

보건의료 부문 비용-효과 분석

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김태현

비용-효과 분석: 경제성 평가 기법 중 하나

- 경제성 평가
 - 투입 vs. 산출
 - 보건 의료 부문의 각종 프로그램, 의료기술, 약품 등에 투입된 비용과 그 결과(산출)를 비교
 - 경제적 효율성을 평가
- 비교
 - 선택의 대상이 될 수 있는 여러 가지 대안(alternatives)을 비교 분석

경제성평가의 주된 목적

- 서로 다른 대안들 간의 우선순위를 결정하는 경우
- 의약품을 포함한 의료기술의 도입에 따른 경제적 가치를 평가
- 신기술이 비용에 상응하는 가치를 갖고 있는지에 대한 관심이 증가
 - 신기술 경제성 평가의 핵심은 비용이 저렴한 기술을 찾는 것이 아니라,
 - 기술의 효과가 비용에 상응하는 가치를 갖고 있는지,
 - 즉 비용을 정당화시켜줄 수 있을 정도로 효과를 가지는 지를 평가하는 것임(건강보험심사평가원. 의약품 경제성평가지침. 2006)

비용-효과 분석(Cost-effectiveness Analysis)

- 가정
 - 여러 가지 보건의료 프로그램의 효과의 성격은 동일하지만 성취수준이 다른 경우
- 의사결정
 - 단위 효과당 최소의 비용이 드는 대안 선택
 - 자연단위(natural unit) 효과
 - life-years saved,
 - mmHg BP reduced,
 - number of patients detected,
 - symptom-free days

비용-효과 분석의 예

- 국가건강검진 항목 중 이상지질혈증 검진의 비용 효과 분석 (2015년)
- 국가건강검진 항목 중 고혈압 검진의 비용 효과 분석 (2016년)
- 심장질환 고위험군 대상 혈압 집중 관리 전략의 경제성
 - Standard Blood Pressure Control vs. Intensive Blood Pressure Control

Cost-Effectiveness Analysis for National Dyslipidemia Screening Program in Korea: Results of Best Case Scenario Analysis Using a Markov Model

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Background: This study evaluated the cost-effectiveness of 21 different national dyslipidemia screening strategies according to total cholesterol (TC) cutoff and screening interval among 40 years or more for the primary prevention of coronary heart disease over a lifetime in Korea, from a societal perspective.

Methods: A decision tree was used to estimate disease detection with the 21 different screening strategies, while a Markov model was used to model disease progression until death, quality-adjusted life years (QALYs) and costs from a Korea societal perspective.

Results: The results showed that the strategy with TC 200 mg/dL and 4-year interval cost ₩4,625,446 for 16.65105 QALYs per person and strategy with TC 200 mg/dL and 3-year interval cost ₩4,691,771 for 16.65164 QALYs compared with ₩3,061,371 for 16.59877 QALYs for strategy with no screening. The incremental cost-effectiveness ratio of strategy with TC 200 mg/dL and 4-year interval versus strategy with no screening was ₩29,916,271/QALY. At a Korea willingness-to-pay threshold of ₩30,500,000/QALY, strategy with TC 200 mg/dL and 4-year interval is cost-effective compared with strategy with no screening. Sensitivity analyses showed that results were robust to reasonable variations in model parameters.

Conclusion: In this study, revised national dyslipidemia screening strategy with TC 200 mg/dL and 4-year interval could be a cost-effective option. A better understanding of the Korean dyslipidemia population may be necessary to aid in future efforts to improve dyslipidemia diagnosis and management.

Keywords: Cost; Dyslipidemia; Effectiveness; Screening

INTRODUCTION

Recent changes in dietary patterns, physical inactivity, lifestyle modification, and increasing cholesterol level of the Asian population raise a concern about the increasing burden of cholesterol related diseases such as coronary heart disease (CHD) in the population [1,2]. Dyslipidemia caused by an accumulation of cholesterol in the blood is a disorder of lipid metabolism, including elevated total cholesterol (TC), elevated triglyceride (TG), elevated low-density lipoprotein cholesterol (LDL-C), and decreased high-density lipoprotein cholesterol (HDL-C).

The National Cholesterol Education Program criteria defines

dyslipidemia as having one or more of the following lipid abnormalities [3]: hypercholesterolemia (TC ≥ 240 mg/dL or diagnosis of dyslipidemia or use of lipid-lowering drugs), hypertriglyceridemia (≥ 150 mg/dL), hyper-LDL-cholesterolemia (≥ 160 mg/dL or diagnosis of dyslipidemia or use of lipid-lowering drugs), and hypo-HDL-cholesterolemia (<40 mg/dL in men and <50 mg/dL in women). Age-standardized prevalence rates of dyslipidemia were 59.0% in 2010 [3]. The overall prevalence of hypercholesterolemia and hyper-LDL-cholesterolemia increased by 1.36 and 1.35 times in 2010 compared to 2007, respectively. Awareness, treatment, and control rates of dyslipidemia improved over the period of surveys in both sexes. In 2010, about 30% of dyslipidemia patients who received lipid-lowering treatment

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Cost-effectiveness analysis of intensive blood pressure control in Korea

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Abstract

This study was a cost-effectiveness analysis of intensive blood pressure (BP) control among hypertensive patients in Korea. We constructed a Markov model comparing intensive versus standard BP control treatment and calculated the incremental cost-effectiveness ratio. The study population consisted of hypertensive patients over 50 years old with systolic blood pressures (SBPs) exceeding 140 mmHg and at high risk of cardiovascular disease. Treatment alternatives included lowering the SBP below 120 mmHg (intensive) and 140 mmHg (standard) for target BP. We assumed five scenarios with different medication adherence. The effectiveness variable was quality-adjusted life years (QALYs), and costs included medical costs related to hypertension (HT), complications, and nonmedical costs. In addition, we performed a sensitivity analysis to confirm the robustness of the results of this study. Scenario 5, with 100% medication adherence, showed the lowest incremental cost-effectiveness ratio (ICER) of \$1,373 USD, followed by scenario 1 (first 15 years: 62.5%, 16–30 years: 65.2%, after 30 years: 59.5%), scenario 2 (first five years: 62.5% decrease by 5% every five years), and scenario 3 (first 10 years: 62.5% decrease by 10% every 10 years). The ICERs in all scenarios were lower than the willingness to pay (WTP) threshold of \$9,492–\$32,907 USD in Korea. Tornado analysis showed that the ICERs were changed greatly according to stroke incidence. Intensive treatment of HT prevents cardiovascular disease (CVD); therefore, intensive treatment is more cost-effective than standard treatment despite the consumption of more health resources. ICERs are considerably changed according to medication adherence, confirming the importance of patient adherence to treatment.

Keywords Cost-effectiveness analysis · Hypertension · Intensive blood pressure control · Cardiovascular disease

Introduction

The number of hypertensive patients in Korea was over 11 million in 2015 and is expected to rise because of population aging [1]. However, HT management is insufficient compared to the increased prevalence of HT [2, 3]. According to the Korean National Health and Nutrition Examination Survey (KNHANES), although 65% of hypertensive patients recognized their diseases, the rate of blood pressure (BP) control below 140/90 mm Hg remained under 50% [4]. In the United States, HT control rates have declined since 2013 [5]. The Systolic Blood Pressure Intervention Trial (SPRINT) has led to a successful strategy to lower BP more intensively in patients without cardiovascular disease (CVD) at systolic BP (SBP) levels ≥ 130 mmHg, targeting less than 120 mmHg [6]. Based on these results, in their 2017 BP guidelines, the American College of Cardiology/American Heart Association (ACC/AHA) lowered the HT threshold to $\geq 130/80$ mmHg and recommended a more intensive BP threshold

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비용-효용분석(Cost-utility Analysis)

- 가정
 - 단일 혹은 복수의 산출물, 산출물의 종류 및 양이 프로그램 대안간 달라도 무방, 효용 측정
- 의사결정
 - 질보정수명 1년당 비용(cost per quality adjusted life year)이 최소로 소요되는 대안 선택
- 예: 암환자 치료, 말기신부전 환자 치료

비용-효용분석의 특징

- 여러 다양한 결과(양적, 질적 결과)를 하나의 복합 결과 지표 (composite index)로 표시
 - 삶의 양적인 변화(mortality) + 삶의 질적인 변화(morbidity)→공통의 측정단위(QALYs)로 전환
- 각 결과의 중요도에 따라 다른 가중치(weight)를 부여
 - 질 보정(quality adjustment)
 - 효용에 근거한 가중치(weights)-특정 건강상태의 바람직한 정도에 대한 상대적 크기-를 이용

경제성 평가의 단계

1단계:연구설계(design of study)

2단계:대안별 비용과 결과측정(assessment of costs and outcomes of alternatives)

3단계:시간에 대한 보정(adjustment for timing)

4단계:불확실성에 대한 보정(adjusting for uncertainty)

5단계:의사결정(making a decision)

1단계: 경제성 평가 연구설계

1) 경제성 평가 대안 설정

2) 경제성 평가의 관점

3) 경제성 평가 대상 기간

4) 분석 방법 선택

경제성 평가 ‘대안’ 설정

- 현재 사용되고 있는 방법(existing practice)
- 가능한 최고의 방법 (best available practice)
- 저가의 대안 (low-cost alternative)
- 별도의 조치를 취하지 않는 방법 (No intervention)



Cost Effectiveness of Quadrivalent Influenza Vaccines Compared with Trivalent Influenza Vaccines in Young Children and Older Adults in Korea

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Abstract

Introduction Trivalent influenza vaccines (TIVs) are currently reimbursed for subjects aged ≥ 65 years and children between 6 and 59 months of age under a national immunization program in South Korea. Quadrivalent influenza vaccines (QIVs) are expected to address the potential problem of influenza B-lineage mismatch for TIVs.

Objective The objective of this analysis was to compare the cost effectiveness of QIV versus TIV in children aged 6–59 months and older adults ≥ 65 years of age in South Korea.

Methods A 1-year static population model was employed to compare the costs and outcomes of a QIV vaccination program compared with TIV in children aged 6–59 months and older adults ≥ 65 years of age in South Korea. Influenza-related parameters (probabilities, health resource use, and costs) were derived from an analysis of the National Health Insurance System claims database between 2010 and 2013 under a broad and narrow set of International Classification of Diseases, Tenth Revision (ICD-10) codes used to identify influenza. Other inputs were extracted from published literature. Incremental cost-effectiveness ratios (2016 South Korean Won [KRW] per quality-adjusted life-year [QALY] gained) were estimated using a ‘limited’ societal perspective as per the Korean pharmacoeconomic guidelines. QALYs lost due to premature mortality were discounted at 5% annually.

Results For both age groups combined, under the narrow definition of influenza, QIV is expected to prevent nearly 16,000 (2923 in children and 13,011 in older adults) medically attended influenza cases, nearly 8000 (672 in children, 7048 in older adults) cases of complications, and over 230 (0 in children, 238 in older adults) deaths annually compared with TIV. The impact of using QIV versus TIV in this setting translates into savings of KRW 24 billion (KRW 0.6 billion in children, KRW 23.4 billion in older adults) in annual medical costs, and over 2100 (18 in children, 2084 in older adults) QALYs. Under the broad definition, the corresponding results are over 190,000 (50,697 in children, 140,644 in older adults) influenza cases, over 37,000 (12,623 in children, 24,526 in older adults) complications, 270 deaths (0 in children, 270 in older adults), KRW 94.22 billion (KRW 16 billion in children, KRW 78.2 billion in older adults), and over 3500 QALYs saved (316 in children, 3260 in older adults).

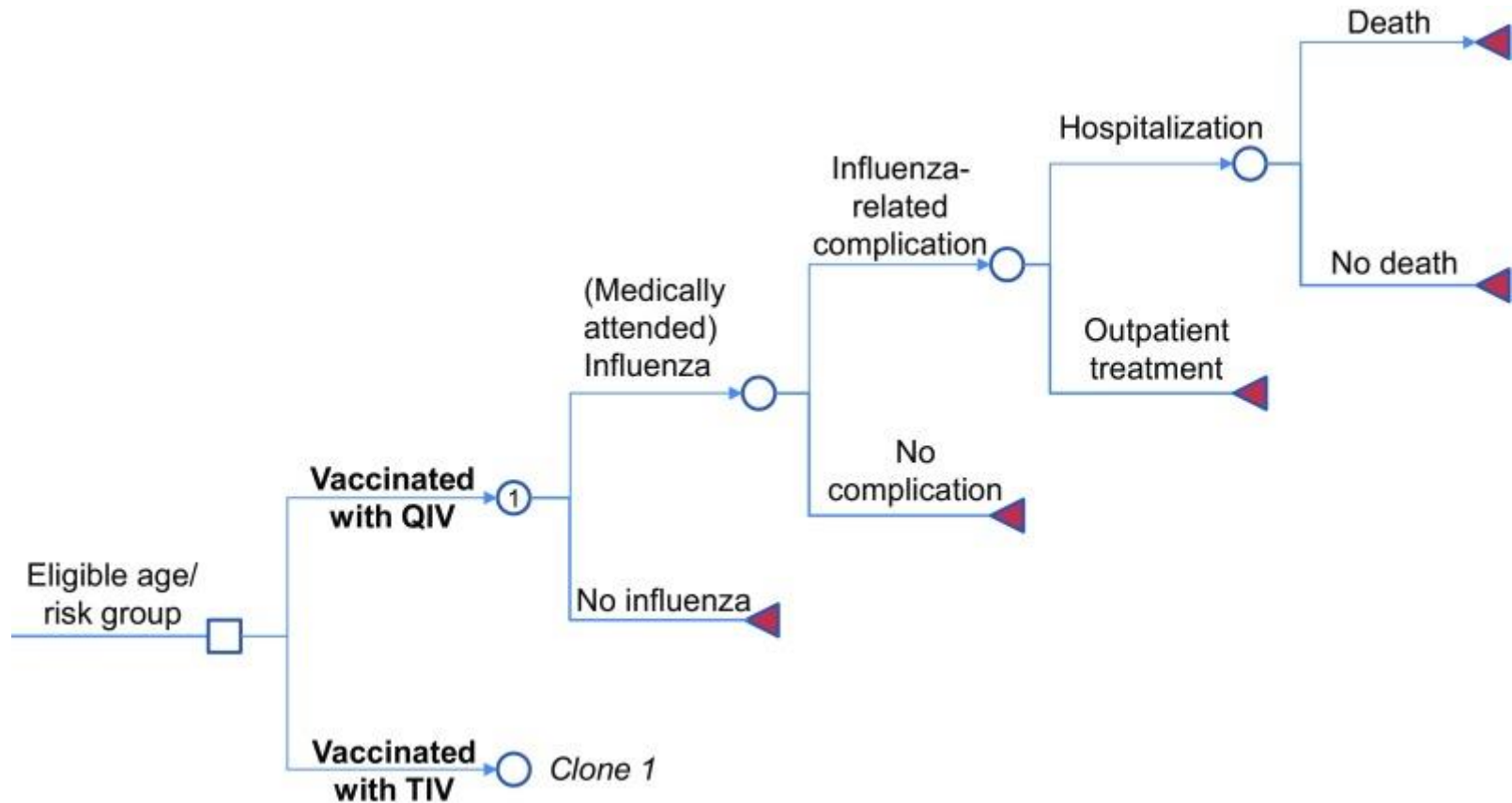
Conclusion The use of QIV over TIV was estimated to not be cost effective in children 6–59 months of age, but cost saving in older adults, using the narrow definition of influenza; however, QIV use was cost saving in both age groups using the broad definition. QIV is expected to yield more benefits in older adults ≥ 65 years of age than in children aged 6–59 months due to higher influenza-related mortality and costs among the older adults. Further analyses considering the indirect effects of influenza vaccination in children are required.

Yun-Kyung Kim and Joon Young Song contributed equally as co-first authors.

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Extended author information available on the last page of the article

의사결정 모형 (Decision Model)의 예



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Conflict of interest

The authors have no financial conflicts of interest.

Cost-Effectiveness Analysis of Hypertension Screening in the Korea National Health Screening Program

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AUTHOR'S SUMMARY

We evaluated the cost-effectiveness of routine hypertension (HTN) screening as a part of the national health-screening program. Compared with no screening, the costs per quality adjusted life years of the following screening strategies were below the incremental cost-effectiveness ratio threshold (approximately Korean won 30.5 million in Korea): first screening examination with the second confirmatory examination in adults aged 40 years or older every 3 years, every 2 years, or annually. The most cost-effective HTN screening strategy was the first screening examination with the second confirmatory examination in aged 40 years or older every 3 years.

ABSTRACT

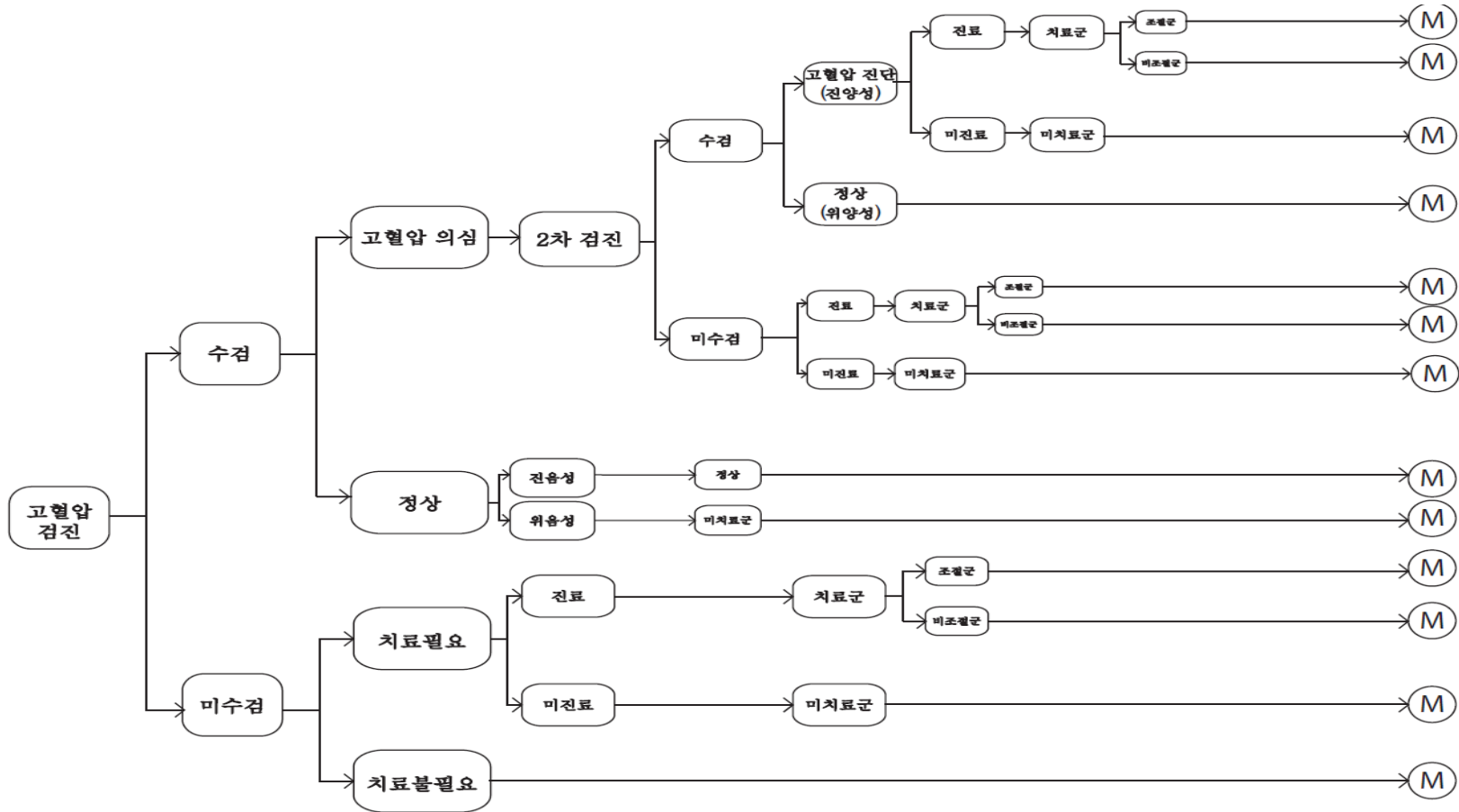
Background and Objectives: To evaluate the cost-effectiveness of routine hypertension (HTN) screening as a part of the national health-screening program.

Methods: Two aspects of cost-effectiveness were examined using the national general health-screening program. First, the cost of case-finding was computed for 5-year interval age groups. Second, the cost per quality adjusted life years (QALYs) gained were estimated for 12 different scenarios varying examination starting age, pattern and interval compared with no screening.

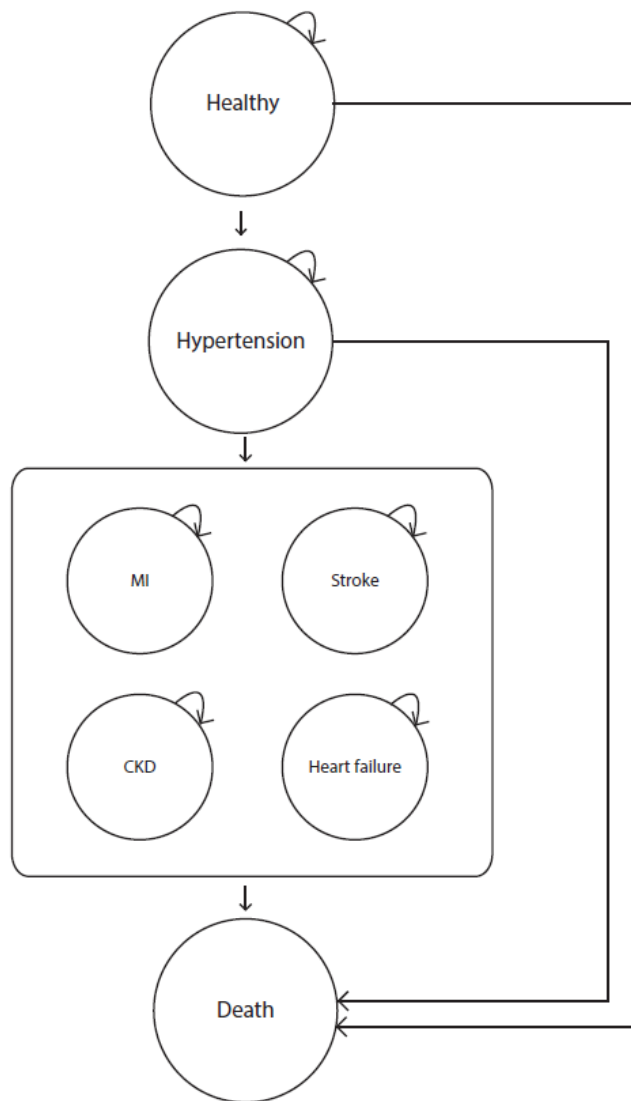
Results: The cost of finding one new HTN case was low as 26,284 Korean won (KRW) (approximately [approx.] United States Dollar 21) for 70–79 years old to as high as 70,552 KRW for 40–44 years old. Compared with no screening, the costs per QALYs of the following screening strategies were below the incremental cost-effectiveness ratio threshold (approx. KRW 30.5 million): first screening examination with the second confirmatory examination in adults aged ≥40 years every 3 years (KRW 10.2 million), every 2 years (KRW 13.2 million), or annually (KRW 19.9 million). One-way sensitivity analyses suggest that the results were mostly influenced by the sensitivity of the first screening examination, followed by the examination rate of the second confirmatory examination.

Conclusions: HTN screening as a part of routine national health screening program was cost-

의사결정 모형 (Decision Model)의 예



Markov 모델의 예



경제성 평가의 관점

- 1) 이용자(환자)관점
- 2) 공급자 관점
- 3) 보험자/정부 관점
- 4) 사회적 관점

➤ 분석관점을 어떻게 정하느냐에 따라 비용과 편익의 개념이 달라질 수 있음

예) 정부가 환자의 치료비를 일부 보조할 경우,
정부에게는 비용이지만, 환자에게는 편익이며, 사회적
관점에서는 비용도 편익도 아닐 수 있음
즉, 일종의 이전편익 개념이 될 수 있음



Original Article

Open Access

Strategic Distributional Cost-Effectiveness Analysis for Improving National Cancer Screening Uptake in Cervical Cancer: A Focus on Regional Inequality in South Korea

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Purpose

The purpose of this study was to conduct a cost effectiveness analysis of strategies designed to improve national cervical cancer screening rates, along with a distributional cost effectiveness analysis that considers regional disparities.

Materials and Methods

Cost effectiveness analysis was conducted using a Markov cohort simulation model, with quality adjusted life years as the unit of effectiveness. The strategies considered were current (biennial Papanicolaou smear cytology of females aged 20 or above), strong screening recommendation by mail to target regions (effect, 12% increase in screening uptake; cost, 1,000 Korean won per person), regular universal screening recommendation by mail (effect, 6% increase in screening uptake; cost, 500 Korean won per person), and strong universal screening recommendation by mail (effect, 12% increase in screening uptake; cost, 1,000 Korean won per person). Distributional cost effectiveness analysis was conducted by calculating the cost effectiveness of strategies using the Atkinson incremental cost effectiveness ratio.

Results

All strategies were under the threshold value, which was set as the Korean gross domestic product of \$25,990. In particular, the 'strong screening recommendation to target regions' strategy was found to be the most cost effective (incremental cost effectiveness ratio, 7,361,145 Korean won). This was also true when societal inequality aversion increased in the distributional cost effectiveness analysis.

Conclusion

The 'strong screening recommendation to target regions' strategy was the most cost effective approach, even when adjusting for inequality. As efficiency and equity are objectives concurrently sought in healthcare, these findings imply a need to develop appropriate economic evaluation methodologies to assess healthcare policies.

Key words

National cervical cancer screening, Cost-benefit analysis, Distributional cost effectiveness analysis, Screening uptake regional disparities, Healthcare disparities

Introduction

A significant proportion of deaths in South Korea can be attributed to cancer, with cancer mortality rates being reported as 150.9 per 100,000 individuals in 2014 [1]. Cancer is known to impose large socioeconomic burdens on society

because it incurs substantial direct healthcare costs, as well as indirect costs such as those associated with caregiving and lost productivity [2]. To address the burden of cancer, the South Korean government implemented the National Cancer Screening Program in 1999 to provide screening for the five most common sites of cancer; namely, stomach, liver, colorectal, breast, and the cervix uteri.

분석의 관점과 비용 유형

비용구분		분석관점			
		보험자	환자	의료공급자	사회
직접 의료비	급여진료비 (보험자부담)	0		0	0
	급여진료비 (환자부담)	0	0	0	0
	비급여진료비	0	0	0	0
직접 비의료비 (교통비, 간병인비...)			0		0
생산성 비용			0		0

경제성 평가 분석 기간

- 대안이 되는 프로그램들의 효과를 충분히 평가할 수 있는 기간을 선정하는 것이 이상적임
- 그러나, 평가대상기간이 길어질 수록 불확실성 또한 증가하게 됨
 - 분석기간에 따른 민감도 분석 필요

2단계: 대안별 비용과 결과 측정

1)결과 측정

(measuring and valuing benefits)

2)비용 측정

(measuring and valuing costs)

결과 측정

- CEA: 자연단위의 효과
-임상연구 결과,메타분석
- CUA: Quality weight
-문헌,설문조사
- CBA: Willingness-to-Pay(WTP)
-조건부가치측정법(contingent valuation)

비용 측정

- 비용항목의 확인(identification)
 - 보건의료중재의 결과로 발생하는 모든 자원사용상의 변화가 발생한 영역을 파악
 - 분석의 관점
- 비용의 측정(Measurement)
 - 자원사용상의 변화의 크기나 양을 측정
 - 자연단위(natural unit)
- 비용의 계량화(Valuation)
 - 자원사용상의 변화를 금액으로 환산
 - unit cost/price

비용의 종류

- 직접의료비용(Direct healthcare costs)
 - 입원,외래,의약품,검사 등
- 직접 비의료 비용(Direct non-healthcare costs)
 - 교통비
 - 가족 간병인 시간
 - 환자의 시간 비용
- 생산성 비용(Productivity costs)
 - 사망 혹은 이환에 따른 생산성 손실
- 무형 비용(Intangible Costs)
 - 고통,심리적 비용

비용의 계량화(valuation)

*특정검사의 예

-직접 의료비:검사횟수*(검사 수사+재진료)

-직접 비의료비(교통비):검사횟수*외래방문 평균 왕복교통비

-직접 비의료비(시간비용):검사횟수*외래방문당 소요시간*시간당 평균임금

3단계: 시간에 대한 보정(Adjusting for timing)

- 할인(discounting)
- 인플레이션 보정

할인(Discounting)

- 시간선호율: 예) 10억 투자비용
- 할인(Discounting)
 - 미래에 발생할 비용과 편익을 현재가치로 환산
- 현재가치(present value)
- 할인율(Discount rate)
 - 높을수록 미래에 발생하는 비용의 현재가치는 작아짐
 - 사회적 할인율(social discount rate)

인플레이션 반영

- 기준 연도 선택
- 모든 비용을 기준 연도 비용으로 환산
 - $X\text{연도 비용} = a\text{년도 비용} \times (x\text{년도 물가지수} / a\text{년도 물가지수})$
- 물가지수 선택
 - 일반 소비자 물가지수
 - 보건의료 소비자 물가지수

4단계: 불확실성에 대한 보정 (Adjusting for uncertainty)

- 민감도 분석(Sensitivity analysis)
 - 비용 또는 효과 추정에 사용된 변수의 불확실성 (uncertainty)을 해소하기 위한 방법
 - 분석에 사용된 parameter 값의 변화가 경제성평가 결과에 미치는 영향분석

민감도 분석 수행 방법

1) 불확실한 변수 선정

2) 변수 값의 타당성 있는 범위 선택

- 근거: - 문헌 고찰
 - 전문가 의견
 - 95% 신뢰구간 혹은 평균값으로부터 일정 표준편차 이내

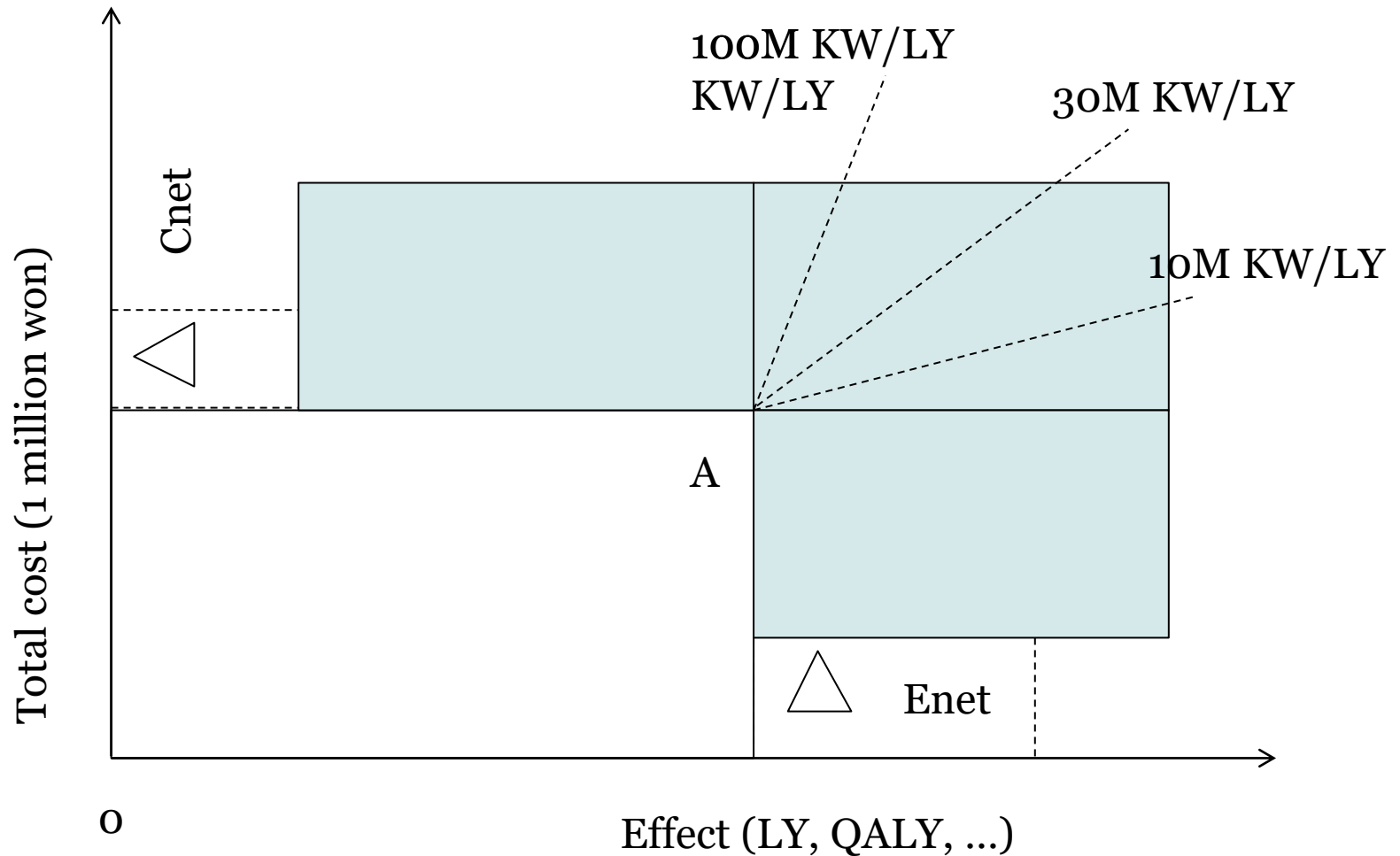
3) 민감도 분석 실행

5단계: 의사결정(Making a decision) 경제성 평가 결과의 제시

- Incremental Cost-Effectiveness Ratio (ICER)

$$= \frac{\text{Net increase in health care cost}(C_1 - C_0)}{\text{Net gain in health effect}(E_1 - E_0)}$$

Cost Effectiveness Plane



LY = Life Years, QALY = Quality Adjusted LY

경제성 평가의 한계와 의의

- 효율성은 보건정책결정시 고려사항의 하나
- 비효율적인 사업시행의 이유
 - 형평성에 대한 고려
 - 정치적, 사회적 수용성
- 그러나, 여러 가지 대안을 비교할 수 있는 공통의 척도를 제공