

Determining Optimal Cut-Off Point of Immunochemical Fecal Occult Blood Test for Population-based colorectal cancer screening with Cost-Effectiveness Analysis

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2008/06/06

Map of Taiwan

Keelung community-based integrated screening (KCIS) has started since 1999



Community-Based Multiple Screening Model

*Design, Implementation, and Analysis of 42,387 Participants
Taiwan Community-Based Integrated Screening Group*

Cancer 2004;100:1734-43.

KCIS subjects
Age ≥ 30 yrs

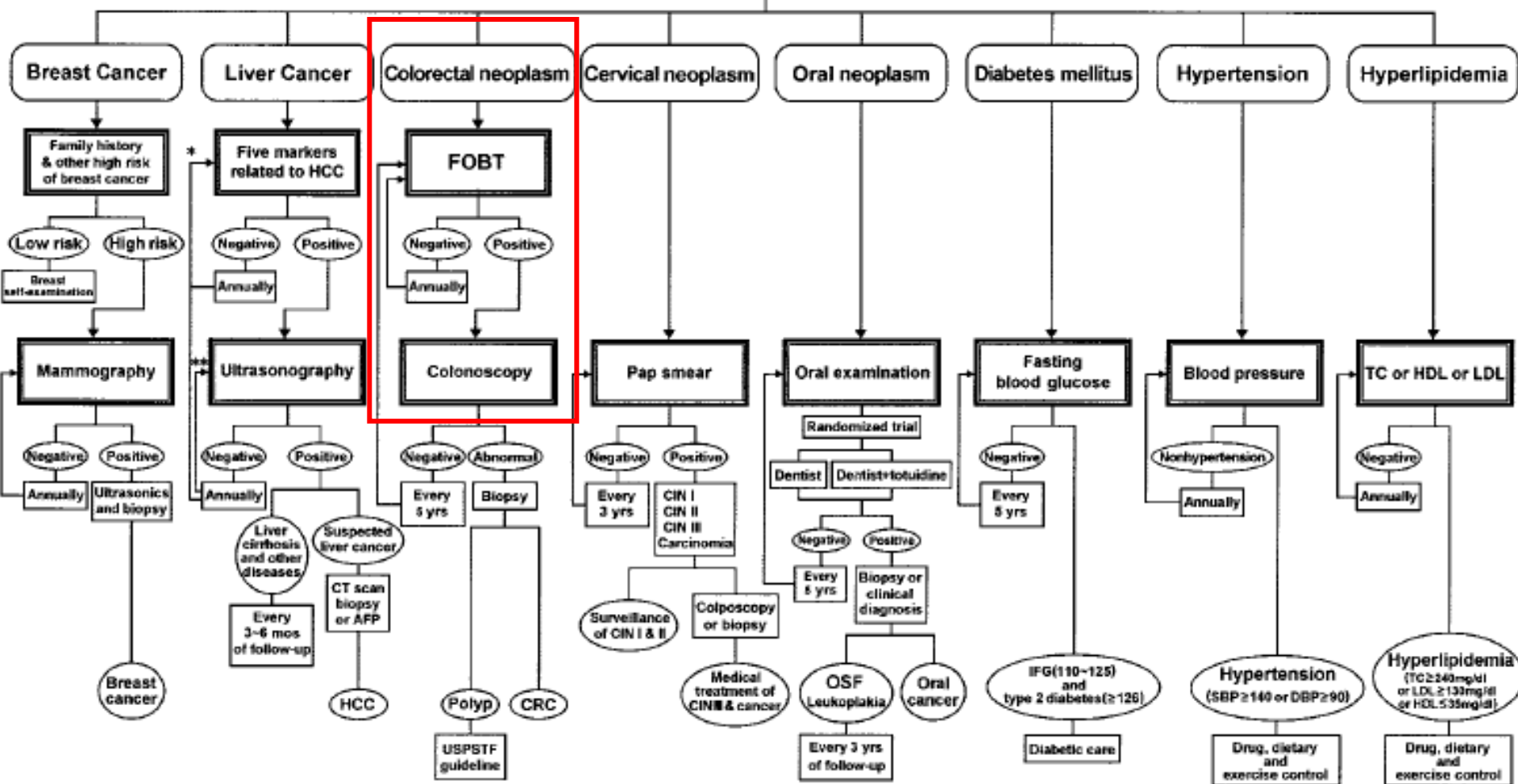
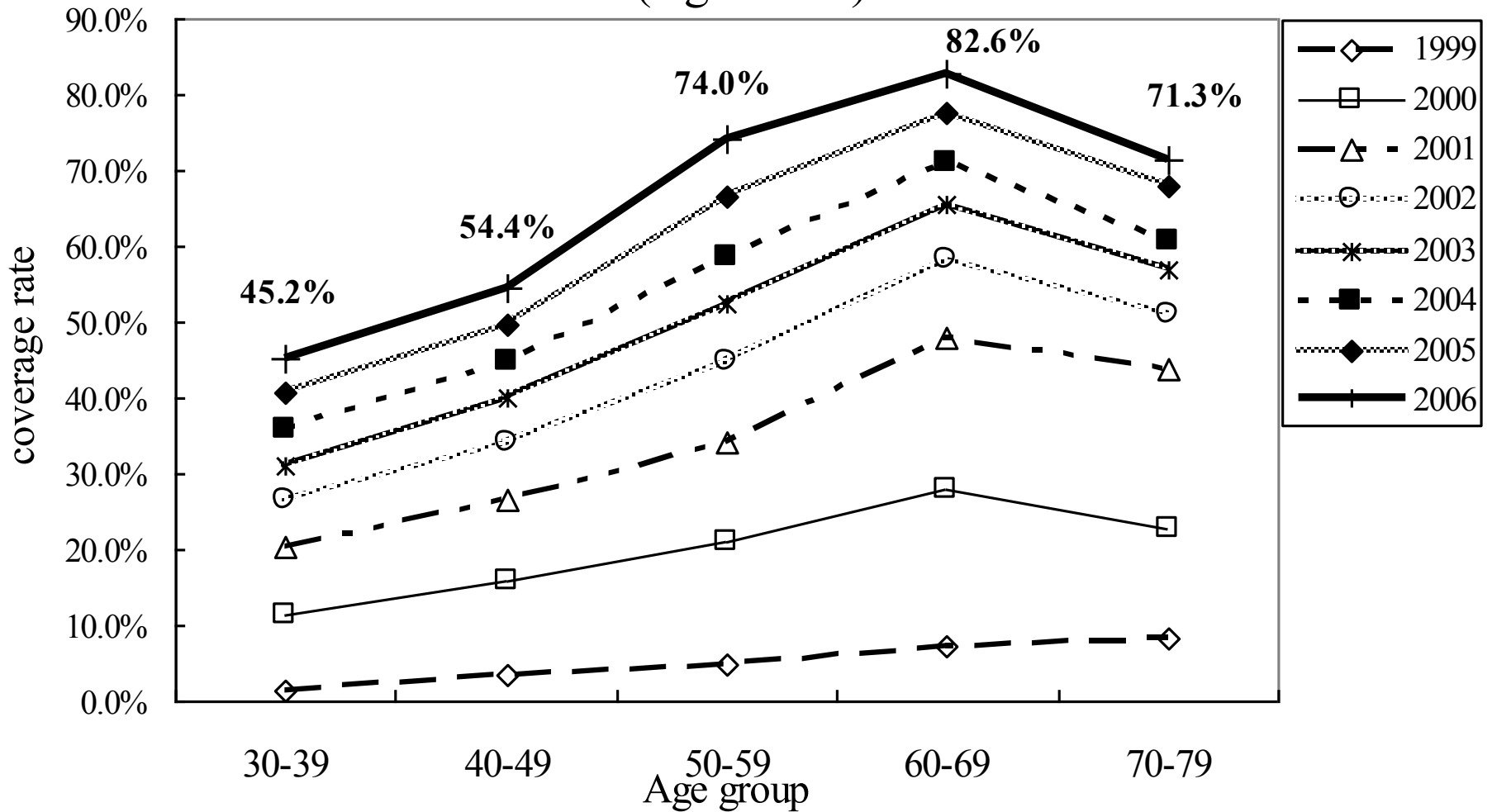


Fig. 3. Coverage rate of KCIS program by Year, 1999-2006
(Age 30-79)



Community-based FOBT Screening



Out-reaching screening



Instruction for FOBT



Scheduled Referral



Health Education

Colorectal cancer screening with faecal occult blood test within a multiple disease screening programme: an experience from Keelung, Taiwan

Kuo-Ching Yang, Chao-Sheng Liao, Yueh-Hsia Chiu, Amy Ming-Fang Yen and Tony Hsiu-Hsi Chen

J Med Screen 2006;13 (Suppl 1):S8-S13

**FOBT
compliance rate**

**Colonoscopy
referral rate**

JMS 2006,13: S8-S13

Table 1 Numbers of invitees and compliers by age groups in the Keelung programme, 2000–2002

	Number invited to screen	Number of compliers	Compliance rate (%)
First screening			
50–59	10,426	8750	84
60–69	9374	7736	83
70–79	6208	4835	78
Total	26,008	21,321	82

Table 2 Rates of positive FOBTs and compliance with follow-up colonoscopy in the Keelung programme, 2000–2002

	Number screened	Number of positive FOBT (%)	Number attending colonoscopy	Colonoscopy attendance rate (%)
First screening				
50–59	8750	393 (4.5%)	270	69
60–69	7736	448 (5.8%)	323	72
70–79	4835	353 (7.3%)	223	63
Total	21,321	1194 (5.6%)	816	68

Colorectal cancer screening: A comparison of 35 initiatives in 17 countries

Victoria S. Benson¹, Julietta Patnick^{1,2}, Anna K. Davies³, Marion R. Nadel⁴, Robert A. Smith⁵
and Wendy S. Atkin^{6*} on behalf of the International Colorectal Cancer Screening Network

¹*Cancer Epidemiology Unit, University of Oxford, England, United Kingdom*

²*NHS Cancer Screening Programmes, Fulwood House, Sheffield, England, United Kingdom*

³*Department of Clinical Health Psychology, University College London, England, United Kingdom*

⁴*Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, GA*

⁵*Cancer Control Department, American Cancer Society, Atlanta, GA*

⁶*Cancer Research UK Colorectal Cancer Unit, St Mark's Hospital, NW London Hospitals Trust, Harrow, Middlesex, England, United Kingdom*

Taiwan ³	Pilot	FOBT	Keelung Community-based Integrated Screening	Kelung, Northern Taiwan	Resident population	50–79	81,000	LG
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Australia (Pilot)	Pilot	I	Magstream HemS, Inform	Biennial	2	2	No
Japan	Program	I	Not specified	Annual	2	2	No
Taiwan ²	Pilot	I	Eiken	Annual	1	1	No

Map of Taiwan

Keelung community-based integrated screening (CIS) has started since 1999

19/23 counties in Taiwan have adopted CIS



Nationwide FOBT screening

免費大腸癌篩檢服務

岡山秀傳醫院關心您的健康 本院為國民健康局指定配合醫院

關心提醒
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家他們的
健康查

篩檢對象

父母兄弟姊妹等
一等血親有罹患大腸癌之高危險群民眾

篩檢年齡

需年滿 50 歲以上到 69 歲 (25 年次 ~ 44 年次)

篩檢日期

即日起至 94 年 12 月 31 日

注意事項

1. 檢查者需檢附大腸癌家屬之診斷書
2. 可證明一等血親關係之文件影本

(雙方身份證正反影本或戶口名簿影本)

大腸直腸癌是國人十大癌症死因第三位，

根據研究，家族中一等血親如有大腸癌，自己也罹患大腸癌的機率，
將是沒有家族史的兩倍！

主辦單位：行政院衛生署國民健康局

承辦單位：高雄縣立岡山醫院（委託秀傳紀念醫院經營）

諮詢專線：07-6222131 轉 130.161

- 50~69 years of age
- Mass media
- Ambulatory propaganda
- Immunological FOBT
- Web-based referral and surveillance



Attendance rate

Jan 2004 - Oct 2006

	Age group	Invited	Screened	Percentage (%)
Male	50-54	73,681	71,881	97.56
	55-59	66,354	64,935	97.86
	60-64	58,082	56,755	97.72
	65-69	76,345	74,613	97.73
		274,462	268,184	97.71
Female	50-54	144,506	141,390	97.84
	55-59	115,121	112,962	98.12
	60-64	92,961	91,026	97.92
	65-69	97,954	95,666	97.66
		450,542	441,044	97.89
Both gender	50-54	218,187	213,271	97.75
	55-59	181,475	177,897	98.03
	60-64	151,043	147,781	97.84
	65-69	174,299	170,279	97.69
Unknown		726	700	96.42
Overall		725,730	709,928	97.82

Positive rate and referral rate

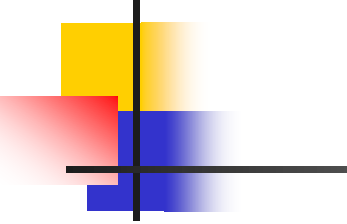
Jan 2004 - Oct 2006

	Age group	Screened	FOBT (+)	Positive rate (%)	No. referred	Referral rate (%)
Male	50-54	71881	2617	3.64	1885	72.03
	55-59	64935	2808	4.32	2030	72.29
	60-64	56755	3029	5.34	2257	74.51
	65-69	74613	4332	5.81	3190	73.64
		268184	12786	4.77	9362	73.22
Female	50-54	141390	3863	2.73	2826	73.16
	55-59	112962	3563	3.15	2648	74.32
	60-64	91026	3409	3.75	2570	75.39
	65-69	95666	3961	4.14	2866	72.36
		441044	14796	3.35	10910	73.74
Both gender	50-54	213271	6480	3.04	4711	72.70
	55-59	177897	6371	3.58	4678	73.43
	60-64	147781	6438	4.36	4827	74.98
	65-69	170279	8293	4.87	6056	73.03
Unknown		700	21	3.00		61.90
Overall		709928	27603	3.89	20285	73.49



Quantitative assay of iFOBT

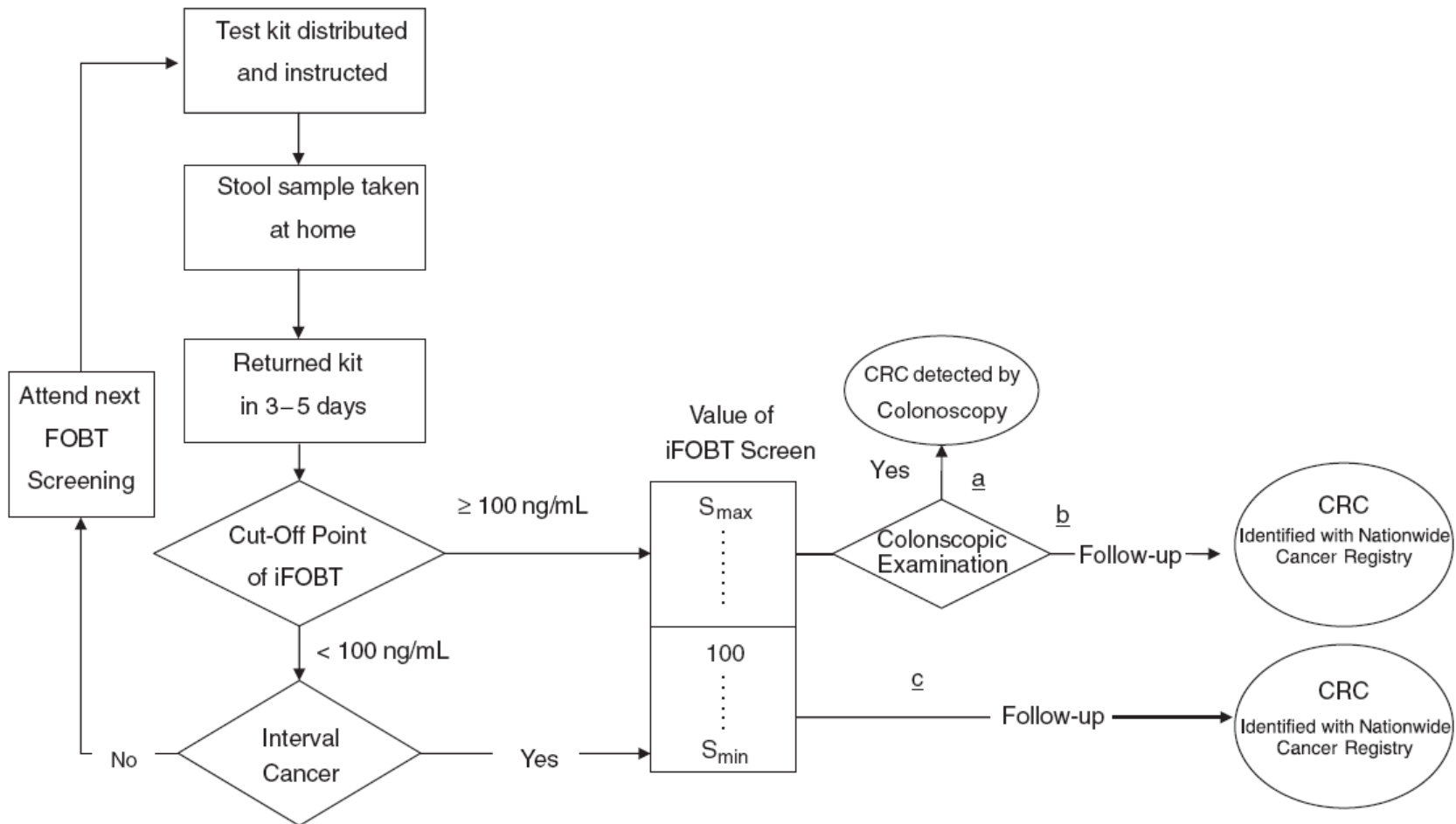
- Determining the optimal cut-off of iFOBT by receiver operating characteristics (ROC) curve and cost-effectiveness analysis with **deterministic** and **probabilistic** approach



Cut-off	True CRC	
	Yes	No
$\geq x$	a	b
$< x$	c	d

- Are c and d available from population-based screening ?
- Solution: Assume interval cancer as false negative cases

Procedure for collecting iFOBT sample and relating the value of iFOBT to CRC

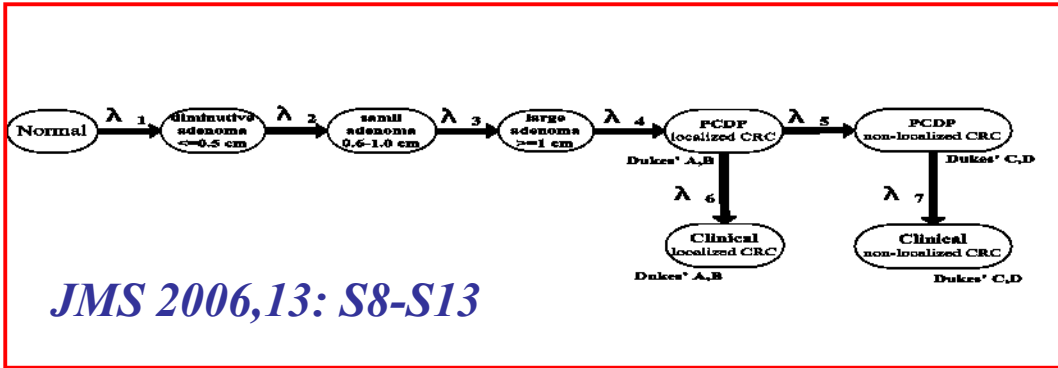
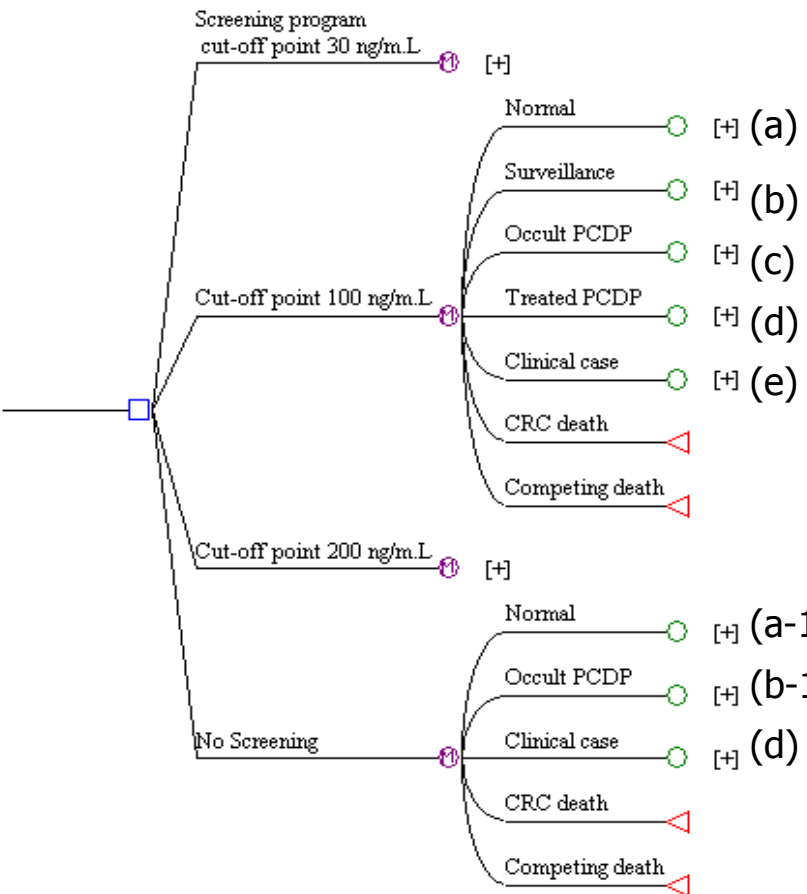




KCIS data

- Data Source: Colorectal cancer screening in KCIS program during the period of 2000 to 2004
- There are 36,145 subjects attended in first screening and 19,020 subjects attended in later screening and 11 CRC detected.

Markov Cycle Decision tree used to evaluate cost-effectiveness of alternative screening for CRC given different cut-off point of FOBT opposed to no screening

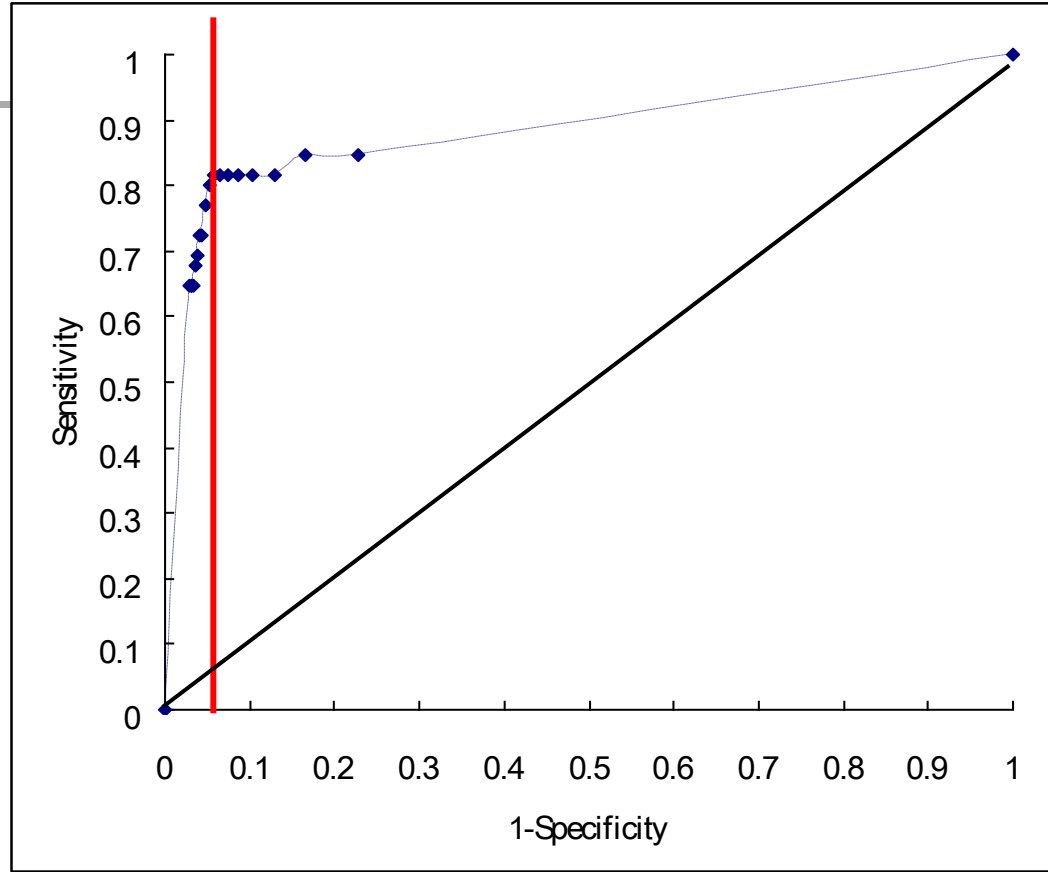


JMS 2006,13: S8-S13

Determining the optimal cut-off point of iFOBT for colorectal cancer screening by ROC

The ROC curve was derived by plotting 1specificity (X) against sensitivity (Y) given a series of cut-offs of iFOBT

The closer the ROC curve to the upper-left corner, the higher the predictive power for predicting CRC



AUC:0.87

Chen LS et al. J Med Screen 2007;14:191-199

Cost-effectiveness analysis for determining optimal cut-off of immunochemical faecal occult blood test for population-based colorectal cancer screening (KCIS 16)

Li-Sheng Chen, Chao-Sheng Liao, Shu-Hui Chang, Hsin-Chih Lai and Tony Hsiu-Hsi Chen

J Med Screen 2007;14:191-199

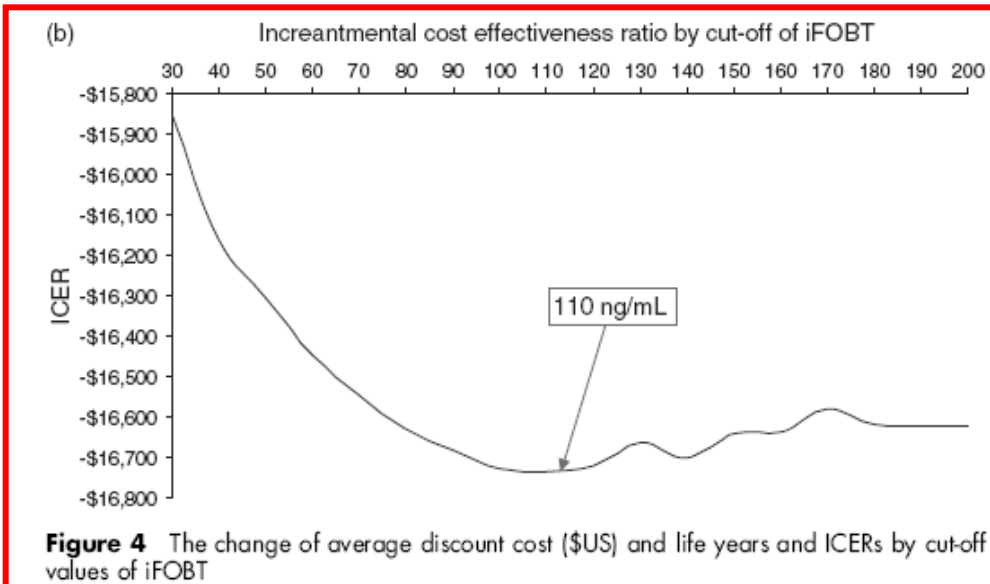
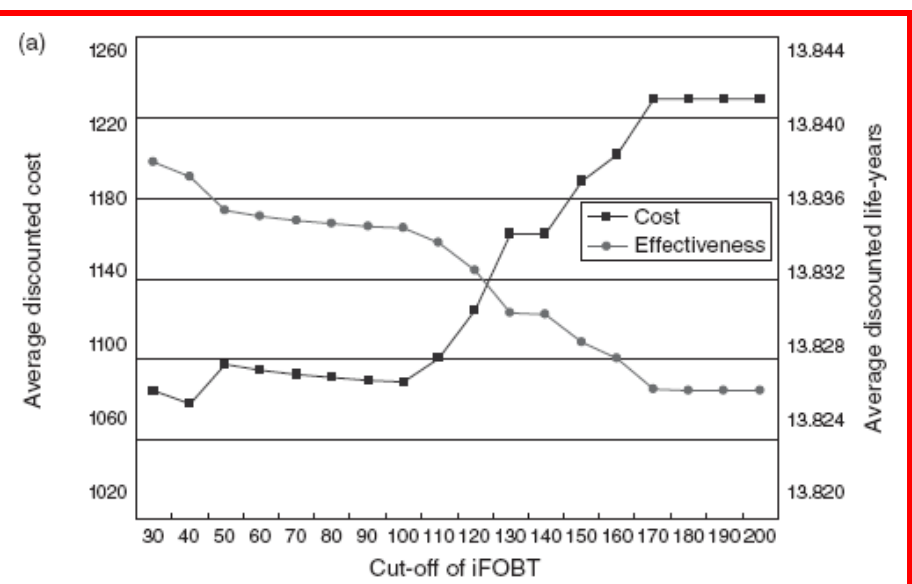
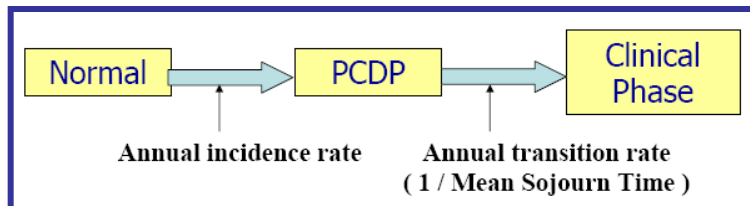


Figure 4 The change of average discount cost (\$US) and life years and ICERs by cut-off values of iFOBT

Probability for interval cancer and screen detected CRC for FOBT < 100 ng/mL

λ_1 :Annual incidence rate
 λ_2 :Annual transition rate

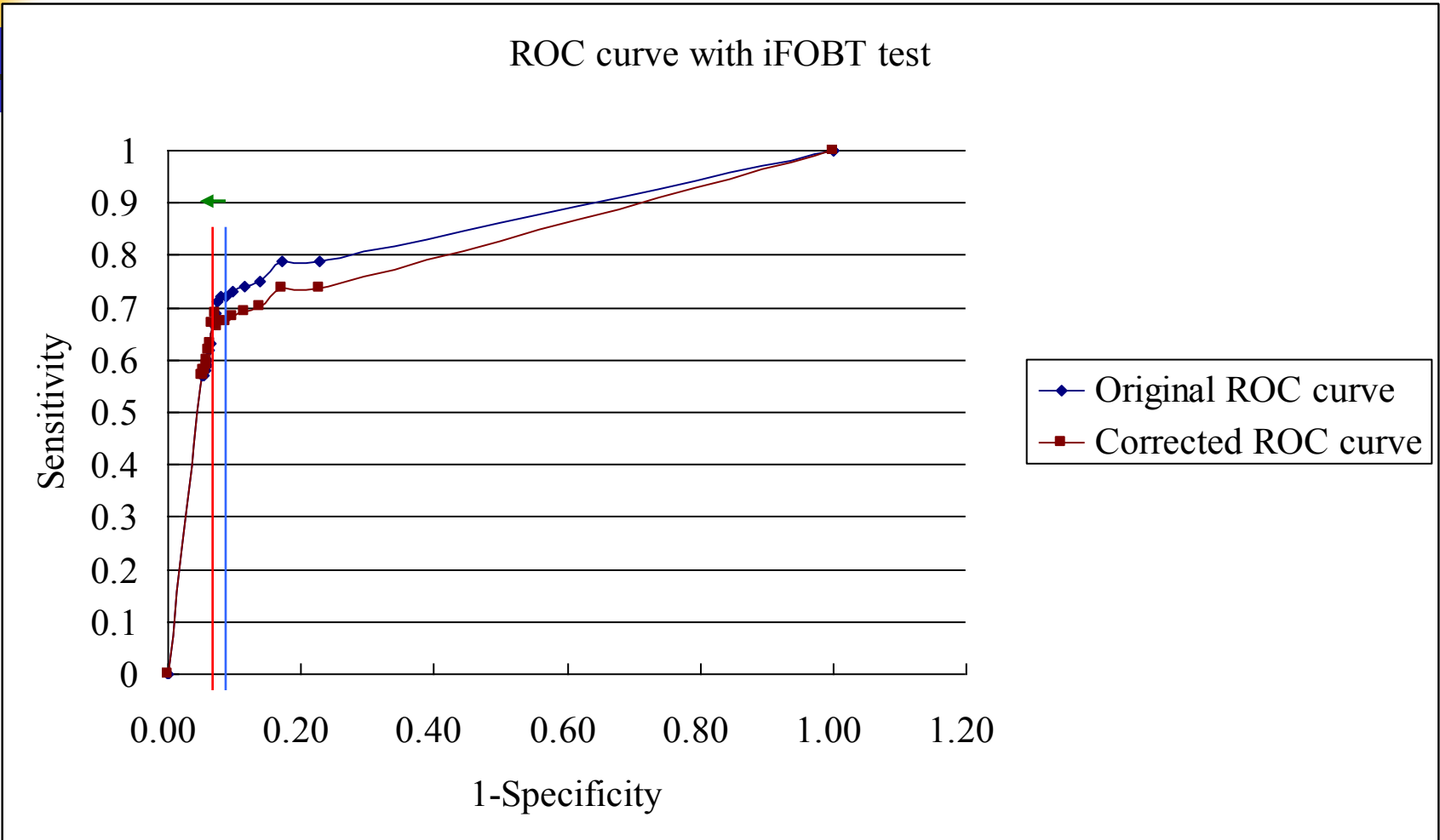


S: Calendar time before screening
Age: Age at first screening
u: Calendar time between screens
t: Time interval between screens
X: Calendar time at Later Screening

Transition Rates for tumour from FOBT < 100 ng/mL

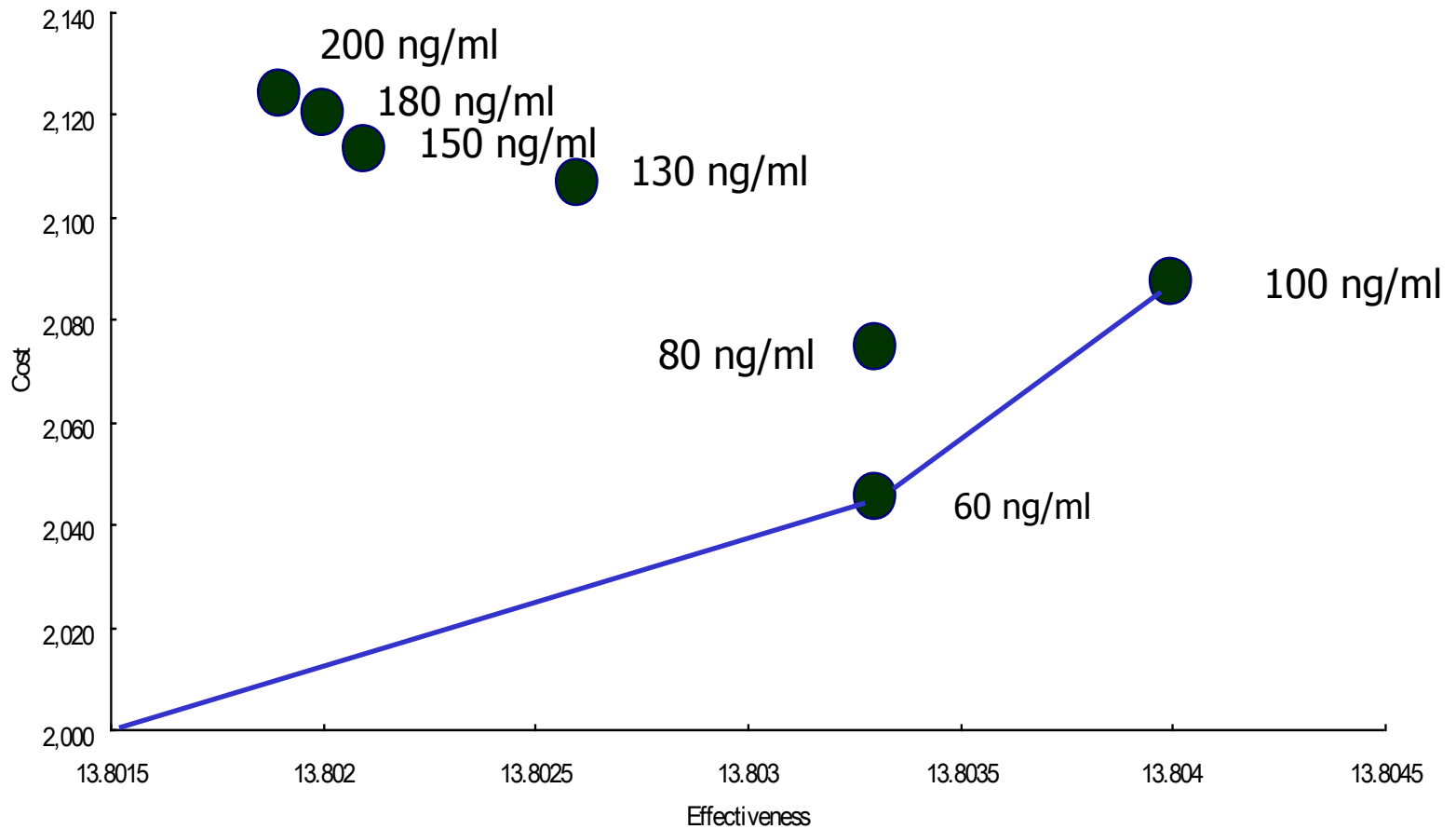
Parameter	Estimation	Lower	Upper
λ_1	0.00031 (per person-year)	0.000162	0.000458
λ_2	0.1116 (per year)	0.07681	0.1463

ROC curve corrected by multi-state model

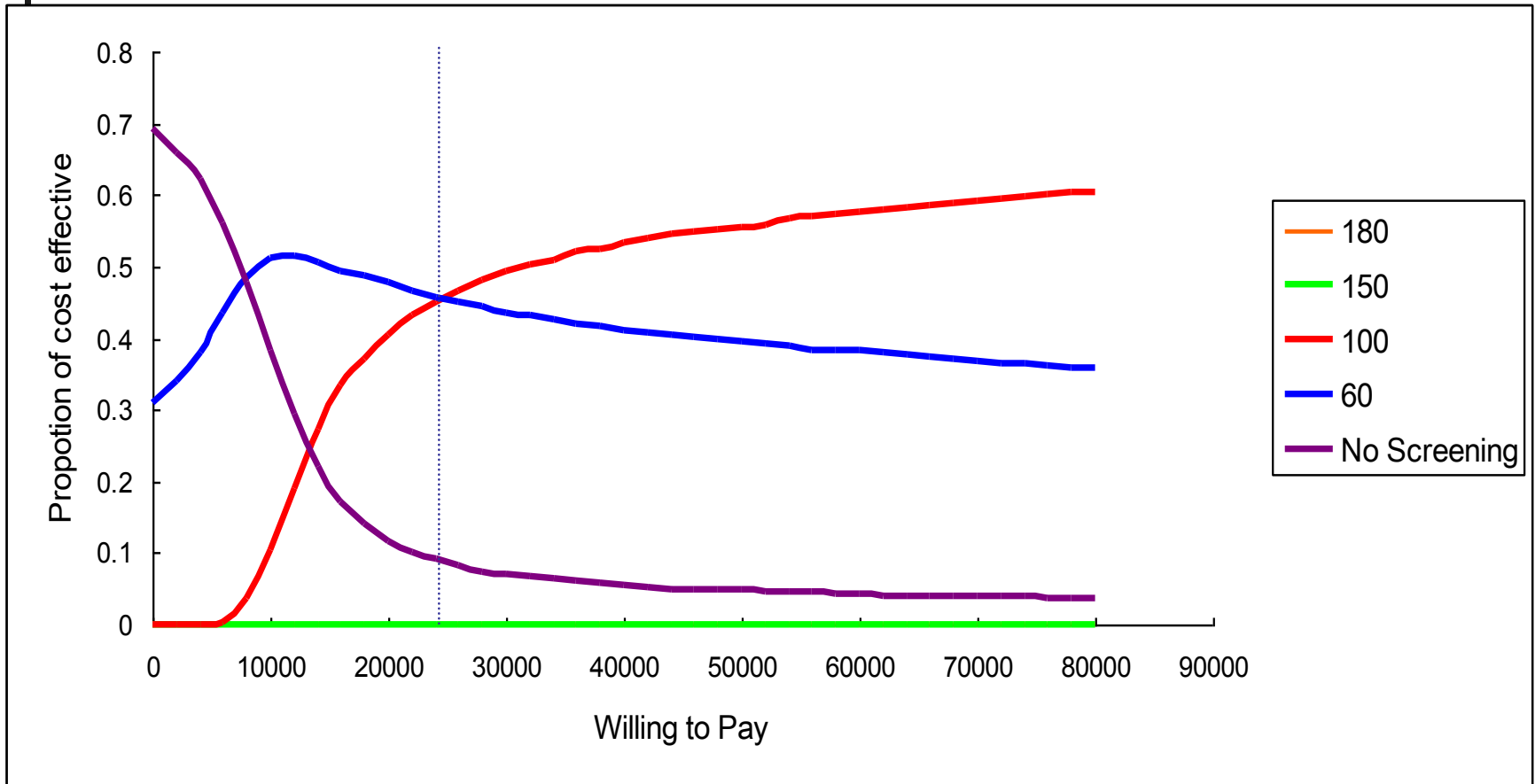


Optimal cut-off point from 90 ng/ml to 100 ng/ml

Cost Effectiveness Plane



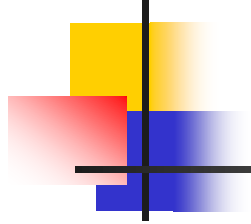
Acceptability Curve



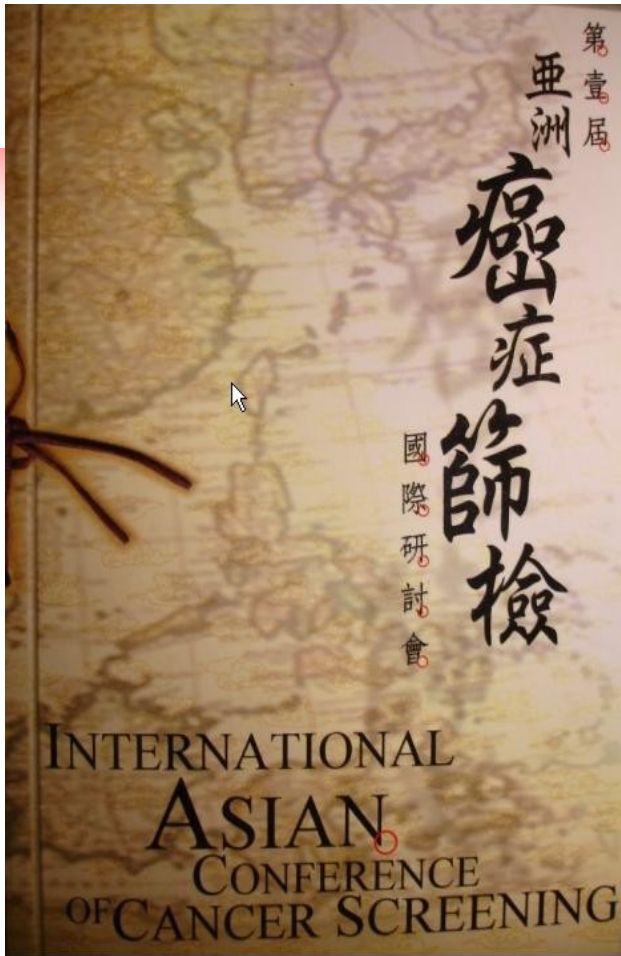


Conclusion

- The optimal cut-off based on multi-state ROC method is 100 ng/mL
- Probabilistic CEA approach suggest the optimal cut-off is determined by “how much society or individual are willing to pay (WTP)”.



International Asian Conference of Cancer Screening (IACCS)



Keelung City, Taiwan, 2004

指導單位：  行政院衛生署國民健康局

主辦單位：  台灣篩檢學會



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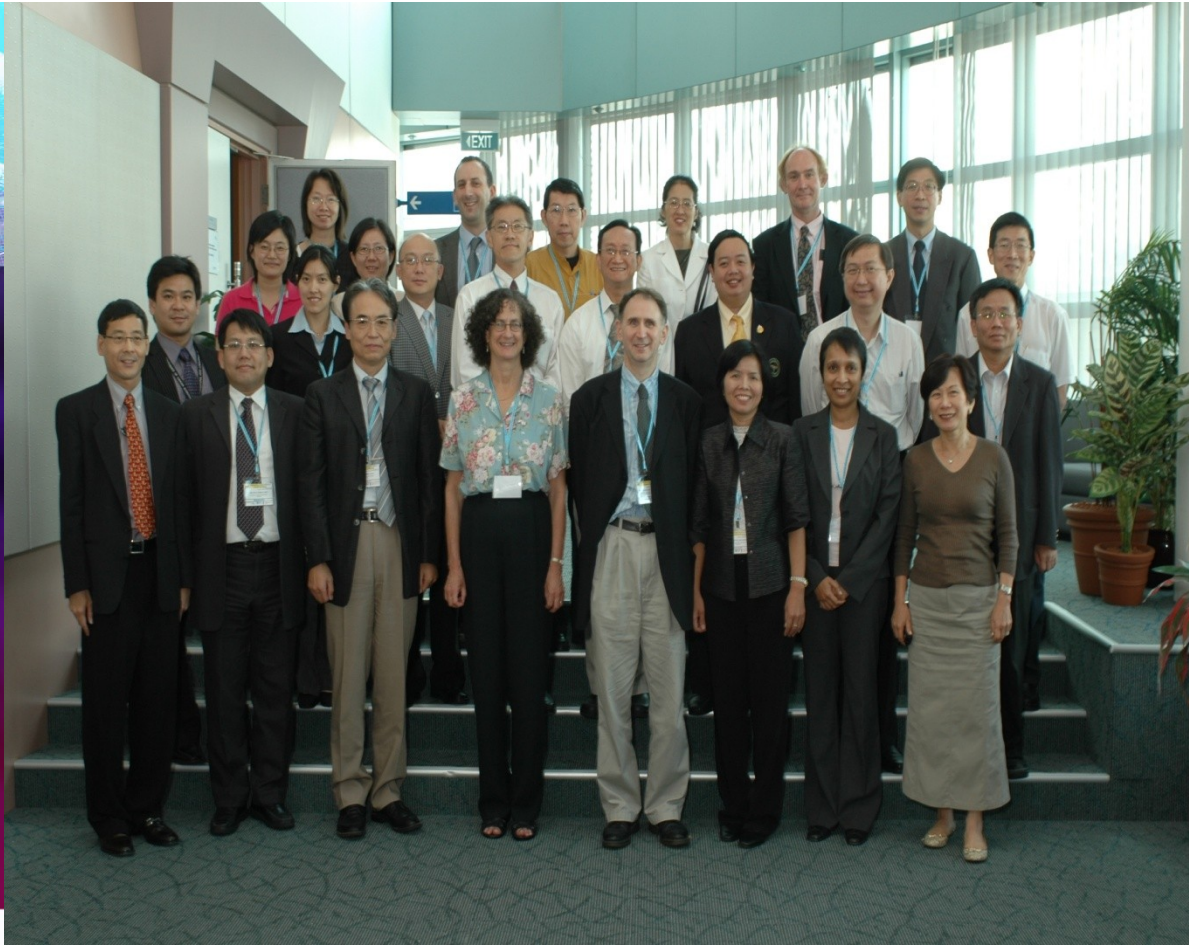
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Quality, Trends and Policy Issues

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Thank you for listening
