RESEARCH ARTICLE

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Willingness to Pay for Colorectal Cancer Screening and Effect of Copayment in Southern Thailand

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Abstract

Background: The incidence rate of colorectal cancer in Thailand is increasing. Hence, the nationwide screening programme with copayment is being considered. There are two proposed screening alternatives: annual fecal immunochemical test (FIT) and once-in-10-year colonoscopy. A copayment for FIT is 60 Thai baht (THB) per test (≈ 1.7 USD); a copayment for colonoscopy is 2,300 THB per test (≈ 65.5 USD). **Methods:** The willingness to pay (WTP) technique, which is theoretically founded on a cost-benefit analysis, was used to assess an effect of copayment on the uptake. Subjects were patients aged 50-69 years without cancer or screening experience. WTP for the proposed tests was elicited. **Results:** Nearly two thirds of subjects were willing to pay for FIT. Less than half of subjects were willing to pay for colonoscopy. Among them, median WTP for both tests was greater than the proposed copayments. In a probit model, knowing CRC patient and presence of companion were associated with non-zero WTP for FIT. Presence of companion, female, and family history of cancer were associated with non-zero WTP for colonoscopy. After adjustment for starting price in the linear model, marital status, drinking behavior, and risk attitude were associated with WTP. None of factors was significant for colonoscopy. Uptake decreased as levels of copayment increased. At proposed copayments, the uptake rates of 59.8% and 21.6% were estimated for colonoscopy and FIT respectively. The demand for FIT was price inelastic; the demand for colonoscopy was price elastic. Estimates of optimal copayment were 62.1 THB for FIT and 460.2 THB for colonoscopy. At the optimal copayment, uptake rates would be 59.8% for FIT and 42.3% for colonoscopy.**Conclusion(s):** More subjects were willing to pay for FIT than for colonoscopy (59.0% versus 46.5%). The estimated uptake rates were 59.8% and 21.6% for colonoscopy and FIT at the proposed copayments.

Keywords: Colorectal cancer- screening- willingness to pay- copayment- Thailand

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Introduction

Similar to many developing countries, colorectal cancer (CRC) is increasingly common in Thailand (Center et al., 2009). During 1990-2010 incidence rates increased at an annual percent change of 2.5 and 2.7 in men and women respectively (Sriplung et al., 2005; National Cancer Institute, 2012; National Cancer Institute, 2013). CRC caused 6,848 deaths in 2012 in Thailand. The number of annual new cases in 2012 was 11,493 and would increase to 20,419 by the year 2035 if the current trend continued (Ferlay et al., 2014).

CRC arises from pre-cancerous lesions that take approximately 10 years to progress into cancer (Muto et al., 1975). Screening for pre-cancerous lesions as well as early cancer can reduce CRC incidence and mortality rates (Muller and Sonnenberg, 1995; Hardcastle et al., 1996; Wada et al., 1996). There are two categories of CRC screening tests: stool test and endoscopic examination. The stool tests aim to detect tumour-generated occult blood in stool. The endoscopic examinations visually identify tumours, serving both screening and diagnostic purposes. The fecal occult blood test (FOBT) and fecal immunochemical test (FIT) are stool tests employed for the screening in many countries. The widely-used endoscopic examinations are flexible sigmoidoscopy and colonoscopy. For general population, the target group of screening is typically individuals aged 50 and above; the starting ages slightly vary between countries. Frequencies of testing were annual or biennial for stool test (Asian countries such as Japan and South Korea recommend annual FIT) and once in 10 years for colonoscopy (Belgium recommends more frequent screening for colonoscopy, which is 5-yearly) (U. S. Preventive Services Task Force, 2008; International Cancer Screening Network, 2014).

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Since 2002, healthcare in Thailand has been provided under the universal health coverage (UHC) policy, which covers 99.9% of Thai population (National Health Security Office, 2016). There are three major public health insurance schemes under the UHC policy: Civil Servant Medical Benefit Scheme (CSMBS) covers government employees and their dependants; Social Security Scheme (SSS) covers private employees in the formal sector; and Universal Coverage Scheme (UCS) covers the rest of Thai population. With respect to CRC screening, the current policy covers only those with high risk of developing CRC (those with family history of CRC or those with suspected signs and symptoms). The general population aged 50 and above-regarded as an average-risk group-has not been covered yet. A CRC screening programme targeting this average-risk population is being considered. Whereas healthcare under the UHC policy is commonly provided without charge to patients, a copayment for CRC screening was proposed due to budget constraints (International Health Policy Program, 2012).

Two screening alternatives have been under consideration: FIT or colonoscopy. FIT would be done on a yearly basis; the proposed copayment is 60 Thai baht (THB) per test (International Health Policy Program, 2012). Colonoscopy would be done once in 10 years; its current fee is 2,300 THB per test (1 USD = 35.09 THB in April 2016) (The Comptroller General's Department, 2006; Bank of Thailand, 2016). The copayment might impede utilisation of the screening programme, resulting in a low uptake rate-a major concern of cancer screening programmes.

This study was conducted to determine willingness to pay (WTP) for FIT and colonoscopy and examine an effect of proposed copayment on uptake rates. To our knowledge, this is the first study estimating WTP for colorectal cancer screening in Thailand. Factors associated with WTP were identified. Price elasticities and optimal copayments for both tests were estimated. This information could facilitate policymakers in design and implementation of the CRC screening programme.

Materials and Methods

Study sample

The study design is a cross-sectional survey. Study samples were patients visiting the primary care clinic, Songklanagarind Hospital, during June-August 2013. The hospital is located in Songkhla province in the south of Thailand. In Southern Thailand, 95.9% of population had Thai nationality similar to the countrywide estimate (National Statistical Office, 2012). Regarding utilization of disease prevention service, the utilization rate was 1.9 times/year in 2015, which was comparable with the national estimate (National Statistical Office, 2016). Inclusion criteria were 50-69 years of age and ability to communicate in Thai language. Exclusion criteria included previous cancer diagnosis and previous CRC screening experience. All eligible patients visiting the clinic during the study period were approached. The study rationale and objectives were explained to them. Those agreed to attend the study were requested for their written consent.

A sample size was calculated to estimate mean WTP. The significance level of 0.05 was used in the calculation. The margin of error was set at 10% of the standard deviation. By allowing 10% for incomplete data, the required sample size was 428.

Data collection

The data collection was conducted at the primary care clinic, Songklanagarind Hospital-a teaching hospital for the Faculty of Medicine, Prince of Songkla University in Southern Thailand. The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University (EC Protocol Number 56-288-18-5-3).

Study interviewers were notified when patients meeting inclusion criteria had visited the clinic. Interviewers approached patients to assess their eligibility. Eligible patients were invited to participate in the study. Those agreed to participate were requested for their written consent. In-person interviews were then conducted.

The first part of interview consisted of demographic characteristics, socio-economic status, health-related behaviors, family history of cancer, perceived susceptibility to CRC, risk attitude toward health gains and losses, and health insurance status. The second part of interview was related to WTP.

WTP

WTP has its theoretical foundation based on a cost-benefit analysis (CBA), a type of economic evaluation. To estimate benefit in CBA, one method used is a contingent valuation. Two alternative techniques used in a contingent valuation include willingness to accept (WTA) and WTP (Drummond et al., 2015). WTA indicates compensation a person accepts in exchange for his/her loss. WTP indicates benefit a person gains from consuming a good in monetary terms. This interpretation is founded on the welfare economic concept of potential Pareto improvement. A contingent valuation is usually employed to value goods that are not available in market (Arrow and Solow, 1993; Drummond et al., 2015). This study applied the WTP technique to assess the proposed screening programme prior to its implementation.

Following the standard procedure for WTP elicitation (Carson and Hanemann, 2005), detailed descriptions of FIT and colonoscopy were provided to subjects followed by WTP questions. The information included risk of developing CRC, process and effectiveness of FIT and colonoscopy and their complications. Pros and cons of FIT and colonoscopy were emphasised. FIT is non-invasive but less accurate. It requires annual testing. Colonoscopy is invasive but highly accurate. The screening frequency is once-in-10-year. Both annual FIT and 10-yearly colonoscopy are comparably effective (Zauber et al., 2009). To avoid bias, interviewers read out this information from the information sheet to subjects verbatim (Carson and Hanemann, 2005). Subjects could ask interviewers to clarify information unclear to them.

Subjects were then asked to state their WTP for FIT and colonoscopy. A combination of two elicitation methods was used in this study: double-bounded

dichotomous choice followed by open-ended question. The double-bounded dichotomous choice was employed prior to an open-ended question because it is relatively easy to answer (Champ et al., 2003). It involved asking two questions in sequence. First, subjects were asked whether they were willing to pay a hypothetic price for a screening test (the price was randomly drawn from a list of pre-specified figures: 37.5, 75, 150, 300, and 600 THB for FIT and 375, 750, 1500, 3,000, and 6,000 THB for colonoscopy). If they responded yes (no), the following question would be asked with a next higher (lower) price on the list. Then, subjects were asked to specify the maximum amount they were willing to pay for the screening (open-ended question). The reason for not directly using an open-ended question was a high level of non-response. The order of screening tests asked was randomised to minimise the ordering effect (i.e., overstating WTP for the first programme being asked) (Stewart et al., 2002). The pilot study had been conducted in 20 persons visiting the same clinic as study subjects.

Data analysis

The data analysis was performed using "epicalc" (Chongsuvivatwong, 2012) and "sampleSelection" (Toomet and Henningsen, 2008) package on R version 3.0.3 (R Core Team, 2014). WTP and characteristics of study subjects were summarised using descriptive statistics. WTP was also summarised with exclusion of zero values. Zero WTP could be interpreted that subjects perceived no benefit from the test. Inclusion of only those perceived positive benefit (stating non-zero WTP) suggested how potential screenees were willing to pay for it.

Our WTP data consisted of many zero values, which is not uncommon (Alberini and Cooper, 2000; Champ et al., 2003). Adopting the method in Woolridge (2012), a probit model (a type of generalised linear models for binary data) was applied to identify factors associated with a binary dependent variable (non-zero WTP versus zero WTP) followed by applying a linear regression to identify factors associated with levels of WTP with zero values excluded (Frew et al., 2001; Wooldridge, 2012).

A relationship between copayment and uptake was estimated using a quadratic function. The logarithmic transformation of copayment and odds of uptake rate were done to make their distributions approximately normal. These log transformed variables were used in a quadratic equation. An uptake rate at each copayment level was a proportion of subjects who were willing to pay equal or higher than that level of copayment.

In this study, quantity demanded was defined as odds of an uptake rate. Hence price elasticities of demand (ε)-i.e., measurement of individual's sensitivity to price change-could be estimated by taking partial derivatives of the quadratic equation with respect to the natural logarithm of copayment. A good is price inelastic-a percentage change in quantity demanded is lower than a percentage change in price-when ε lies between 0 to -1. If ε is less than -1, the good is considered price elastic-a percentage change in quantity demanded is higher than a percentage change in price. Finally, optimal copayments for both tests were estimated at $\varepsilon = 0$. When $\varepsilon = 0$, a change in price (copayment) does not affect quantity demanded (uptake).

Results

A total of 504 individuals satisfied the eligibility criteria. Of those, 437 agreed to participate in the study (response rate 86.7%). A majority of subjects were female. An average age was 58.4 years. Nearly half had a bachelor's degree or higher. Less than 5% perceived higher-than-average susceptibility to CRC, whereas 66.1% perceived lower-than-average. Selected characteristics of subjects were presented in Table 1.

Table 2 shows descriptive statistics of WTP (from all subjects and from subjects stated non-zero WTP). A greater percentage of subjects were willing to pay any positive amounts for FIT compared to colonoscopy (59.0% versus 46.5%). WTP for both tests was positively skewed; hence, median WTPs are reported. Among those willing to pay for the screening, median WTP was 300 THB for FIT and 3,000 THB for colonoscopy. Median WTP for both tests was higher than the proposed copayments (60 THB for FIT and 2,300 THB for colonoscopy).

Table 3 shows factors associated with non-zero WTP (binary variable) from a probit model. This model demonstrated factors associated with subjects perceiving positive benefit from the screening (as opposed to perceive no benefit). For FIT, knowing someone with CRC and presence of companion during hospital visits increased the likelihood of stating non-zero WTP. Those with presence of companion were also

Table 1. Characteristics of Study Subjects (n = 437)

Variable	Frequency (%)
Age group (years)	
50-54	119 (27.2)
55-59	138 (31.6)
60-64	111 (25.4)
65-69	69 (15.8)
Gender	
Male	183 (41.9)
Female	254 (58.1)
Education	
Grade 6 or below	116 (26.5)
Grade 7 - Grade 12	120 (27.5)
Bachelor's degree	143 (32.7)
> Bachelor's degree	58 (13.3)
Household income (THB)	
0-30,000	167 (39.9)
30,001-60,000	125 (29.8)
≥ 60,001	127 (30.3)
Perceived susceptibility to CRC	
Lower-than-average	289 (66.1)
Average	67 (15.3)
Higher-than-average	20 (4.6)
No opinion	61 (14.0)

THB, Thai baht; CRC, colorectal cancer

Table 2. Willingness to Pay (WTP) for FIT and Colonoscopy (THB)

Screening test	WTP			WTP (zero excluded)		
	N (%)	Median (Q1, Q3)	Skewness	N (%)	Median (Q1, Q3)	Skewness
FIT	437	150.0	3.84	258	300	3.52
	(100)	(0, 500)		(59.0)	(200, 700)	
Colonoscopy	437	0.0	3.46	203	3000	2.63
	(100)	(0, 2000)		(46.5)	(1000, 5000)	

FIT, fecal immunochemical test; THB, Thai baht; Q1, the first quartile; Q3, the third quartile

more likely to state non-zero WTP for colonoscopy. Female and family history of any cancers were associated with lower likelihood of stating non-zero WTP for colonoscopy.

Results from a linear regression are shown in Table 4. As WTP were highly skewed, the log transformed WTP (with exclusion of zero values) was used as a dependent variable. The effect of starting price (i.e., a price in the first question of double-bounded dichotomous questions) was adjusted for in models for both screening tests. For FIT, singles and frequent drinkers were willing to pay more for the test, whereas those with risk seeking attitude gave less WTP. Although the overall effect of education was insignificant, higher education tended to be associated with lower WTP. For colonoscopy, none of factors was statistically significant except the effect of starting price.

The effect of copayment on uptake rates is illustrated in Figure 1. Each line in the figure represents the fitted quadratic function. Both axes are in the logarithmic scale. Odds of uptake rates for both screening tests decreased as levels of copayment rose. The uptake rate of 59.8% was estimated from the equation for FIT at the proposed copayment of 60 THB. At the copayment of 2,300 THB for colonoscopy, the uptake rate of 21.6% was estimated.

Since quantity demanded (QD) was defined as odds of an uptake rate, price elasticity was obtained by taking partial derivatives of the quadratic equation with respect to the logarithm of copayment (copay) as shown in (1).

$$\varepsilon = \frac{d(Q_D)}{Q_D} \Big/ \frac{d(copay)}{copay} = \frac{\partial ln(Q_D)}{\partial ln(copay)} \qquad (1)$$

Resulting equations of price elasticities for FIT and colonoscopy are (2) and (3) respectively. At proposed copayments, price elasticity for FIT was -0.02. The price elasticity was -1.20 for colonoscopy. The demand for FIT was price inelastic, whereas the demand for colonoscopy was price elastic.

$$\varepsilon_{FIT} = 2.89 - 0.70 \cdot ln\ (copay) \qquad (2)$$

$$\varepsilon_{COL} = 4.66 - 0.76 \cdot ln\ (copay) \qquad (3)$$

Finally, optimal copayments were estimated by solving (2) and (3) at ε = 0. The optimal copayments were 62.1 THB for FIT and 460.2 THB for colonoscopy. The corresponding uptake rates would be 59.8% for FIT and 42.3% for colonoscopy, the maximum uptake rates according to the quadratic function.

Discussion

Nearly two thirds of subjects were willing to pay for FIT. Less than half of subjects were willing to pay for colonoscopy. Among them, median WTP for both tests was greater than the proposed copayments. Knowing CRC patient and presence of companion were associated with non-zero WTP for FIT. Presence of companion, female, and family history of cancer were associated with non-zero WTP for colonoscopy. In the linear model, marital status, drinking behavior, and risk attitude were associated with WTP. None of factors was significant for colonoscopy. At proposed copayments, the uptake rates of 59.8% and 21.6% were estimated for colonoscopy and FIT respectively. The demand for FIT was price inelastic; the demand for colonoscopy was price elastic. Estimates of optimal copayment were 62.1 THB for FIT and 460.2 THB for colonoscopy.

A copayment is a cost of screening to subjects; WTP represents subjects' perceived benefit in monetary terms. Accordingly, both screening tests were worth paying for because, on average, their benefit (WTP) offset the costs (copayments). Nevertheless, this study demonstrated that FIT would achieve nearly 60% of uptake. Yet the optimal copayment for colonoscopy would lead to less than 50% uptake. At the proposed copayment, the uptake would be only 21.6%. A study of

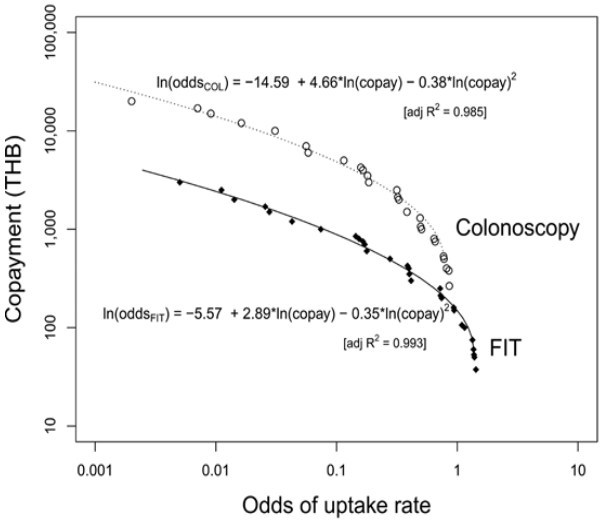

Figure 1. Relationship between Copayment and Odds of Uptake Rate (Both Axes in Logarithmic Scale). Note. FIT; fecal immunochemical test; COL; colonoscopy; THB; Thai baht; copay; copayment; oddsFIT; odds of uptake rate of FIT; oddsCOL; odds of uptake rate of colonoscopy.

Table 3. Results from a Probit Model

Variable	FIT		Colonoscopy	
	Estimate/S.E.	P-value	Estimate/S.E.	P-value
(Constant)	0.47/0.31	0.126	0.36/0.30	0.227
Age (years)		0.338		0.373
50-54	Reference		Reference	
55-59	0.10/0.17		-0.01/0.17	
60-64	0.07/0.18		-0.08/0.18	
65-69	-0.26/0.21		-0.35/0.22	
Gender		0.221		0.027*
Male	Reference		Reference	
Female	-0.17/0.14		-0.30/0.14*	
Education		0.618		0.639
Grade 6 or below	Reference		Reference	
Grade 7 - Grade 12	-0.22/0.19		-0.10/0.19	
Bachelor's degree	-0.10/0.22		0.14/0.22	
> Bachelor's degree	-0.26/0.27		0.003/0.27	
Monthly household income (THB)		0.690		0.292
0-30,000	Reference		Reference	
30,001-60,000	0.12/0.18		-0.07/0.18	
≥ 60,001	0.16/0.20		0.20/0.20	
Public insurance scheme		0.336		0.299
UCS	Reference		Reference	
SSS	0.36/0.31		0.20/0.30	
CSMBS	-0.12/0.19		-0.24/0.19	
Cannot specify	0.16/0.60		-0.25/0.61	
Family history of cancer (any types)		0.931		0.027*
No	Reference		Reference	
Yes	-0.01/0.15		-0.33/0.15*	
Knowing someone with CRC		0.021*		0.525
No	Reference		Reference	
Yes	0.37/0.16*		0.10/0.16	
Perceived susceptibility to CRC		0.513		0.117
Lower-than-average	Reference		Reference	
Average	0.10/0.18		0.29/0.18	
Higher-than-average	0.48/0.33		0.61/0.31	
No opinion	-0.002/0.19		0.01/0.19	
Presence of companion during hospital visits		0.026*		0.050*
No	Reference		Reference	
Yes	0.30/0.13*		0.26/0.14*	
Out-of-pocket healthcare expenditures was paid by whom		0.186		0.259
By other	Reference		Reference	
By oneself	-0.27/0.20		-0.22/0.20	
Traveling time to the hospital (minutes)		0.612		0.853
≤ 30	Reference		Reference	
30-60	-0.16/0.17		-0.06/0.17	
≥60	0.03/0.22		0.05/0.16	
McFadden's pseudo R^2	0.049		0.057	

WTP, willingness to pay; FIT, fecal immunochemical test; S.E., standard error; THB, Thai baht; UCS, Universal Coverage Scheme; SSS, Social Security Scheme; CSMBS, Civil Servant Medical Benefit Scheme; CRC, colorectal cancer

Table 4. Results from a Linear Model

Variable	FIT		Colonoscopy	
	Estimate/S.E.	P-value	Estimate/S.E.	P-value
(Constant)	3.89/0.34*	< 0.001*	3.47/0.48*	< 0.001*
Age (years)		0.815		0.700
50-54	Reference		Reference	
55-59	-0.07/0.13		-0.15/0.14	
60-64	0.02/0.14		-0.03/0.17	
65-69	0.06/0.17		-0.03/0.20	
Gender		0.241		0.831
Male	Reference		Reference	
Female	-0.15/0.13		-0.03/0.14	
Education		0.060		0.100
Grade 6 or below	Reference		Reference	
Grade 7 - Grade 12	-0.04/0.14		0.25/0.16	
Bachelor's degree	-0.36/0.16*		0.36/0.18	
> Bachelor's degree	-0.45/0.21*		0.04/0.24	
Monthly household income (THB)		0.197		0.857
0-30,000	Reference		Reference	
30,001-60,000	-0.03/0.14		0.08/0.16	
≥ 60,001	0.20/0.16		0.09/0.18	
Marital status		0.049*		0.533
Married	Reference		Reference	
Single	0.58/0.27*		-0.17/0.35	
Separated	-0.54/0.33		-0.45/0.37	
Widowed	0.13/0.19		0.14/0.23	
Public insurance scheme		0.792		0.055
UCS	Reference		Reference	
SSS	0.15/0.21		-0.21/0.23	
CSMBS	0.13/0.14		0.20/0.17	
Cannot specify	-0.09/0.47		-0.91/0.58	
Having private insurance plan		0.228		0.127
No	Reference		Reference	
Yes	0.14/0.12		0.20/0.13	
Alcohol consumption frequency		0.023*		0.800
Never	Reference		Reference	
Occasionally	-0.16/0.21		-0.14/0.24	
Every week	0.37/0.16*		0.02/0.16	
Perceived susceptibility to CRC		0.373		0.196
Lower-than-average	Reference		Reference	
Average	-0.08/0.14		0.20/0.15	
Higher-than-average	0.20/0.21		-0.02/0.23	
No opinion	-0.19/0.15		-0.23/0.17	
Risk attitude towards health loss		0.029*		0.785
Aversion	Reference		Reference	
Neutral	-0.18/0.19		-0.10/0.22	
Seeking	-0.29/0.11*		-0.08/0.12	

Table 4. Continued

Variable	FIT		Colonoscopy	
	Estimate/S.E.	P-value	Estimate/S.E.	P-value
Last year out-of-pocket payment for healthcare (THB)		0.191		0.111
none	Reference		Reference	
1-5,000	0.15/0.11		0.24/0.12*	
≥ 5,001	0.27/0.19		0.19/0.20	
WTP questions were asked first for		0.089		0.929
FIT	Reference		Reference	
Colonoscopy	-0.17/0.10		-0.01/0.11	
First price used in the double-bounded dichotomous choice question (log transformed)	0.45/0.05*	< 0.001*	0.54/0.06*	< 0.001*
Adjusted R^2	0.295		0.392	

WTP, willingness to pay; FIT, fecal immunochemical test; S.E., standard error; THB, Thai baht; UCS, Universal Coverage Scheme; SSS, Social Security Scheme; CSMBS, Civil Servant Medical Benefit Scheme; CRC, colorectal cancer.

community-based screening programme in Hong Kong reported an uptake rate similar to our estimate: about 60% of participants chose FIT as a screening test (Wong et al., 2012). This preference of FIT over colonoscopy was demonstrated in previous studies (Quintero et al., 2012; Saengow et al., 2015). Both screening tests were value for money at the proposed copayments. Nevertheless, FIT would achieve considerably higher uptake.

The positive influence of companion was demonstrated for both tests. Possible explanations might be either a companion encouraged subjects to visit the hospital in the first place or having a companion during the hospital visit was socially favourable. Subjects therefore had a more positive attitude towards whatever offered at the hospital. Knowing someone with CRC was positively associated with non-zero WTP for FIT. This might indicate subject's awareness and knowledge about preventability of the disease. Previous literature reported the similar finding (Frew et al., 2001; Rees et al., 2008). Informing public regarding the disease and its preventability would improve the uptake for FIT.

For colonoscopy, family history of any types of cancer had a negative effect. As the effect of knowing CRC patient already adjusted in the model, this factor indeed reflected familiarity with cancers other than CRC. Since few cancers can be effectively screened for, familiarity with less preventable cancers might make subjects perceive less benefit from the screening. Provision of information regarding benefit from CRC screening might increase uptake for colonoscopy. An effect of gender was consistent with previous studies: females were less likely to undergo endoscopic screening (Codori et al., 2001; Robb et al., 2004; Molina-Barcelo et al., 2011).

The results showed that singles stated higher WTP for FIT. A recent survey of individuals aged 60 and above in Thailand reported that participants preferred their children or spouses to be their caregivers (Manonuek, 2014). As singles had no children and spouses, they would invest more in preventive healthcare to delay their future disabilities. The effect of marital status on CRC screening utilisation was mixed in previous studies (Brenes and Paskett, 2000; Thrasher et al., 2002; Zapka et al., 2002; Robb et al., 2004). Alcohol is a well-known risk factor for colorectal cancer (Rehm et al., 2009). Frequent drinkers might have this knowledge and would like to pay more for the screening. Lesser WTP in those with risk-seeking attitude reflected their willingness to take future risk rather than screening for it at present.

A copayment was a price of the screening to subjects. The uptake rate was a demand for the screening. Therefore, a negative effect of copayment on uptake followed the law of demand. The uptake for FIT was nearly 60% and that was just above 20% for colonoscopy at the proposed copayment levels. A reduction of copayment to an optimal level for colonoscopy (460.2 THB) might boost the uptake to 42.3%. However, this was still considerably lower than uptake of FIT. Our results supported using FIT as a screening tool because it would achieve a higher uptake rate. It was worth notice that our estimates of uptake for both tests were still lower than the target of 70% recommended by the World Health Organization (WHO) (Organization, 2007).

Previous studies reported that price elasticities for healthcare concentrated around -0.2 (Newhouse and Group, 1993; Ringel et al., 2002). Preventive care had a higher price elasticity (-0.17 to -0.43) (Newhouse and Group, 1993). In this study, the price elasticity for FIT was consistent with those findings. For colonoscopy, the price elasticity was lower than -1, which was price inelastic. Its relatively high cost might be an explanation. Although both screening tests were preventive care, a copayment for colonoscopy was substantially higher. When colonoscopy was relatively expensive, its substitutes would become more attractive. FIT is obviously a substitute for colonoscopy. Moreover, price elasticities for health services are closer to zero at the smaller cost (Ringel et al., 2002).

There were two major limitations in this study. As the study was conducted at the healthcare facility, all subjects were apparently seeking healthcare. Hence,

this study could overestimate the uptake rates. The other limitation was that subjects' actual WTP would be different from what they stated during the interview. Any attempts to assess a programme before its implementation faced this challenge.

The findings from this study have a number of implications in design and implementation of the proposed screening programme. To achieve a high uptake rate, FIT was preferred to colonoscopy. The optimal copayments were 62.1 THB for FIT and 460.2 THB for colonoscopy. At this level, the uptake rates were at the maximum: 59.8% (FIT) and 42.3% (colonoscopy). Informing about the disease and benefit of the screening would increase the uptake.

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