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Factors Affecting the Decision to Participate in Down Syndrome Screening of Pregnant Women at HRH Princess Maha Chakri Sirindhorn Medical Center

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ABSTRACT

Objectives: To evaluate the factors which affect Thai pregnant women's decision to participate in prenatal Down syndrome (DS) screening, including their knowledge and attitudes.

Materials and Methods: An analytic cross sectional study of 326 self-administered questionnaires from Thai pregnant women who attended their first antenatal care clinic at HRH Princess Maha Chakri Sirindhorn Medical Center (MSMC) between June and December 2018 were collected. The participants' knowledge and attitudes on DS and DS screening tests, including their acceptance in prenatal DS screening, were examined. Factors which affected their decision to whether or not participate in screening were also evaluated.

Results: The mean age of the participants was 29.1 ± 5.6 years. Regarding their knowledge on DS, 30.7% of the participants were classified as having good knowledge. However, only 7.4% of the participants were classified as having good knowledge on prenatal DS screening. The percentages of the participants with positive, neutral and negative attitudes on DS and DS screening were 12.9%, 42.9% and 44.2%, respectively. Multivariate logistic regression revealed that pregnant women with an education level of bachelor degree or higher and familial income of ≥ 30,000 Baht per month were more likely to accept DS screening, but these did not reach statistical significance. Most participants (297/326, 91.1%) in our study agreed to participate in DS screening, with the majority (116/297, 35.6%) selecting integrate test. Also, most agreed that the cost of screening test should not exceed 5,000 baht and the test should be done in general provincial hospital. Over half of the participants (179/326, 54.9%) believed that pregnant women's personal health coverage should be responsible for the cost.

Conclusion: An education level of bachelor degree or higher and familial income of ≥ 30,000 baht per month are potential factors associated with the pregnant women's decision to accept DS screening.

Keywords: Down syndrome, screening, factors, acceptance, knowledge, attitude.

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ปัจจัยที่มีผลต่อการตัดสินใจเข้ารับการตรวจคัดกรองทารกกลุ่มอาการดาวน์ของสตรีตั้งครรภ์ไทยที่ศูนย์การแพทย์สมเด็จพระเทพรัตนราชสุดา ฯ สยามบรมราชกุมารี

มรุต วณิชชานนท์, อรสา เหมะจันทร

บทคัดย่อ

วัตถุประสงค์: *เพื่อศึกษาปัจจัยที่มีผลต่อการตัดสินใจเข้ารับการตรวจคัดกรองทารกกลุ่มอาการดาวน์ของสตรีตั้งครรภ์ไทย ซึ่งรวมไปถึงความรู้และทัศนคติต่อภาวะดาวน์และการตรวจคัดกรองทารกกลุ่มอาการดาวน์*

วัสดุและวิธีการ: *เป็นการศึกษาวิจัยเชิงวิเคราะห์โดยให้สตรีตั้งครรภ์ไทยผู้ซึ่งมาฝากครรภ์ครั้งแรกที่ห้องตรวจครรภ์ของศูนย์การแพทย์สมเด็จพระเทพรัตนราชสุดา ฯ สยามบรมราชกุมารี จำนวน 326 ราย ตอบแบบสอบถามหลังจากรับฟังการให้คำปรึกษาและแนะนำเรื่องการตรวจคัดกรองทารกกลุ่มอาการดาวน์ โดยทำการเก็บข้อมูลตั้งแต่เดือนมิถุนายน ถึงธันวาคม 2561 ในการศึกษาดังกล่าวได้มีการเก็บข้อมูลในส่วนของความรู้และทัศนคติของทั้งกลุ่มอาการดาวน์และการตรวจคัดกรองทารกกลุ่มอาการดาวน์ รวมไปถึงการตัดสินใจของสตรีตั้งครรภ์ที่เข้าร่วมงานวิจัยในการเข้ารับการตรวจคัดกรองและเหตุผลประกอบ นอกเหนือจากปัจจัยเหล่านี้แล้วยังมีการศึกษาเกี่ยวกับปัจจัยอื่นๆซึ่งมีผลต่อการตัดสินใจเข้ารับการตรวจคัดกรองอีกด้วย โดยข้อมูลได้ถูกรวบรวมและวิเคราะห์โดยใช้สถิติ Chi-square และ logistic regression analysis*

ผลการศึกษา: *สตรีตั้งครรภ์ที่เข้าร่วมงานวิจัยมีอายุเฉลี่ยเท่ากับ 29.17 ± 5.6 ปี โดยสัดส่วนของสตรีตั้งครรภ์ที่มีความรู้เกี่ยวกับภาวะกลุ่มอาการดาวน์และการตรวจคัดกรองทารกกลุ่มอาการดาวน์อยู่ในเกณฑ์ดีคิดเป็นร้อยละ 30.7 และ 7.4 ตามลำดับ ในเชิงทัศนคติสัดส่วนของสตรีตั้งครรภ์ที่เข้าร่วมงานวิจัยซึ่งมีทัศนคติในแง่บวก เป็นกลางและแง่ลบคิดเป็นร้อยละ 12.9, 42.9 และ 44.2 ตามลำดับ ปัจจัยที่มีแนวโน้มที่จะมีผลต่อการตัดสินใจเข้ารับการตรวจคัดกรองทารกกลุ่มอาการดาวน์ของสตรีตั้งครรภ์ได้แก่การจบการศึกษาระดับปริญญาตรีขึ้นไปและรายได้ครอบครัวที่มากกว่าหรือเท่ากับ 30,000 บาทต่อเดือนถึงแม้ว่าจะไม่มีนัยสำคัญทางสถิติ สตรีตั้งครรภ์ในการศึกษาส่วนมากเลือกที่จะเข้ารับการตรวจคัดกรองทารกกลุ่มอาการดาวน์ (ร้อยละ 91.1) โดยร้อยละ 35.6 ของผู้ที่ตัดสินใจเข้ารับการตรวจทั้งหมดเลือกวิธี integrate test นอกเหนือจากนี้สตรีตั้งครรภ์ส่วนมากเห็นด้วยว่าราคาของการตรวจคัดกรองไม่ควรเกิน 5,000 บาทและการตรวจคัดกรองควรทำในโรงพยาบาลจังหวัดหรือโรงพยาบาลศูนย์ ในส่วนของผู้รับผิดชอบค่าใช้จ่ายในการตรวจคัดกรอง สตรีตั้งครรภ์ส่วนมาก (ร้อยละ 54.9) เห็นด้วยว่าควรขึ้นอยู่กับสิทธิของการรักษาของตน*

สรุป: *ปัจจัยซึ่งมีแนวโน้มที่จะมีผลต่อการตัดสินใจเข้ารับการตรวจคัดกรองทารกกลุ่มอาการดาวน์ของสตรีตั้งครรภ์ไทยได้แก่การจบการศึกษาระดับปริญญาตรีขึ้นไป และรายได้ครอบครัวที่มากกว่าหรือเท่ากับ 30,000 บาทต่อเดือน*

คำสำคัญ: *กลุ่มอาการดาวน์, การคัดกรอง, ปัจจัย, การยอมรับ, ความรู้, ทัศนคติ*

Introduction

Down syndrome (DS) or trisomy 21 represents the most common genetic cause of moderate to severe mental retardation and the most common chromosomal abnormality of the newborn. However, it is most compatible with survival compared with other autosomal trisomies[1, 2]. Its incidence is around 1 in 700 to 800 live births[2]. It is associated with characteristic physical features and multiple congenital anomalies, involving organs such as the heart, gastrointestinal tract, thyroid gland, eyes and ears[3,4]. However, the most concerning problems are developmental delay and mental retardation as these may imply significant social costs due to the special care needed[2,4]. In Thailand, around 1,000 cases of DS are delivered yearly[5]. At HRH Princess Maha Chakri Sirindhorn Medical Center (MSMC), a university hospital located in Nakhon Nayok province of Thailand, there are approximately 1,800 to 2,000 deliveries per year which result in 0-3 DS cases if no screening strategy.

Generally, the risk of a pregnant woman having a DS fetus increases steeply when maternal age is 35 years or older[1,3]. The American College of Obstetricians and Gynecologists (ACOG) has been recommending that DS screening should be offered to all women who are pregnant regardless of age since 2007[6,7]. Over the past years, a wide range of prenatal screening tests for DS have been developed with predictive rates obtained either with a single test or a combination of several tests. Thus, this allows an offering of multiple options for pregnant women to select based on their informed choices. Prenatal DS screening tests are non-invasive, and those with positive screening results are offered a diagnostic test such as amniocentesis, chorionic villus sampling or cordocentesis to determine fetal karyotype[7-9].

A variety of factors may influence the pregnant woman's decision to accept a screening test including her knowledge and attitude towards both DS and the screening tests. At present, most studies concerning the pregnant women's knowledge and attitudes of DS, its screening tests and the factors which affect their decision to accept screening have been carried out in Western countries[10-13]. Although knowledge and attitude may directly influence their decision, factors such as maternal age[12,13], ethnicity[12,13], religion, education level[13] and familial income may also be crucial. In addition, previous miscarriage[11,12], previous antenatal counseling on prenatal testing[11-12,14] and number of antenatal visits[11] have been shown to associate with screening uptake.

In Asian countries, including Thailand, extensive studies of pregnant women's knowledge and attitudes towards DS and screening have been widely carried out[5,15-17] but the evaluation of significant factors affecting their decision to undertake screening is lacking. Previously, two large cross-sectional studies were carried out in Thailand's university hospitals examining the knowledge and attitudes of pregnant women[5,15]. Unfortunately, these studies were conducted for almost a decade at the time when prenatal DS screening was firstly introduced in Thailand. Since that time, many issues dealing with Thailand's social context have changed, such as the extended use of social media and the internet to gain information and more effective genetic counselling which have been increasingly offered in various medical institutions.

At MSMC, genetic counselling has been offered to all pregnant women at their first visit to our antenatal clinic beginning in 2012. This includes information on the available DS screening tests, the appropriate gestational age for testing considering every available option, each individual test's detection rate and cost. In recent years, there have been approximately 150-200 pregnant

women who visited our first antenatal care clinic per month. However, only about 12-14% of those attending our clinic decided to undergo a DS screening test. Thus, the primary objective of this study was to evaluate the factors which affect Thai pregnant women's decision to participate in prenatal DS screening, including their knowledge and attitudes. The secondary objectives were to evaluate their decisions and preferences of screening tests, reasons for making a decision, affordable cost, preferred place for testing and responsibility of screening payment.

Materials and Methods

This analytic cross-sectional study was conducted among pregnant women who attended antenatal care clinic at MSMC, Faculty of Medicine, Srinakharinwirot University, Ongkharak, Nakhon Nayok, Thailand, between June and December 2018. It was approved by the research Ethics Committee of the Faculty of Medicine, Srinakharinwirot University (registry number: SWUEC/E-025/2561). After the informed consents from all participants were obtained, they were asked to complete the questionnaires during the first antenatal visit. This was done immediately after the routine patient education program was offered to all new attendants at our antenatal care (ANC) clinic. The inclusion criteria were all pregnant Thai women who were 18 years of age or older who came for the first antenatal visit at MSMC. Participants who could not read or write Thai, were unable to fully complete the questionnaire by themselves, or whose fetus was already diagnosed with any structural anomalies were excluded. The sample size for the study was calculated by Yamane's formula[18], and the data of the number of Thai pregnant women aged 18 years or older who made a first ANC visit at MSMC in 2017 which matched the inclusion and exclusion criteria of the current study was 1,772. Based on this, a total of 326 completed questionnaires were required and used to analyze. To account for possible attrition of 20%, 408 questionnaires were collected.

The questionnaire, which consisted of five parts, was adapted from previous studies[5,10]. Part I consisted of the participants' demographic information including their age, ethnicity, religion, current residence, level of education, familial income, gravida, parity, personal and familial history of having a DS child, history of any previous fetal congenital anomaly, and the type of health coverage. Part II included information on the routes by which the participants have received counselling or information about DS and 10 items which focused on their knowledge about DS. Part III comprised of information on the routes by which the participants have received counselling or information about DS screening and 15 items which focused on their knowledge about DS screening tests. Part IV contained 15 items which focused on the participants' attitudes. The participant's opinion on each question was expressed based on five Likert scales: strongly disagree, disagree, uncertain, agree, and strongly agree. Finally, Part V of the questionnaire focused on the participant's decision to whether or not accept the DS screening test. If the participant chose to accept the DS screening, the preferable screening method was asked. To aid the participant's decision-making process, a table of four screening tests available at our ANC clinic (first trimester screening, quad test, integrate test, and non-invasive prenatal test (NIPT)) along with their suitable gestational age range for testing, detection rate and cost was provided. If the participant's gestational age at the first antenatal visit was too advanced, her opinion on the preferable choice of screening was asked instead. In addition, the final part included information on the participant's economic capability of payment, the preferred screening location and total cost support.

The questionnaire used in our study was evaluated for validity in the knowledge about DS and its screening tests by three maternal fetal medicine specialists. Using Cronbach's alpha statistic, the reliability of the questionnaire was calculated based on a pilot study of 50 volunteers to be 0.83.

Data collection and analyses in this study were done using Statistical Package for the Social Sciences, Windows version 22.0 (SPSS Inc., Chicago, IL, USA). Baseline demographic data and characteristics of all participants were expressed as percentages or as a means with a standard deviation (SD). The total knowledge score on DS and DS screening was summed after giving a score of -1 for incorrect answer, 0 for do not know, and 1 for correct answer in each question. The correct and incorrect answers were based on scientific knowledge which the participants should be aware before antenatal DS screening. The possible sum score of knowledge on DS ranged from -10 to 10. All participants were categorized into three levels: poor (defined as score ≤ 1), intermediate (defined as score 2-4) and good (defined as score 5-10). Whereas, the possible summed score of knowledge on DS screening ranged from -15 to 15. The participants were also categorized into three levels: poor (defined as score < 2), intermediate (defined as score 3-7) and good (defined as score 8-15).

For the analysis of attitude, the scores for each participant was summed, giving -2 for strongly disagree, -1 for disagree, 0 for uncertain, 1 for agree and 2 for strongly agree. Therefore, the possible summed score ranged from -30 to 30. All participants were categorized into three groups of attitudes: negative (defined as score of -30 to 8), neutral (defined as score of 9-14) and positive attitude (defined as score of 15-30).

Each dependent factor in our study was categorized as dichotomous variables including maternal age (< 35 vs ≥ 35 years old), religion (Buddhism vs others), current residence (Bangkok & nearby vs others), education (bachelor degree or higher vs lower than bachelor degree), family income per month (< 30,000 vs ≥ 30,000), history of having a child with DS (yes vs no), history of having a child with congenital anomaly (yes vs no), health coverage (payment by other vs. self-paid), knowledge on DS and DS screening (good vs. intermediate to poor), and attitude (positive vs neutral to negative). Factors affecting the Thai pregnant women's decision to accept DS screening were initially analyzed using the chi-square test and the prevalence rate ratio was expressed for each factor. Then, univariate and multivariate logistic regression models were constructed to identify factors which were independently and significantly associated with the pregnant women's acceptance to participate in DS screening. The p value of < 0.05 was considered as statistically significant in all tests performed in this study.

Finally, this study analyzed the final decision on the acceptance of antenatal DS screening and presented it as the percentages of participants who agreed, disagreed, or felt uncertain about screening. In addition, the percentages for the reasons why the participants chose to agree, disagree or felt uncertain, the affordable cost of screening, the preferred places for screening, and economic support preference were also presented.

Results

Demographic characteristics of the 326 participants based on the complete questionnaires are presented in Table 1. Mean ± SD for maternal age was 29.1 ± 5.6 years. One participant had a previous history of having a DS child while one participant had a history of a child having congenital anomaly.

Table 1. Participant demographic characteristics (n = 326).

Characteristics	N (%)
Age (years)	
18-34	262 (80.4)
≥ 35	64 (19.6)
Ethnicity	
Thai	326 (100.0)
Chinese	0 (0.0)
Others	0 (0.0)
Religion	
Buddhist	283 (86.8)
Muslim	38 (11.7)
Others	5 (1.5)
Current residence	
Bangkok & nearby	199 (61.0)
Others	127 (39.0)
Level of Education	
High school or less	178 (54.6)
Bachelor degree	127 (39.0)
Higher than bachelor degree	21 (6.4)
Family income (Baht/month)	
< 15,000	93 (28.5)
15,000 - 29,999	158 (48.5)
≥ 30,000	75 (23.0)
Nulliparous	136 (41.7)
Primigravida	118 (36.2)
History of having a DS child	1 (0.3)
History of having a child with congenital anomaly	1 (0.3)
Family history of Down syndrome/mental retardation	
Yes	0 (0.0)
No	325 (99.7)
Unknown	1 (0.3)
Type of health coverage	
Self-paid	113 (34.7)
Civil servant medical benefit scheme	37 (11.4)
Social security scheme	153 (46.9)
Government universal coverage	22 (6.7)
Others	1 (0.3)

Concerning the knowledge on DS and DS screening, the percentages of the correct, incorrect, and do not know answer for each individual question were calculated. The three most common routes in which the participants gained their knowledge about DS were from a physician (82.2%), a medical provider (73.3%), and social media or the internet (57.4%). Medical providers included registered nurses, practical nurses and public health officers. The number of the participants who had good, intermediate and poor knowledge on DS were 100/326 (30.7%), 196/326 (60.1%) and 30/326 (9.2%), respectively. The majority of the patients (75.2%) were aware that DS is a genetic disease, and that the risk of having a fetus with DS increases as the maternal age advances (89.6%). Furthermore, most participants understood that children with DS need someone to take special care of them (93.9%) and that they could be trained (85.9%). For the knowledge on DS screening tests, most participants gained their knowledge from a physician (90.2%), a medical provider (77.3%), and social media or internet (38.7%). The number of the participants who had

good, intermediate and poor knowledge on DS screening were 24/326 (7.4%), 241/326 (73.9%) and 61/326 (18.7%), respectively. The majority appreciated that DS screening could be performed during the prenatal period (96.0%) and the time at which it could be performed depends on the screening method (90.5%). In addition, almost all pregnant women in this study were aware that the tests are performed only to screen for disease or abnormalities of the fetus (97.2%).

In our study, the number of patients with positive, neutral and negative attitudes were 42/326 (12.9%), 140/326 (42.9%) and 144/326 (44.2%), respectively. Most participants appreciated that the DS screening tests could be beneficial to all pregnant women regardless of their age (92.6%), and that the performance of these tests could relieve the anxiety of the pregnant women (92.6%).

The factors affecting the Thai pregnant women's decision to participate in DS screening from our study are shown in Table 2. One participant of 326 who was unsure whether or not she would participate in DS screening was not included in this non-parametric chi-square test. The only statistically significant factor was having a family income of ≥ 30,000 Baht per month. Pregnant women with age > 35 years old, who are a Buddhist, an education level of bachelor degree or higher, a previous history of having a DS child or child with congenital anomaly, and a good knowledge on DS and DS screening, were more likely to accept a DS screening test but without statistical significance.

Table 2. Factors affecting the decision to accept DS screening (n = 326).

Characteristics	Acceptance		Prevalence rate ratio	95% CI	p value
	Deny	Accept			
Age (years)					
≥ 35 (%)	4 (6.2)	60 (93.8)	1.036	0.962-1.117	0.407
< 35 (%)	25 (9.5)	237 (90.5)			
Religion					
Buddhism (%)	23 (8.1)	260 (91.9)	1.068	0.942-1.210	0.245
Others (%)	6 (14.0)	37 (86.0)			
Current residence					
Bangkok & nearby (%)	18 (9.1)	180 (90.9)	0.995	0.928-1.066	0.878
Others (%)	11 (8.6)	117 (91.4)			
Education					
Bachelor degree or higher (%)	2 (3.1)	62 (96.9)	1.080	1.017-1.147	0.070
Lower than bachelor degree (%)	27 (10.3)	235 (89.7)			
Family income (Baht/month)					
≥ 30,000 (%)	2 (2.7)	73 (97.3)	1.091	1.030-1.155	0.031*
< 30,000 (%)	27 (10.8)	224 (89.2)			
Previous history of having DS child					
Yes (%)	0 (0.0)	1 (100.0)	1.098	1.061-1.136	1.000
No (%)	29 (8.9)	296 (91.1)			
Previous history of having a child with congenital anomaly					
Yes (%)	0 (0.0)	1 (100.0)	1.098	1.061-1.136	1.000
No (%)	29 (8.9)	296 (91.1)			
Health coverage					
Payment by others (%)	21 (9.9)	192 (90.1)	0.970	0.907-1.038	0.402
Self-paid (%)	8 (7.1)	105 (92.9)			
Knowledge on DS					
Good (%)	6 (6.0)	94 (94.0)	1.047	0.980-1.118	0.222
Intermediate to poor (%)	23 (10.2)	203 (89.8)			
Knowledge on DS screening					
Good (%)	2 (8.3)	22 (91.7)	1.007	0.888-1.141	1.000
Intermediate to poor (%)	27 (8.9)	275 (91.1)			
Attitude					
Good (%)	5 (11.9)	37 (88.1)	0.962	0.856-1.081	0.398
Neutral to negative (%)	24 (8.5)	260 (91.5)			

CI: confidence interval, DS: Down syndrome

In Table 3, the logistic regression analysis of factors affecting the pregnant women's decision to accept DS screening is shown. Bivariate logistic regression showed that pregnant women with familial income ≥ 30,000 Baht per month and education level of bachelor degree or higher are more likely to accept DS screening, but only the income factor was statistically significant. Multiple logistic regression showed that again, both familial income ≥ 30,000 Baht per month and education level of bachelor degree or higher are more likely to accept DS screening; however, both factors did not reach statistical significance.

Table 3. Logistic regression analysis of factors affecting the decision to accept DS screening. (n = 326)

Characteristics	Crude OR[a]	95% CI	p value	Adjusted OR[b]	95% CI	p value
Familial income (Baht/month)						
≥ 30,000	4.400	1.021 - 18.952	0.047*	4.293	0.994 - 18.549	0.051
< 30,000						
Education						
Bachelor degree or higher	3.562	0.824 - 15.388	0.089	3.453	0.795 - 14.987	0.098
Lower than bachelor degree						

CI: confidence interval, OR: odds ratio
[a] Estimated by binary logistic regression, [b] Estimated by multiple logistic regression, adjusted for religion, education, familial income and knowledge on DS.

Finally, Table 4 represents the participants' decision to whether or not accept DS screening, the reasons for agreement or disagreement to participate, their affordable costs, the preferred locations for screening and their preference for total cost support. For those patients who accepted to participate in DS screening, the percentages for the individual tests they would prefer are also shown. Of those who agreed to undergo DS screening (297/326, 91.1%), the two most common choices were integrate test (116/326, 35.6%) and cell-free fetal DNA test (87/326, 26.7%). The majority of the participants who chose to screen for DS wished to evaluate the risk of having a DS fetus and determine the fetal sex. For those who denied to participate in DS screening (28/326, 8.6%), most were worried about the high cost of the price and fear of the venipuncture pain.

Table 4. Decision for acceptance of Down syndrome screening. (n = 326)

	N (%)
Agreed to participate in DS screening	297 (91.1)
(1) First trimester screening	63 (19.3)
(2) Quad test	31 (9.5)
(3) Integrate test	116 (35.6)
(4) Cell-free fetal DNA testing / NIPT	87 (26.7)
Denied to participate in DS screening	28 (8.6)
Unsure about participation in DS screening	1 (0.3)
Affordable costs of screening (Thai Baht)	
< 500	11 (3.4)
501 - 5,000	248 (76.1)
5,001 - 10,000	46 (14.1)
10,001 - 20,000	21 (6.4)
Preference for total cost support	
Self-paid	39 (12)
Based on personal health coverage	179 (54.9)
Total governmental support	108 (33.1)
Preferred locations for screening[a]	
Public health center	20 (6.1)
Primary community public hospital	51 (15.6)
General provincial hospital	288 (88.3)
Tertiary or university hospital	106 (32.5)
Private hospital	101 (31)
Private clinic	38 (11.7)

[a] Participants could choose more than one response. DS: Down syndrome, DNA: deoxyribonucleic acid, NIPT: Non-Invasive Prenatal Testing

Discussion

Our study is a relatively recent study to evaluate the factors influencing pregnant women's decision to accept DS screening, including their knowledge and attitudes, on DS and its screening methods in a developing country such as Thailand. Participants in our study lived in various areas of Thailand, with a variety of levels of education, family incomes and types of health coverage. Almost all participants had no previous history of a child with DS or congenital anomaly. Only one participant was unsure whether or not any of her family members has DS. Our participants had baseline characteristics which were commonly found in other pregnant women. Thus, the results of this study could represent as the Thai data.

Based on the results of this study, the levels of knowledge for both DS and DS screening tended to be intermediate to poor and hence needed to be improved. This was similar to previous studies conducted in university hospitals in Thailand in which the majority of Thai pregnant women had inadequate knowledge on DS screening[5,15]. For the participants' attitude, the majority of them in our study had a negative attitude (44.2%). This differs from the previous studies in which the majority of the patients had positive attitudes towards DS and DS screening[5, 7, 10, 15]. We believe that by building the pregnant women's knowledge on DS and its screening tests, their attitudes would be improved. This would lead to an overall increase in the rate of DS screening at our institution and thus in Thailand. In addition to arranging a routine academic program using an audiovisual presentation which includes information on DS and DS screening for all pregnant women who make their first visit to our ANC clinic, we plan to provide further genetic counseling methods. Counseling has been shown to be a key role in pregnant women's informed decision and thus is essential to ensure understanding of advantages and limitations of prenatal testing and further actions if there is a positive result[19-22]. For instance, a leaflet, a poster or person-to-person counseling by a physician or medical staff may be utilized. The various methods may be compared and the patients' knowledge scores and attitudes can be re-evaluated[14, 20].

Several studies were conducted at university hospitals in Thailand regarding knowledge and attitudes of Thai pregnant women on DS and its screening. A study from Maharaj Nakorn Chiang Mai Hospital found that most Thai pregnant women had adequate knowledge on DS but not on its screening tests. The majority of the patients had positive attitudes and almost all participants accepted DS maternal serum screening[15]. Although most questionnaire items were similar compared with our study, they did not include items evaluating attitudes towards specific DS screening tests. In addition, unlike our study, the categories of response in evaluating attitudes were different; there were only three categories (agree, neutral, disagree)[15]. These factors could have led to contrasting results concerning attitudes between studies. Another study conducted by Songklanagarind Hospital depicted that Thai pregnant women had inadequate knowledge in both DS and screening tests[5]. Factors that affected their knowledge on DS included levels of education, familial income and types of health coverage. However, the two factors that affected knowledge on DS screening tests were levels of education and types of health coverage. Maternal age was the only significant factor affecting attitudes[5]. Most participants in that study had a positive attitude towards DS screening, which again was different from our study. The study focused on evaluating two main aspects of attitude separately: towards DS screening and acceptance of having DS child[5]. However, our study evaluated a wider number of aspects including attitudes towards DS, acceptance of having a DS child and different types of DS screening methods; the responses were then analyzed simultaneously to represent the overall attitude of the pregnant women. The results of the latter study were similar to our study in that most patients had intermediate to poor knowledge on DS and its screening tests. The drawback of the previous studies was that they were conducted at the time when prenatal DS screening tests have only been implemented in Thailand for a short while. Many aspects in the social context have obviously evolved over time, including

advancements in visual aids and media used for genetic counseling. We believe these changes could have affected Thai pregnant women's knowledge and attitude levels and thus our current study was conducted also in a university hospital setting.

In our study, based on the chi-square test, the only factor with statistical significance was family income of ≥ 30,000 Baht per month. Further multivariate logistic regression analysis showed that Thai pregnant women with family income of ≥ 30,000 Baht per month and education level of bachelor degree or higher were more likely to accept DS screening, although these nearly achieved statistical significance. The statistical analyses from our study reflected that income was an important determinant in pregnant women's decision. Although income is a non-modifiable factor, we believe that the government has a role in setting an appropriate screening cost by establishing an effective policy on prenatal DS screening to cover every pregnant woman.

In our study, 91.1% (297/326) of the participants agreed to participate in DS screening with 35.6% (116/326) preferring integrate test and 26.7% (87/326) preferring NIPT. Although NIPT is more costly compared with other screening tests, we believe that many participants still chose NIPT because of its higher detection rate and reduction in false positive rate[23]. Most participants wished to evaluate the risk of having a DS fetus and determine the fetal sex. For those who denied to participate in DS screening (28/326, 8.6%), most were worried about the high cost of the price and fear of the venipuncture pain. Therefore, we postulate that psychotherapy and any local anesthetic agent might be offered to individuals with significant degree of fear of venipuncture pain. Another interesting aspect of our study was that most participants preferred general provincial hospital and tertiary or university hospital as screening places. We believe that this is due to patients' confidence in larger medical institutions with a greater number of trained and experienced staffs, including ultrasonologists, and equipments available. The results of our secondary outcomes cannot be compared to other studies because these aspects have never been extensively studied especially in developing countries like Thailand.

The strengths of our study were its analytic cross-sectional nature and that the included participants may represent all Thai pregnant women based on their varied demographic background. Also, it is one of the first studies in Thailand to evaluate the factors affecting DS screening uptake in a large medical institution such as our university hospital. We believe that the results from this study should raise awareness in our institution and all others in Thailand to promote effective genetic counseling aimed to improve Thai pregnant women's knowledge and attitudes. The government should also carefully consider its universal prenatal DS screening policy to the general Thai population in order to increase access to screening for a greater proportion of Thai pregnant women. Consequently, the overall rate of DS screening should be increased across Thai population. A drawback of our study was the nature of the questionnaire which only asked for the participants' opinion on the preferred screening test if they had agreed to participate. Data on whether or not those participants who agreed to undergo screening really did the test was not collected as this was outside the scope of our study. In addition, there could have been a selection bias because of the variability in baseline maternal demographic characteristics in different clinical settings. Further analysis on the data based on whether or not the pregnant women really undergo screening could be done to evaluate the actual screening rate instead of asking for their opinions. Also, future studies may use a larger sample size to detect more significant factors associated with Thai pregnant women's acceptance towards DS screening. This would build a greater understanding of the significant factors, leading to establishment of effective strategies aimed to increase Thailand's DS screening.

Conclusion

Thai pregnant women's knowledge on DS and DS screening were mostly intermediate to poor and most of them had negative attitudes. An education level of bachelor degree or higher and family income of ≥ 30,000 Baht per month were factors affecting Thai

pregnant women's decision to accept DS screening, although these nearly reached statistical significance.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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