Special Article

Health System and Equity Perspectives in Health Technology Assessment

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Economic evaluation is a useful and increasingly popular tool that helps policy makers and health practitioners in the assessment of new technology and health interventions. It is expected that careful assessment of the costs and benefits of all technology choices will guide one's decision in selecting the best mixture of cost-effective options, thus promoting allocative efficiency and increasing value for money within the limited resources available. The use of economic evaluation is also seen as a key step towards evidence-based medicine and evidence-based policy-making.

Nevertheless, value for money and allocative efficiency may not be the only or the most important issue to be considered in technology adoption. There are a number of factors that should be evaluated in addition to economic efficiency. These include safety, efficacy, and effectiveness of the technology or policy of interest. In addition, it is important to assess other external factors that could be impacted by the use of such technology or policy. This article presents two important areas of health technology assessment, in addition to economic evaluation, that must be considered as a part of any health technology assessment exercise. They are (1) health system feasibility and impact analysis, and (2) equity and fairness assessment.

Keywords: *Health systems, Health technology assessment, Equity, rationing, Feasibility analysis*

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With scarcity of resources, access to technology and health programs could be limited and may sometimes be restricted to certain groups of population. In many clinical settings, the choice of who will have access to the technology or drug is not decided explicitly. The rationing of health services could take several forms such as removing useful drugs or beneficial treatments from health insurance benefit packages to exclude some potential beneficiaries, having long waiting time to delaying access to services, requiring referral letters from primary providers to discourage easy access, etc[1]. Without the necessary information to guide decisions, it is difficult to choose between the different rationing methods. Also, the selected options may not produce the best-expected results for society. Economic evaluation is a tool that is increasingly popular, especially in health technology assessment (HTA) as it provides explicit information on the benefit or value a society could gain in relation to the cost involved in the adoption of an intervention or technology. It is expected that with better information from economic evaluation exercises, informed decisions to select the best mixture of cost-effective options will promote allocative efficiency and will increase value for money within the limited resources available.

Nevertheless, it is important to recognize that economic evaluation is not the only tool that has been used in HTA. The scope of HTA is not limited to evaluation of value for money of the new technology or innovation. In addition, increasing efficiency and maximizing value for money is not necessarily the only objective of health technology assessment. Evaluation of safety, efficacy, and effectiveness is seen as a necessary prerequisite to the economic evaluation of any technology. In addition, there are also other external factors, with regard to the technology of interest that should be assessed.

This article presents two important areas of health technology assessment, in addition to economic

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evaluation, that must be considered as a part of any health technology assessment exercise. They are (1) a health system feasibility and impact analysis, and (2) an equity and fairness assessment. The first section of the article explores health system-related issues that are relevant to HTA including the use of health system perspectives in HTA exercises. It also argues for the inclusion of health system implications and feasibility analysis in the assessment of technology. The second section explores the equity and fairness assessment of new technology and describes the use of these criteria in the reality of health care rationing and priority settings in the health system. The article ends with the conclusions and recommendations.

I. Health Systems, Health Technology Assessment, and Feasibility Analysis

The word 'health system' seems to be quite simple. However, it may mean different things to different people. Some may think of a health system as hospitals and clinics. Some may think of the Ministry of Public Health. It is therefore important to clarify the definition of 'health system' before we discuss further its goals and its interaction with health technology. The World Health Organization, in its World Health Report 2000, proposed the definition that the term 'health system' includes all actors, institutions and resources that undertake health actions - where the primary intent of a health action is to improve health. It is not limited to the health sector as programs such as environmental control, tobacco tax, and health education in schools are also included.

It is rather obvious that the goal of health systems is to improve health, *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"*[2]. However, the interest of health systems is not limited to individual health. The focus of health systems should be on population health, the level of health of the population as well as the distribution of health outcomes among them.

Several other goals of health systems in addition to population health have also been proposed. The World Health Report in 2000 suggested that the ultimate goals of health systems include level and distribution of health; level and distribution of system responsiveness; and fairness in financial contribution to health[3]. The Organization for Economic Co-operation and Development (OECD), and a few other countries, proposed additional dimensions of health system goals such as acceptability, accessibility, appropriateness, competence, continuity, effectiveness, efficiency, and safety [4]. To achieve these health system goals, the health system relies on its four main functions-service delivery, financing, resource generation, and stewardship-which are described in Table 1.

A. Health Technology and Health System Impacts

Health technology is defined as *"prevention and rehabilitation, vaccines, pharmaceuticals and*

Table 1. Four main functions of health systems

Functions	Description
Financing	Health system financing is the process by which revenues are collected from primary and secondary sources, accumulated in fund pools and allocated to provider activities. Health Financing is comprised of three subcomponents: revenue collection, fund pooling, and pur chasing.
Resource generation	Production of inputs, particularly human resources, physical resources such as facilities and equipment, and knowledge by various organizations to support the provision of health services
Service delivery	Service delivery refers to the combination of inputs into a production process that takes place in a particular organizational setting and that leads to the delivery of a series of interventions of both personal and non-personal health services.
Stewardship	Stewardship involves three key aspects: setting, implementing and monitoring the rules for the health system; assuring a level playing field for all actors in the system (particularly purchasers, providers and patients), and defining strategic directions for the health system as a whole. It can be subdivided into six sub-functions: overall system design, performance assessment, priority setting, intersectoral advocacy, regulation, and consumer protection.

Source: adapted from[3]

devices, medical and surgical procedures, and the systems within which health is protected and maintained"[5]. Within this broad scope, health technology is not limited to drugs or diagnostic machines. Innovative public health interventions, new health policy initiatives, and new clinical management techniques are all considered parts of health technology.

Health technology and interventions play a key role in health systems. They serve as a major resource, in addition to financial and human resources, for all health system functions. They are also inputs for health service delivery which can contribute to health system performance in the achievement of health system goals [6]. Technology changes the way health care is delivered and generally improves its health outcome.

Nonetheless, new technology and interventions are not always beneficial or risk-free. New pharmaceutical ingredients may create serious side effects to the patients. Some new appliances are not effective outside laboratory conditions and create no benefit to health. Inappropriate and over utilization of technology could also be harmful to an individual's health. Moreover, new technology and innovations may require additional financing and resources for their adoption or application. In the US, technology is seen as a major cost driver of health expenditure[7,8]. The introduction of new technology or interventions could also draw resources from other health programs and weaken the health system. It is therefore important for any new health technology to be assessed before its adoption.

B. Health Technology Assessment

According to Banta [9], the term HTA was first conceptualized in 1976 even though the practice of technology assessment predated that by several decades. Initial interest in technology assessment came from the area of pharmaceutical safety. The Elixir Sulfanilamide tragedy led to the promulgation of the US Food, Drug and Cosmetic Act of 1938, which requires safety approval for New Drug Applications before marketing[10]. The interest in efficacy and efficacy requirements only came in 1962. Therefore, most of the treatments recommended in medical textbooks in the early 20th century were found to be of dubious effect or even harmful[9].

The rapid diffusion of high cost technology, *e.g.* CT scanners, raised an important concern about the value for money of new technology and brought the interest in HTA to a higher level[11]. One historical landmark in HTA development was the release of the Cochrane's book titled "Effectiveness and Efficiency" in 1971[9]. Cochrane proposed the use of quality evidence, particularly from randomized-controlled trials, for medical intervention and health technology assessment. In the same year, the United States Congress established the U.S. Congressional Office of Technology Assessment which later became a key player in health technology assessment in the United States with a focus on effectiveness and cost-effectiveness.

Health technology assessment (HTA) has been defined as a form of multi-disciplinary policy research that systematically examines the short- and long-term, direct and indirect, intended and unintended, consequences of the development, diffusion, and application of a health technology, a set of related technologies or a technology related issue[5,12-14]. HTA involves the assessments of relevant available knowledge in various fields from medicine, social studies, ethics, and economics. Its main purpose is to inform decision-making[13]. According to Draborg et al, HTA *"systematically evaluates the effects of a technology on health, on the availability and distribution of resources and on other aspects of health system performance such as equity and responsiveness"*[6].

Despite its initial focus on pharmaceuticals and clinical procedures, HTA has a broad scope. It covers a whole range of interventions and technologies that are provided within the health system. Medical devices, surgical procedures, and diagnostic techniques are included. In addition, HTA also covers interventions that are implemented by the health system such as health financing policies or monitoring and evaluation programs[6].

There are also debates as to whether HTA should limit its scope only to assessment *("the scientific analysis, gathering and summarizing information and producing knowledge")* or extend to the area of health technology appraisal *("the political process of decision-making, taking into account information as well as values")*[15]. The latter requires that the knowledge acquired from assessment be considered at the policy-making level with an explicit framework of values and preferences[15,16]. The ten basic steps of HTA as proposed by Goodman are shown in Box 1 below.

C. Roles of HTA in Health Systems

HTA is a component of health system functions. It serves as a resource generation function

whose product – knowledge – benefits other health system functions including health service delivery. HTA informs priority setting and resource allocation processes as well as helps policy-makers in defining strategic directions for the health system.

McDaid *et al* and Goodman propose that HTA can help influence decisions in regard to health systems in many ways and at several levels[13,17]. At the clinical service level, HTA can be used to develop treatment guidelines to guide health workers' practice and patients' understanding of the proper use of health care technology. At macro policy level, it helps decision-makers in deciding on strategic directions of health care organizations including decisions to adopt or implement new policies or interventions. HTA is also frequently used by health insurers and national health program managers to guide decisions regarding benefit packages and resource allocations. In many countries, the knowledge gained from HTA has been used in pricing decisions such as health service charges and drug prices.

For its effective use, HTA should take into account the impact of technology adoption on health system functions in addition to clinical or economic aspects. There are several possible health system impacts from technology adoption such as financial, labor, and infrastructure needs, as well as the requirements for managerial and information system support. HTA should also consider the potential implications on health system goals beyond aggregate health gains *e.g.* the distribution of health, responsiveness, and fairness.

Box 1. Basic Steps of HTA

1) Identify assessment topics
2) Specify the assessment problem (including purpose and intended users)
3) Determine locus of assessment
4) Retrieve available evidence
5) Collect new primary data (as appropriate)
6) Interpret evidence
7) Synthesize and consolidate evidence
8) Formulate findings and recommendations
9) Disseminate findings and recommendations
10) Monitor impact

Source: [13]

D. Feasibility Analysis

A feasibility study is an initial study to determine whether a project or technology could be implemented with potential success and sustainability. They are frequently used in the business sector to initially evaluate a project of high investment value before carrying out a more detailed study. In the health

Box 2. Common tools for economic feasibility analysis

Indicator	Description	Calculation
Average rate of return (ARR)	average level of profitability as a percentage of investment	average profit / average investment
Average payback period	time required to obtain full investment amount	net investment / average annual cash inflow
Net present value (NPV)	profitability measure that uses the discounted cash flow techniques	present value of total inflows – present value of all investment
Benefit to cost ratio	Proportion of benefit in relation to cost	present value of cash inflows / present value of investment
Internal rate of return (IRR)	percentage profitability, or its percentage rate of return	discount rate which forces the NPV of the project to equal zero
Break-even volume	the volume needed to reach the financial break-even point	fixed cost / (net revenue per unit –variable cost per unit)

Source: [18,19]

sector, feasibility studies are particularly useful for projects that require extensive investment or have a broad impact on the overall health system. For example, broad implementation of expensive interventions, the purchase of big-ticket medical equipments, or the adoption of national programs deserve a full feasibility analysis-assessment as a part of HTA.

Several dimensions of feasibility should be assessed before the decision to adopt such technology or interventions. Four main types of feasibility analysis are described here. They are market feasibility assessment (demand analysis), economic feasibility assessment (financial analysis), technical and organizational feasibility assessment, and legal, environmental and cultural feasibility assessment.

Marketing Feasibility / Demand Analysis

In the business sector, market feasibility analysis is crucial to determine the success of a product. It involves the analysis of demand for the product, and the willingness to pay for it, in the population. It also needs to take into account other competitors in the business as well as other competing technologies that exist and that may emerge in the future.

In health, this issue is a little more complex as we consider not only the demand but also the need for the technology. The population in need of the technology is usually larger as demand only identifies expressed need. The analysis therefore depends on the type of technology and the types of purchaser, payer, and/or sponsoring agency. Usually this requires epidemiological data of the disease involved and the demographic data of the population of interest.

Economic Feasibility / Financial Analysis

Economic or financial feasibility analysis determines whether a project or a technology produces adequate monetary returns which merit its investment, as well as whether the health system has enough financial resources to invest in it. It is usually done in the event of an intensive capital or high price technology investment. The analysis usually looks at two major components of program finance: (1) return on investment; and (2) cash flow requirements. Common tools for economic feasibility analysis are provided in Box 2.

Return on investment considers the financial returns that can be collected over the life time of a product or a technology in relation to the investment costs. In health programs, the return may be in the form of usage charges or co-payments or nothing. The analysis is sometimes called budget impact analysis," and identifies the level of budget that needs to be prepared for this product or technology over a period of interest. For that technology with a stable demand or need, the required budget could be quantified on a periodic basis *e.g.* per year. However, for certain technologies or health programs where the users or beneficiaries could increase over time, the budget requirements could be continuously increasing and the overall budget requirements could reach an exorbitant amount. For example, an inclusion of hemodialysis for chronic renal failure patients in the reimbursement package would incur increasing costs to the health insurers as the number of eligible beneficiaries would increase each year during their longer life span and their prolonged demand for dialysis.

Cash flow analysis identifies the amount of money required for a certain period of time. It is important for big-ticket technology *e.g.* expensive diagnostic machines, where the cost of acquisition is high and may require expensive maintenance or even replacement. The level of cash required may not be stable over a prolonged period of time and there may be a surge in money requirement during certain periods i.e. for key component replacement, etc.

An economic feasibility analysis usually involves multiple time periods. It is therefore important that the use of adjustment factors or discount value is used to calculate net present value. The level of inflation could impact the financial requirements and the feasibility of the project.

To conduct full financial analysis for capital investment, Gapenski proposes five key steps: (1) estimate the total capital expenses; (2) forecast the operating cash flows including the incremental cash flows (cash flow if project undertaken minus cash flow if it was not), sunk cost, inflation, and the effect of the project on other parts of the system *e.g.* changing clinical or practice styles; (3) assess the riskiness of the estimated cash flows using tools such as break-even analysis or a calculation of the payback period; (4) estimate the project's capital costs given the level of riskiness; and (5) assess the profitability of the project using tools such as net present value (NPV) or internal rate of return (IRR). Decision-makers should consider the financial information from this analysis before investing in any capital-intensive projects.

Technical, Organizational, and Schedule Feasibility

For technology or projects to function effectively, there are other types of inputs that are required

in addition to monetary inputs. These include human managerial requirements.

As health programs or projects are largely labor-intensive and frequently require special skills, it is important to evaluate the human resource requirements for every program or technology to be implemented. Shortages in the health workforce could limit the feasibility of the program. An estimation of health workforce requirements should take into account both quantity and quality requirements. This involves the analysis of workforce capacity and competency, as well as skill-mix in comparison to the expected demand or need of the program or technology.

The decision to adopt a technology or intervention program should also consider managerial requirements and information system gaps. When a number of actors are required in technology adoption or project implementation, time analysis of key actors in relation to the project's time frame is also necessary.

Legal, Environmental, and Cultural Feasibility

There are also other dimensions of feasibility analysis that need to be considered. Legal feasibility requires a careful review of relevant laws, bylaws, and regulations in relation to the project or technology to be adopted. In Thailand since 1992, the Environmental Protection Act has required that a project in selected areas of the country or of a certain size need an Environmental Impact Assessment study before being approved. For example, an EIA study is required for any construction project to build a hospital above a 60-bed capacity in any area, or any river-side or beachside hospital that is above a 30-bed capacity.

In addition to legal and environmental requirements, there is a cultural dimension. This includes both the acceptance by the general Thai culture and also by the local or area-specific culture as well. The program adoption needs to be aware of and sensitive to the cultural and religious diversity in the area of implementation. For example, a policy to retain a newborn's placenta for laboratory investigation may face resistance in Muslim-dominated areas as a placenta is considered a part of the body that should be brought home to be buried properly.

II. Equity and Fairness in Health Technology Adoption Decision

With scarcity of resources, economic evaluation has been advocated as a tool to guide policy makers in their decisions on which technology to adopt based on the value for money of said technology and interventions. In a number of countries, cost-effectiveness is required - in addition to its efficacy, safety, and effectiveness - for a technology to be evaluated for adoption or funding. For example, the National Institute of Clinical Excellence in the UK and the Pharmaceutical Benefit Scheme in Australia both require economic evaluation for their decisions to adopt certain technologies or drugs into the health care program.

The use of economic evaluation as the only tool for technology assessment and adoption decisions, however, faces several limitations. These limitations are both methodological and operational. Methodological issues include the choice of comparators, the choice of incremental versus marginal analysis for non-constant or non-divisible interventions, the inconsistency of economic evaluation guidelines, and the constraint of economic evaluation tools in capturing externalities and non-health outcomes[17,20-22]. Operational limitations include substantive informational and time requirements needed for the assessment, perspectives and the ability to generalize the results, poor linkage with decision-makers, and the lack of a publicly acceptable, incremental cost-effectiveness threshold[1,22,23].

A stronger criticism on the focus on economic evaluation in health technology assessment and resource allocation lies at its ignorance of distributional aspect. Generally, economic evaluation practice aims to maximize health gains by treating everyone the same and ignores the distribution concern over individuals[24-26]. This could be against the principles of policy-makers or the public and results in a reluctance to use the economic evaluation results by policy-makers. Several studies have found that policy-makers and the public are willing to accept a certain degree of inefficiency in exchange for an improvement in equity or fairness[27,28]. In addition, they feel that several criteria should be used in health care rationing[1,29].

This part focuses on the important role that equity and fairness have in technology adoption decisions. It explores the meaning of equity and fairness with particular focus on health equity. It then explains how health equity has been prominently considered in health system rationing and priority setting. It then discusses how equity and fairness should be included in HTA as well as the possibility of integrating equity considerations with economic evaluation results.

A. Definition of Equity and Health Equity

Equity is not the same as equality. It is a moral

and ethical concept that is grounded in the principles of distributive justice[30]. An equitable society is not necessarily a society in which everyone is equal or has the same level of wealth and resources. The emphasis is on social justice or fairness in the society.

Similarly, health equity is a concept that is based on the equity concept. Health equity is not the same as health equality[30,31]. The differences in the level of health or health disparities in the population are not always unfair. An obvious example is the difference between young and old. Health inequities are defined as the *"differences in health that are unnecessary, avoidable, unfair and unjust"*[31] and health equity is therefore referred to as "the absence of socially unjust or unfair health disparities"[30].

The World Health Organization states that *"[e]quity in health implies that ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that no one should be disadvantaged from achieving this potential, if it can be avoided"*[32]. According to Sen, health equity is among the most important components of social justice[33]. Equity in health is an "ethical value, inherently normative, grounded in the ethical principle of distributive justice and consonant with human rights principles"[30].

Two main concepts of equity are frequently referred to in health: horizontal and vertical equity. Horizontal equity applies to people in the same status or situation. In the horizontal equity concept, people who are alike should be treated in the same fashion. For example, patients with the same health needs should receive an equal share of health care resource and treatments.

Vertical equity focuses on the difference between individuals or groups of people. In this concept, people who are unlike in relevant respects, *e.g.* income or health needs, should be treated differently in a just way. For example, people in lower economic groups should receive more priority in public support than higher economic groups and people with higher health needs should receive more treatments.

It is argued that the scope of health equity, both vertical and horizontal, should not be limited to the equity of health care access[33]. Recent debates on health equity have expanded its scope to the distribution of health of the population. Sen takes this further and argues for an even broader scope; equity in the opportunity to health. Health equity should also consider how *"resource allocation and social arrangements link health with other features of states of affairs"*[33].

B. Equity implications from the choices of economic evaluation techniques

Economic evaluation techniques are generally based on assumptions to quantify the gains or benefits and the costs into comparable units. The Thai Health Technology Assessment Guidelines propose a number of techniques and assumptions for economic evaluation for researchers in their analyses[34]. It is therefore very important for researchers and users of the evaluation results to realize the possible equity implications of these choices.

The choice of outcome measurement certainly has an implication on whose benefit will be counted more. For example, if improvement in life expectancy is used as the outcome measure, an intervention that benefits the elderly relatively more will be considered as less cost-effective than another intervention that benefits younger people more (when other aspects are the same). Similarly, some measurement techniques will value the benefit to disabled persons less because their potential gains from recovery (disability averted) from an intervention will be less than for non-disabled persons.

The selection of costing types could also give different value to different groups especially on the evaluation of economic cost *e.g.* loss of productivity. The use of 'willingness to pay' will put a higher value on those with the higher ability to pay (richer people). The guidelines suggest the use of a national wage average in the analysis, which means it will be insensitive to the difference in actual productivity lost by different population groups. Different perspective used in the analysis could also affect the inclusion or exclusion of certain costs or benefits. This may have different implications on different groups as well.

The level of 'discount rate' may also suit different groups differently. It was found that the rate of time preference is not the same for different income level populations, with low income households generally having a higher discount rate[1]. This means the use of a higher discount rate is more reflective of the poorer population preference.

C. Ethical perspective for health resource allocation

Economic evaluation techniques are generally based on utilitarianism which focuses on efficiency through maximizing gains or benefits in respect to cost. These benefits could be in the form of well being (cost-benefit analysis), health utility (cost-utility analysis, or health gains (cost-effectiveness analysis) and are valued equally irrespective of their distribution. This

creates criticism against its use by some especially those who do not want to provide relatively more resources to the rich or those already having an advantage in the society. This assumption of "distributive neutrality" used in the Economic Evaluation exercise is also against public respondents' and policy-makers' views as found in many studies[35]. Many of them believe that fairness should have a greater importance than the maximization of benefits[29,36]. In the equity approach, maximizing aggregate benefits to the society is not its primary concern.

Despite a strong interest in fairness of resource allocation, there is no consensus among the public or philosophers on a single set of allocation criteria which would be considered as a fair allocation[37,38]. On several occasions, the ethical and justice theories may be in conflict among themselves[39]. It is, therefore important to make explicit the decision criteria used in resource allocation decisions.

Several equity and fairness criteria have been used in resource allocation decisions. A number of studies have been carried out to explore the preference for these criteria in hypotethical allocation decisions by both the public and policy-makers[27,40]. Six major decision rules are discussed here: severity of health conditions, realization of potential health, rule of rescue, preservation of hope, concentration of benefit, and age-related preferences.

Severity of health conditions

Under this criterion, the priority of resource allocation should be given to the neediest i.e. those who have the most need. There are several ways to define health needs, each of which could be based on a subjective evaluation. In practice, it is common to use severity of health conditions as the criterion to reflect need[41] when patients or a population with more severe health conditions receive more resources irrespective of the value for money of the interventions or their capacity to benefit. Many previous studies have shown that people are willing to prioritize interventions that address severity of health over interventions that are cost-effective[27,40,42,43].

Realization of potential health

The use of capacity or potential to benefit from the intervention as a measurement of need in resource allocation decisions is another choice. However, this policy was not well received among the public as this approach unavoidably discriminates against those with disabilities or permanent injuries. There is abundant evidence from many countries which shows that people reject discrimination on the basis of disability, and that people want to avoid discrimination against those with disabilities or chronic illness[27,41].

Rule of rescue

Similar to the criterion based on severity of health conditions, the rule of rescue is a criterion that is based on one aspect of health need; the case of imminent and immediate life threats. Decisions based on this rule would choose to save "identifiable" individuals from life-or-death situations instead of other cost-effective non-lifesaving measures that may benefit statistical lives[42]. The allocation decisions would allow them to be saved or would leave them to die. The use of this criterion is common in clinical practice such as in the case of the retransplantation of organs in previously transplanted cases to save immediate life instead of giving these organs to other first time transplant candidates who may have a higher chance of success[40,44].

Preservation of hope

Empirical evidence from a number of studies suggests that people may not be willing to totally ignore patients who are left with only cost-ineffective therapy[44-47]. The case of allocation of scarce organs for transplantation is frequently raised. It is found that people do not want to restrict the allocation only to those who have the chance of the greatest health gains, thus leaving the others to die. They still want to preserve the hope of survival to those persons who may be less cost-effective candidates otherwise[46].

Concentration and dispersion of health benefits

A number of studies have shown that people prefer a more even spread of the distribution of health benefits [27,48,49]. For example, an experimental study by Nord *et al.* found that an intervention that can save 1 year of life for 10 persons (10 years in total) is considered the equivalent to another intervention that will prolong life for 5 years for 3.5 persons (17.5 years in total) despite the latter's higher aggregate years of life gains[49]. In this case, a health intervention that spreads the health benefits, in terms of life years to a broader population, is valued more highly than an intervention with concentrated benefits to a few individuals for the same level of total benefits. There seems to be a discounting of value of additional life years in this reasoning.

However, recent evidence shows that this preference for the dispersion of health benefits does

not always apply[43,50,51]. A few studies have found evidence of a minimum threshold level of benefit below which the public would prefer concentrating benefits to fewer individuals instead. For example, Choudhry, Slaughter and colleagues found that in the study of Canadian senior health officials, the same respondents could have differing preferences for concentrating or spreading benefits depending on the level of the benefits in consideration[52]. A study by Olsen in Norway also found a similar pattern. This threshold level varies based on the size of both the small and the big benefit in question[51].

Age-related social preferences

Many studies indicate that people are willing to give priority to certain age groups, usually the young, in competition for limited health care resources[27,49]. Three groups of reasons for the preferences to the young over the elderly have been proposed. Utilitarian ageism gives preference to younger patients because saving them means saving longer expected years of living. Productivity ageism considers the level of productivity as the basis of giving preference. Egalitarian ageism, on the other hand, aims to reduce inequality in age of death by favoring equal opportunity to live to a certain age. This last form of ageism is similar to the "fair innings" concept proposed by Williams on a social expectation for the achievement of a fair minimum length of life[53]. Because everyone can expect to pass through the different stages of the life span, giving different value to a year of life extension at different stages in the life span need not unjustly discriminate against individuals[54].

Other dimensions of social preferences

Fair distribution is not necessarily the same as equal distribution. Because the existing distribution of health and health opportunities in the population is generally not equal, priorities may be assigned to certain subgroups of the population who are currently underprivileged. For example, those who believe in the "maximin theory" of justice, which aims to maximize the minimum, would give priority of benefit to the worse-off population in the society. In some societies, preference may be given to a specific population with certain characteristics such as gender, geographical regions, or ethnicity. In a study of 80 economic students in Sweden, the respondents showed that an intervention that produces 1 quality-adjusted life year (QALY) gained in a healthier group is equivalent to an intervention that increases only 0.45 QALY for a health deprived group[48].

Evidence on public interest in fairness of resource allocation decisions reflects the willingness to trade efficiency or health maximizing goals with equity or fairness. In the context of a national health system, fairness or social justice plays a more important role as the main reason for a national health scheme is to primarily achieve fairness-related objectives[55]. Several methods have been invented to try to integrate equity-dimension into, or in addition to, the existing economic evaluation techniques as described below.

D. Integrating equity dimensions into health technology priority settings

Considering the public's and policy-makers' interest in integrating equity concerns into resource allocation decisions, a number of tools and methods have been introduced to allow for the integration of normative values in economic evaluation techniques. These can be done as part of the outcome measurements or separately in addition to the economic evaluation results.

One way of integrating equity dimensions into outcome measurements is by the choice of the evaluation technique. It is argued that the use of cost-benefit analysis instead of cost-effectiveness analysis allows the researcher to take other externalities, beyond health outcome, into consideration[20]. However, in practice there are still several methodological concerns about the valuation of health outcome and other benefits into monetary units to be used in CBA. Some of the methods, such as the human capital approach or the contingent valuation approach, also inherit equity concerns in themselves.

Another approach of integrating equity dimensions into outcome measurements is by adjusting total QALYs by some weights that reflect the public's value of certain population groups. This approach is sometimes called "cost-value analysis" to reflect that the outcome of interest has now changed from health utility to social value[56,57]. An example of this approach is the use of severity weight and potential weight to adjust for the social preference put on severity of health conditions and potential to benefit from interventions[43]. However, this approach is still far from practical to implement due to its weakness in methods, the current data gaps, and political acceptance in the real world[57].

Equity perspective could also be explicitly integrated into the decision-making process after economic evaluation analyses are done. One approach proposed by James et al, the Clarified Criteria Approach,

employs a model to estimate prioritization score. This allows policy makers to put weights on equity and efficiency explicitly[58].

Recent developments to integrate equity and fairness concerns into economic evaluation decisions involves the use of a "discrete choice experiment" – a form of multicriteria-decision analysis – to allow for the consideration of other attributes of health outcomes and social preferences into the priority setting decisions[59,60]. Under this approach, multiple allocation criteria *e.g.* severity of health conditions, the concentration of benefits, and efficiency, could be simultaneously considered using quantitative statistical techniques in a systematic and transparent manner. However, despite its attractiveness and feasibility as a priority decision aid, this approach and its method are still being developed and tested to gain a better understanding of the caveats and limitations[61,62].

E. Health system resource allocation in practice

Resource allocation and priority setting of health interventions occur at many levels in the health system. Clinicians are involved in bedside rationing. Health managers control the budget, staff, and time allocation for various health programs. Health insurance managers decide on benefit packages and reimbursement limits for new and old technologies.

At each level, the decisions can be made through explicit or implicit criteria and several factors may be considered altogether. Apart from efficiency and equity or fairness criteria, policy-makers may incorporate other factors into their allocation decisions. Financial factors, such as level of total financial investment and affordability and sustainability, are generally high on the agenda. Some technologies or drugs may be excluded from the benefit package or public subsidy if individual responsibility is expected. Additionally, most of the decisions are heavily influenced by the political situation and the environment surrounding the decision process.

It is also found that different levels of health care managers or decision-makers may have different concepts of equity. The public, doctors and health managers may have different view on priorities, and how to spend health resources[63,64]. Nevertheless, there is strong support for a pluralistic combination of different criteria in rationing[65]. A study in Thailand interviewing 36 key informants in the health sector - health authorities, health professionals, and academia - confirms that health maximization is not the only or the preferred criteria in health care rationing[29].

Additionally, the public wants to be involved in how priorities in the health sector are set[66-68]. There are several possible mechanisms where people's views can be heard such as through interviews, postal surveys, public consultations, or a system of citizen juries[66,69]. One caveat is that people's opinions may differ significantly when they are given enough chance to deliberate or discuss[70]. In other words, the instinctive view could be completely different from the considered view (after discussion) on any priority-setting issue. The public consultation process could also be costly and *"may result in an inefficient use of resources"*[71].

One major challenge in evidence based priority decisions is the lack of information. Health technology assessment and economic evaluation is a new field of the late 20th century with a limited number of studies available to inform decision-makers and the public. This applies globally as well as in the case of Thailand[29]. The evidence available is also of varying quality and requires careful and critical appraisal before its use[72,73].

IV. Conclusion

Economic evaluation is a tool to aid priority setting with the aim of increasing efficiency of resource allocation. It is a major component of the health technology assessment exercise that produces knowledge beneficial to the health system performance. However, economic evaluation alone is not sufficient in making health technology adoption and rationing decisions. Many other tools and criteria such as the use of feasibility analysis and equity perspective should also be employed.

This article describes the linkage between economic evaluation, health technology assessment and the health system. However, it has been found in many countries that the impacts of HTA in policy appraisal and the decision-making process are still very minimal[16]. One possible reason, as claimed by Oliver and colleagues, is that *"[m]any people from many different perspectives and for many different reasons remain skeptical of the relevance of current HTA activities for practical decision-making purposes"* [16]. Also, the assessment of the social, political, and ethical aspects of health technology remains limited, jeopardizing its popularity[11].

A number of suggestions have been proposed for the success of HTA in health system decision makings. They are:

- HTA should be considered as a

multidisciplinary approach that needs to consider all relevant aspects in addition to economic evaluation[16]. This includes political, social, equity, and ethical dimensions in the assessment process.

- For HTA guidelines, the process of development must be open and fair[39,67]. The criteria and the process used in the development should be explicitly explained. The final guideline products should be easily available to the public.

- Formal structures or institutions should be developed with mandates to advocate for the use of HTA and its results in decision making[16,74]. There should be regular communication and exchanges between HTA evaluators and stakeholders working in the health technology sector[11,16]

- The technology assessment process should be informed by a broad set of perspectives[11]. The involvement of the public in priority setting decisions could be beneficial but may come at a cost. Nevertheless, all the decisions and the rationales behind them must be made accessible to the public. Also, a system should be developed to allow for a change or challenge to these decisions by the public.

Opportunity exists for the development of HTA and its influence in policy decision-makings in Thailand. The challenge is the lack of quality evidence and the limitation of the resource available for HTA activities in the country. Optimistically, the emergence of newly established programs such as the Ministry of Public Health's Health Intervention and Technology Assessment Program (HITAP) and the Setting Priorities using Information on Cost Effectiveness (SPICE) Project will lead the country in HTA development and implementation which will result in a better health system performance and health outcomes for the population.

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มุมมองเชิงระบบและประเด็นทางจริยธรรมในการประเมินเทคโนโลยีด้านสุขภาพ

ปิยะ หาญวรวงศ์ชัย

การประเมินความคุ้มค่าทางการแพทย์เป็นเครื่องมือที่สำคัญซึ่งจะช่วยให้ผู้วางแผนนโยบายและบุคลากรทางการแพทย์มีข้อมูลเพิ่มเติมในการตัดสินใจเลือกใช้เทคโนโลยีทางการแพทย์หรือนโยบายสุขภาพต่าง ๆ โดยเฉพาะอย่างยิ่งการประเมินต้นทุนที่เกี่ยวข้องเพื่อเปรียบเทียบกับประโยชน์ที่ได้รับจากการเลือกใช้เทคโนโลยีและนโยบายนั้น ๆ ก่อนการตัดสินใจนำมาใช้ จะช่วยให้สังคมได้รับประโยชน์สูงสุด ภายใต้ทรัพยากรที่มีอยู่อย่างจำกัด ทั้งนี้ยังช่วยเพิ่มประสิทธิภาพ (efficiency) และส่งเสริมการกำหนดนโยบายและเวชศาสตร์เชิงประจักษ์

อย่างไรก็ตามความคุ้มค่าทางการแพทย์มิได้เป็นประเด็นที่สำคัญที่สุดเพียงประการเดียวในการตัดสินใจเลือกใช้เทคโนโลยีหรือนโยบายใด ๆ จำเป็นต้องมีการพิจารณาถึงปัจจัยต่าง ๆ อีกหลายประการ คุณสมบัติที่สำคัญอื่น ๆ ของเทคโนโลยีที่ควรได้รับการประเมินก่อนการเลือกใช้ ได้แก่ ความปลอดภัย (safety) ประสิทธิผลทางคลินิก (efficacy) และประสิทธิผล (effectiveness) นอกจากนี้ ยังต้องมีการประเมินปัจจัยภายนอกที่มีความสำคัญต่อการเลือกใช้เทคโนโลยีหรือนโยบายเหล่านั้นด้วย บทความนี้ นำเสนอปัจจัยภายนอกที่สำคัญสองประการ นอกเหนือจากการประเมินความคุ้มค่าทางการแพทย์ที่ควรได้รับการพิจารณาในฐานะองค์ประกอบหลักของการประเมินเทคโนโลยีและนโยบายด้านสุขภาพ โดยปัจจัยสองประการนี้ได้แก่ (1) ความเป็นไปได้และผลกระทบในระบบสุขภาพ และ (2) ความเสมอภาคและความเป็นธรรม