ่าตัดหรือไม่ ☐ ไม่ผ่าตัด ☐ ผ่าตัด (..)

-ต้องนอนรักษาตัวที่โรงพยาบาลหรือไม่ ☐ ไม่ได้นอน ☐ นอน จำนวนวันที่พักรักษาตัว ....วัน

ค่าใช้จ่ายในการเข้ารักษา .... บาท/ครั้ง

-สาเหตุการ D/C: (1) แพทย์อนุญาตให้กลับ (2) หนีกลับบ้าน (3) ส่งต่อ (4) อื่นๆ (..............................)

-การเดินทาง (ไป - กลับ)

(1) รถยนต์ส่วนตัว (2) แท็กซี่ (3) โดยสารสาธารณะ

(4) เดินเท้า (5) เครื่องบิน (6) อื่นๆ โปรดระบุ (..............................)

ระยะทาง .... กิโลเมตร ค่าใช้จ่าย..บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่ ☐ ไม่มี ☐ มี ค่าจ้างคนขับรถ............................. บาท/ครั้ง

-จำนวนผู้ดูแลผู้ป่วย ระบุ ...... คน ☐ ลูกจ้างประจำ ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

<u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>ครั้งที่ 2</u> โรค...

-ผ่าตัดหรือไม่ ☐ ไม่ผ่าตัด ☐ ผ่าตัด (..)

-ต้องนอนรักษาตัวที่โรงพยาบาลหรือไม่ ☐ ไม่ได้นอน ☐ นอน จำนวนวันที่พักรักษาตัว ....วัน

ค่าใช้จ่ายในการเข้ารักษา .... บาท/ครั้ง

-สาเหตุการ D/C: (1) แพทย์อนุญาตให้กลับ (2) หนีกลับบ้าน (3) ส่งต่อ (4) อื่นๆ (..............................)

-การเดินทาง (ไป - กลับ)

(1) รถยนต์ส่วนตัว (2) แท็กซี่ (3) โดยสารสาธารณะ

(4) เดินเท้า (5) เครื่องบิน (6) อื่นๆ โปรดระบุ (..............................)

ระยะทาง .... กิโลเมตร ค่าใช้จ่าย..บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่ ☐ ไม่มี ☐ มี ค่าจ้างคนขับรถ............................. บาท/ครั้ง

-จำนวนผู้ดูแลผู้ป่วย ระบุ ...... คน ☐ ลูกจ้างประจำ ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

<u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

ชื่อเล่น...............................

HN...............................

ส่วนที่ 3 ต้นทุนทางตรงทางการแพทย์

<u>กิจกรรมฟื้นฟูหรือส่งเสริมสมรรถภาพผู้ป่วย ที่เกิดขึ้นนอก รพ.ยุวประสาทไวทโยปถัมภ์</u>　□ ไม่มี　□ มี

1. กิจกรรม ....
2. จำนวนครั้ง ....ครั้ง ต่อ (ปี/เดือน)　ราคากิจกรรม...................................บาท/ครั้ง
3. สถานที่จัดกิจกรรม..ระยะเวลาที่จัดกิจกรรม .... ชั่วโมง / วัน
4. การเดินทาง (ไป - กลับ)　□ เหมือนกัน.......ครั้ง　　□ ไม่เหมือนกัน　.........ครั้ง

<u>ครั้งที่1</u>　(1) รถยนต์ส่วนตัว　　(2) แท็กซี่　　(3) โดยสารสาธารณะ

(4) เดินเท้า　　(5) เครื่องบิน　　(6) อื่นๆ โปรดระบุ (...)

ระยะทาง .... กิโลเมตร　ค่าใช้จ่าย...บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่　　□ ไม่มี　□ มี ค่าจ้างคนขับรถ.............................. บาท/ครั้ง

-จำนวนผู้ดูแล　ระบุ ...... คน □ ลูกจ้างประจำ　□ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

<u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

-กรณีกิจกรรมที่ > 1 วัน ผู้ดูแลต้องนอนค้างคืนหรือไม่ :　□ ไม่ค้างคืน　□ ค้างคืน

(ถ้าค้างคืน) เสียค่าใช้จ่ายที่พัก........................... บาท/คืน　จำนวน..............................คืน

หรือ เสียค่าเหมาจ่ายรวมกับค่ากิจกรรมของผู้ป่วย หรือเสียค่ากิจกรรมสำหรับผู้ดูแล ....บาท

(ถ้าไม่ค้างคืน) ผู้ดูแลเดินทาง □ ไป-กลับเช้า ไป-กลับเย็น　□ ไปเช้าเย็นกลับ　□ อื่นๆ ....

เดินทางโดย...........................เป็นระยะทาง............................กม. ค่าเดินทาง ....บาท / ครั้ง

<u>ครั้งที่2</u>　(1) รถยนต์ส่วนตัว　　(2) แท็กซี่　　(3) โดยสารสาธารณะ

(4) เดินเท้า　　(5) เครื่องบิน　　(6) อื่นๆ โปรดระบุ (...................................)

ระยะทาง .... กิโลเมตร　ค่าใช้จ่าย...บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่　　□ ไม่มี　□ มี ค่าจ้างคนขับรถ.............................. บาท/ครั้ง

-จำนวนผู้ดูแล　ระบุ ...... คน □ ลูกจ้างประจำ □ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

<u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

<u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

-กรณีกิจกรรมที่ > 1 วัน ผู้ดูแลต้องนอนค้างคืนหรือไม่ :　□ ไม่ค้างคืน　□ ค้างคืน

(ถ้าค้างคืน) เสียค่าใช้จ่ายที่พัก........................... บาท/คืน　จำนวน..............................คืน

หรือ เสียค่าเหมาจ่ายรวมกับค่ากิจกรรมของผู้ป่วย หรือเสียค่ากิจกรรมสำหรับผู้ดูแล ....บาท

(ถ้าไม่ค้างคืน) ผู้ดูแลเดินทาง □ ไป-กลับเช้า ไป-กลับเย็น　□ ไปเช้าเย็นกลับ　□ อื่นๆ ....

เดินทางโดย...........................เป็นระยะทาง............................กม. ค่าเดินทาง ....บาท / ครั้ง

<div align="right">

ชื่อเล่น.............................

HN.................................

</div>

ส่วนที่ 3 ต้นทุนทางตรงทางการแพทย์

<u>การแพทย์ทางเลือก</u> (ถ้าใช้สมุนไพร)　　　□ ไม่มี　　□ มี

ช่วงเวลาที่ใช้	ชื่อสมุนไพร	วิธีรับประทาน (ต่อวัน)	ความถี่	ราคา (บาท)
....	....	....................Tab /caps รับประทานได้ .... วัน /	□ ทุกวัน □ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	..............฿ ต่อ ห่อ /กระปุก /ขวด /แผง /...................................
....	....	....................Tab /caps รับประทานได้ .... วัน /	□ ทุกวัน □ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	..............฿ ต่อ ห่อ /กระปุก /ขวด /แผง /.............
....	....	....................Tab /caps รับประทานได้ .... วัน /	□ ทุกวัน □ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	..............฿ ต่อ ห่อ /กระปุก /ขวด /แผง /.............

<u>การแพทย์ทางเลือก</u> (ถ้าใช้ผลิตภัณฑ์อาหารเสริม)　　　□ ไม่มี　　□ มี

รหัส	A	B	C	D	E
อาหารเสริม	Vitamin B-12	Magnesium	Omega-3 Fatty Acids	Calcium	อื่นๆ

ช่วงเวลาที่ใช้	ชื่อผลิตภัณฑ์อาหารเสริม	วิธีรับประทาน (ต่อวัน)	ความถี่	ราคา (บาท)
....	....	...............Tab /caps /......... จำนวน......................... tabs /caps/........... ต่อ ขวด	□ ทุกวัน　□ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	.... ฿ ต่อ กระปุก /ขวด /แผง /...........................
....	....	...............Tab /caps /......... จำนวน......................... tabs /caps/........... ต่อ ขวด	□ ทุกวัน　□ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	.... ฿ ต่อ กระปุก /ขวด /แผง /...........................
....	....	...............Tab /caps /......... จำนวน......................... tabs /caps/........... ต่อ ขวด	□ ทุกวัน　□ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	.... ฿ ต่อ กระปุก /ขวด /แผง /...........................
....	....	...............Tab /caps /......... จำนวน......................... tabs /caps/........... ต่อ ขวด	□ ทุกวัน　□ วันเว้นวัน □ 2 วันครั้ง □ อื่นๆ	.... ฿ ต่อ กระปุก /ขวด /แผง /...........................

ชื่อเล่น..............................

HN.............................

<div style="border:1px solid black">

ส่วนที่ 3 ต้นทุนทางตรงทางการแพทย์

</div>

<u>**การแพทย์ทางเลือกอื่นๆ**</u>   ☐ ไม่มี   ☐ มี

รหัส	การบำบัด
A	ดนตรีบำบัด
B	ฝังเข็ม
C	ศิลปกรรมบำบัด
D	การบำบัดด้วยสัตว์
E	การบำบัดด้วยหุ่นยนต์
F	HBOT
G	เซลล์บำบัด

1. ประเภทการแพทย์ทางเลือกบำบัด..

2. จำนวน ....ครั้งต่อ (ปี/เดือน) ค่าใช้จ่าย..............................บาทต่อครั้ง/ ....

3. สถานที่บำบัด...

4. ระยะเวลาบำบัด จำนวน ....ชั่วโมง/วัน

5. การเดินทาง (ไป - กลับ)   ☐ เหมือนกัน.......ครั้ง   ☐ ไม่เหมือนกัน .... ครั้ง

<u>ครั้งที่1</u> (1) รถยนต์ส่วนตัว   (2) แท็กซี่   (3) โดยสารสาธารณะ

            (4) เดินเท้า   (5) เครื่องบิน   (6) อื่นๆ โปรดระบุ (...)

ระยะทาง .... กิโลเมตร ค่าใช้จ่าย...บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่   ☐ ไม่มี   ☐ มี ค่าจ้างคนขับรถ............................. บาท/ครั้ง

-จำนวนผู้ดูแลผู้ป่วย ระบุ ...... คน ☐ ลูกจ้างประจำ ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

      <u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

      <u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

-ผู้ดูแลต้องรอรับกลับหรือไม่ : ☐ ไม่รอรับ ☐ รอรับ

   (ถ้ารอรับ) เสียค่าเหมาจ่ายรวมกับค่าการบำบัดของผู้ป่วย หรือเสียค่ากิจกรรมสำหรับผู้ดูแล ....บาท

   (ถ้าไม่รอรับ) ผู้ดูแลเดินทาง ☐ ไป-กลับเช้า ไป-กลับเย็น ☐ อื่นๆ ....

   เดินทางโดย..........................เป็นระยะทาง...................................กม. ค่าเดินทาง ....บาท / ครั้ง

<u>ครั้งที่2</u> (1) รถยนต์ส่วนตัว   (2) แท็กซี่   (3) โดยสารสาธารณะ

            (4) เดินเท้า   (5) เครื่องบิน   (6) อื่นๆ โปรดระบุ (...)

ระยะทาง .... กิโลเมตร ค่าใช้จ่าย...บาท/ครั้ง

-ต้องจ้างคนขับรถ (เฉพาะคราว) หรือไม่   ☐ ไม่มี   ☐ มี ค่าจ้างคนขับรถ............................. บาท/ครั้ง

-จำนวนผู้ดูแลผู้ป่วย ระบุ ...... คน ☐ ลูกจ้างประจำ ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/.........

      <u>คนที่1</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

      <u>คนที่2</u> ผู้ดูแล.......... การขาดงาน .... ชั่วโมง / วัน ต่อเดือน

-ผู้ดูแลต้องรอรับกลับหรือไม่ : ☐ ไม่รอรับ ☐ รอรับ

   (ถ้ารอรับ) เสียค่าเหมาจ่ายรวมกับค่าการบำบัดของผู้ป่วย หรือเสียค่ากิจกรรมสำหรับผู้ดูแล ....บาท

   (ถ้าไม่รอรับ) ผู้ดูแลเดินทาง ☐ ไป-กลับเช้า ไป-กลับเย็น ☐ อื่นๆ ....

   เดินทางโดย..........................เป็นระยะทาง...................................กม. ค่าเดินทาง ....บาท / ครั้ง

ชื่อเล่น..............................

HN..............................

| ส่วนที่ 4 ต้นทุนทางตรงที่ไม่ใช่ทางการแพทย์ |

<u>ค่าใช้จ่ายด้านการศึกษา</u>

1. ผู้ป่วยมีเรียนที่โรงเรียน หรือสถานศึกษาอื่นๆหรือไม่   ☐ **ไม่เรียน**   ☐ **เรียน**

    (ถ้าเรียน)   ☐ รัฐบาล

                 ◯ โรงเรียนและชั้นเรียนปกติทั่วไป   ◯ โรงเรียนการศึกษาพิเศษ

        ☐ เอกชน

                 ◯ โรงเรียนและชั้นเรียนปกติทั่วไป   ◯ โรงเรียนการศึกษาพิเศษ

2. ปัจจุบันเรียนอยู่ระดับ.........................โรงเรียน...

    ผู้ป่วยไปโรงเรียน...........................วัน/เดือนต่อเทอม ใน 1 ปี เรียน..............เทอม

3. ผู้ดูแลที่โรงเรียนหรือไม่   ☐ ไม่มี   ☐ มี

    (ถ้ามี)   ☐ ผู้ดูแล........ การขาดงาน .... ชั่วโมง/วัน ต่อเดือน

                ผู้ดูแล........ การขาดงาน .... ชั่วโมง/วัน ต่อเดือน

                ผู้ดูแล........ การขาดงาน .... ชั่วโมง/วัน ต่อเดือน

           ☐ ลูกจ้างประจำ

           ☐ ผู้ดูแลที่จ้างมาเฉพาะคราว มีค่าจ้าง..............................บาทต่อครั้ง/........

4. ค่าเทอมต่อปี.......................................บาท/ปี ประกอบด้วย

    ☐ ค่าเล่าเรียน   ....บาท/..........   ☐ ค่าหนังสือ ....บาท/..........

    ☐ ค่าอุปกรณ์การเรียน ....บาท/.........   ☐ ค่าบำรุงการศึกษา ....บาท/..........

    ☐ ค่าอาหารกลางวัน ....บาท/..........   ☐ ค่าชุดนักเรียน ....บาท/..........

    ☐ ค่ารถรับส่ง   ....บาท/..........   ☐ ค่าเรียนพิเศษ ....บาท/..........

    ☐ อื่น ๆ ระบุ...

    ....

<u>กรณีค่าเดินทางไปโรงเรียน</u>

       (1) รถยนต์ส่วนตัว ระยะทาง......................... กิโลเมตร ค่าใช้จ่าย ....บาท/ครั้ง

       (2) แท็กซี่ ค่าใช้จ่าย.....................................บาท/ครั้ง

       (3) โดยสารสาธารณะ ค่าใช้จ่ายในการเดินทาง..บาท/ครั้ง

       (4) เดินเท้า

       (6) อื่นๆ โปรดระบุ (...) ค่าใช้จ่าย ....บาท

       ต้องจ้างคนขับรถไปส่งที่โรงเรียนหรือไม่   ☐ ไม่มี   ☐ มี.................................บาท/ครั้ง

ชื่อเล่น...........................

HN............................

ส่วนที่ 4 ต้นทุนทางตรงที่ไม่ใช่ทางการแพทย์

<u>ค่าใช้จ่ายในครัวเรือน</u>   ขนาดครอบครัว.............คน

1.   ค่าอาหารที่ปรุงที่บ้าน เครื่องปรุงรส..........................บาท/เดือน

      ค่าอาหารสำเร็จรูปที่ซื้อมารับประทานที่บ้าน.....................บาท/เดือน

      ค่าอาหารที่รับประทานนอกบ้าน.........................บาท/เดือน   ....บาท/........

      ค่าเครื่องดื่มที่ไม่ใช่แอลกอฮอล์........................บาท/เดือน

11. ค่าน้ำ ค่าไฟ.............................บาท/เดือน

      ค่าแก๊สหุงต้ม.........................บาท/เดือน   จำนวน.......... ถัง/ .... ยี่ห้อ......................... ขนาด................ kg.

12. ค่าเฟอร์นิเจอร์ตกแต่งบ้าน (เช่น โต๊ะ ตู้ เตียง เก้าอี้ โซฟา ผ้าม่าน เป็นต้น) ....บาท/ปี

      ค่าเครื่องใช้สอยเบ็ดเตล็ดในบ้าน(เครื่องใช้ไฟฟ้า ค่าติดตั้งอุปกรณ์) ....บาท/ปี

      ค่าใช้จ่ายในการทำความสะอาด(อุปกรณ์ วัสดุ น้ำยาทำความสะอาด)..บาท/เดือน

13. ปกติทำความสะอาดบ้านเอง หรือจ้างแม่บ้าน   ☐ ไม่มี   ☐ มี จำนวน..............คน

      คนที่ 1 ค่าจ้าง..บาท/เดือน

      คนที่ 2 ค่าจ้าง..บาท/เดือน

14. การจ้างแม่ครัว   ☐ ไม่มี   ☐ มี จำนวน..............คน

      คนที่ 1 ค่าจ้าง..บาท/เดือน

      คนที่ 2 ค่าจ้าง..บาท/เดือน

15. การจ้างคนขับรถประจำหรือไม่   ☐ ไม่มี   ☐ มี จำนวน..............คน

      คนที่ 1 ค่าจ้าง..บาท/เดือน

      คนที่ 2 ค่าจ้าง..บาท/เดือน

16. การจ้างคนสวนเฉพาะคราวหรือไม่   ☐ ไม่มี   ☐ มี จำนวน..............คน

      คนที่ 1 ค่าจ้าง..บาท/เดือน

      คนที่ 2 ค่าจ้าง..บาท/เดือน

ชื่อเล่น..............................
HN................................

17. ค่าอุปกรณ์ การบันเทิง (เครื่องเล่น ของเล่น คอมพิวเตอร์) ....บาท/เดือน

ค่ากีฬา(อุปกรณ์กีฬา)...........................บาท/เดือน

ค่าใช้จ่ายเกี่ยวกับสัตว์เลี้ยง(ค่าอาหารสัตว์ ค่าพยาบาล)...................................บาท/เดือน

ค่าใช้จ่ายเกี่ยวกับไม้ประดับ(ปุ๋ย อุปกรณ์ดูแล กระถางต้นไม้ สารเคมี)...............................บาท/เดือน

ค่าผ่านประตู (ค่าบัตรไปเที่ยว) ....บาท/เดือน

ค่าเรียนและเล่นกีฬา(ค่าเรียนด้านกีฬา เช่น ว่ายน้ำ เทควันโด เปียโน เป็นต้น ค่าเรียนคำนวณ)

....บาท/เดือน

16. ค่าเสื้อผ้าและเครื่องแต่งกาย..............................บาท/เดือน ค่ารองเท้า...................................บาท/เดือน

17. ค่าบริการส่วนบุคคล(ค่าบริการตัดผม ค่าสมาชิกต่างๆ เช่น ค่าเข้าสปา ค่าเสริมสวย)

....บาท/เดือน

ค่าของใช้ส่วนตัว(ค่าสบู่ ยาสระผม ยาสีฟัน เครื่องสำอาง เป็นต้น)..บาท/เดือน

18. โทรศัพท์บ้าน

ค่าบริการโทรศัพท์....................................บาท/..........

มีการรวมค่าบริการอินเตอร์เน็ตด้วยหรือไม่ ☐ ไม่มี ☐ มี ....บาท/เดือน

19. โทรศัพท์เคลื่อนที่

ค่าบริการโทรศัพท์....................................บาท/..........

มีการรวมค่าบริการอินเตอร์เน็ตด้วยหรือไม่ ☐ ไม่มี ☐ มี ....บาท/เดือน

VITA

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Education and Training

2017 - Current: Master of Science (Health Economics and Health Care Management) Currently studying

Faculty of Economics at Chulalongkorn University, Bangkok, Thailand

2009 - 2015: Doctor of Pharmacy (Pharmaceutical Care)

Faculty of Pharmacy at Siam University, Bangkok, Thailand.

Thesis on "Patterns of drug use in autism spectrum disorders at Yuwaprasart Waithayopathum hospital"

Responsibilities and activities

My current position is a lecturer of Pharmacy Faculty at Siam University. Generally, my main function and responsibility as a lecturer is teaching pharmacy students regarding social and administration pharmacy in terms of pharmacoeconomic, pharmacy jurisprudence and community pharmacy.

Interested research areas: Autism spectrum disorders, Economics evaluation