

Methodological Approaches to Cost-Effectiveness Analysis in Saudi Arabia: What Can We Learn? A Systematic Review

Fatma Maraiki , Shouki Bazarbashi, Paul Scuffham ,
and Haitham Tuffaha

Abstract

Objective. The recent establishment of the health technology assessment (HTA) entity in the Kingdom of Saudi Arabia (KSA) has resulted in increased interest in economic evaluation. The aim of this study is to evaluate the technical approaches used in published economic evaluations and the limitations reported by the authors of the respective studies that could affect the ability to perform economic evaluations in the KSA. **Methods.** We conducted a systematic literature review of published economic evaluations performed for the KSA over the past 10 years. An electronic literature search of the PubMed, EMBASE, and Cochrane databases was performed. A CHEERS checklist was used to assess the quality of reporting. Reported limitations were classified into domains including the definition of perspectives, identification of comparators, estimation of costs and resources, and use of the incremental cost-effectiveness ratio threshold. **Results.** Twelve evaluations were identified; most involved cost-effectiveness analysis (92%). Missing and unclear data were found within the CHEERS criteria. Regardless of the perspective used, most described the perspective as an “institutional” perspective (70%) and almost half were reclassified by the current reviewer (42%). Most did not clearly state the comparator (83%), and published model comparators were commonly used (50%). Resource estimation was mostly performed by the authors of the respective studies (67%), and costs were mostly obtained from hospital institutional data (75%). The lack of an established threshold for the country-specific willingness to pay was observed in 50% of the analyses. **Conclusions.** Economic evaluations from the KSA are limited. Capacity building and country-specific HTA guidelines could improve the quality of evaluations to better inform decision making.

Highlights

- Economic analysis of health technology should follow standard guidelines. Unfortunately, these guides are often underutilized, and our findings identify considerable missing, not clearly stated, or incomplete data within the analyses, which can weaken the impact of the recommendations.
- The limitations reported by the authors of the respective studies emphasize the suboptimal quality of the reporting. A lack of data was frequently identified and resulted in using “institutional” practice as a major source of data input for the analyses.
- In light of the call for the establishment of an HTA entity in the KSA, framing a standard analytic approach when conducting economic evaluations will support HTA in informing resource allocation decisions. We hope that our findings highlight the need for country-specific guidance to improve practice and enhance future research.

Corresponding Author

Fatma Maraiki, King Faisal Hospital and Research Centre, P.O. Box 3354, Riyadh, 11211, Saudi Arabia; (f_maraiki@hotmail.com).



Keywords

cost-effectiveness analysis, economic evaluation, Saudi Arabia, systematic review, value assessment

Précis: Limitations reported by authors of the cost-effectiveness analyses reiterate the suboptimal quality of reporting the economic analysis and the need for KSA guidelines to support future practice.

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Background

The health care system in the Kingdom of Saudi Arabia (KSA) has grown rapidly since the launch of Vision 2030 and the National Transformation Program (NTP).¹ The program's goal is to make health care and social development a top priority to improve quality of life. Public expenditures in 2020 for health and social services accounted for SAR 167 (US \$44.5) billion (16.4%) of the total budget.² Actual spending for the same year increased by 13.5% and was allocated to the COVID-19 pandemic crisis. The national health care transformation strategy has been directed toward reforming health sector governance, corporatizing the model of care for accountable health care facility clusters, privatizing hospitals according to public private participation health care models, enhancing health insurance programs, and expanding manpower and the digital health system.³ The Saudi health care system's current structure consists of 3 entities: the organizer of legislation, the service provider, and the financier.³ Within the vision realization programs, the Ministry of Health (MOH) will be responsible solely for organization and legislation, while national holding companies will take over service delivery. National health insurance will cover finance. The main strategy is to ensure financial sustainability with transparency. Improving health care performance is expected to contribute to public resources and budget allocation decisions. This led to the launch of a series of reforms to improve infrastructure and build the capacity of health economics. Recently, at the 2020 meeting of the Group

of Twenty (G20), the KSA promoted a value-based health care system as a key transformation strategy under the Global Coalition for Value Health Care.^{4,5} This includes a health technology assessment (HTA) proposal to assess the value of health technologies.^{6,7}

Health care structure and the distribution of access to health care in the KSA vary owing to an ongoing transformation program and reconstruction of health services; this includes the privatization model and insurance expansion. The overall structure can be simplified into public or private sectors. Currently, public services cover citizens regardless of employment status, whereas private services cover residents or citizens who are employees in the corporate or private sectors.⁸ The public-to-private ratio of hospital numbers is 2:1.⁹ The public sector consists of MOH clusters with medical cities, other hospitals, and primary health care centers. The sector also includes specialized hospitals, such as the Ministry's hospitals (interior, defense, national guard, and education) and the King Faisal Hospital and Research Centre (KFSH&RC). The KFSH&RC is one of the major health care system sectors, along with the Saudi Health Council, the Council of Cooperative Health Insurance, the Saudi Commissions for Health Specialties, the Saudi Food and Drug Authority (SFDA), and the Saudi Red Crescent Authority.³ Collectively across health care providers, most already have structured plans for transformation as part of Vision 2030, and some have even published these plans on their websites.¹⁰

Economic evaluations play a critical role in priority setting for decision making in health care. There are few publications on health economic evaluations in the KSA and Gulf States, leading to a call to build research capacity.^{11,12} Systematic reviews of economic evaluations or systematic reviews with cost and cost-effectiveness outcomes have drawn increased interest in the field.^{13–20} Identifying current methodological considerations for published cost-effectiveness analysis (CEA) will improve practice and enhance future research foundations. In a systematic review to assess the quality of CEA reporting in the KSA, the conclusion was drawn that there was a

Department of Pharmacy, King Faisal Hospital and Research Centre, Riyadh, Saudi Arabia (FM); Oncology Centre, King Faisal Hospital and Research Centre, Riyadh, Saudi Arabia (SB); Centre for Applied Health Economics, School of Medicine, Griffith University, Nathan, Queensland, Australia (FM, SB, PS); Menzies Health Institute, Griffith University, Gold Coast, Queensland, Australia (PS); Centre for the Business and Economics of Health, The University of Queensland, Brisbane, Queensland, Australia (HT). The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. The authors received no financial support for the research, authorship, and/or publication of this article.

general absence of reporting specific details of a CEA.²¹ This review identified some deficiencies in the published CEAs; however, there is a need to comprehensively review and better understand the reported limitations of CEAs and the challenges facing analysts in the KSA to improve the quality of future evaluations. Our systematic review aims to go in depth on CEA methodology and to navigate future research to inform decision making on ways to value technologies for HTA within the KSA health system. Therefore, the aim of this review was to evaluate the technical approaches used in published economic evaluations conducted for the KSA. The present review examines limitations reported by authors of the respective studies that affect the ability to perform economic evaluations for the KSA's health care system. It is not intended to draw conclusions about technology adoption or rejection in health care.

Methods

Data Sources and Study Selection

An electronic literature search of the MEDLINE databases (including ePub and MEDLINE), PubMed, EMBASE, and the Cochrane Central Register of Controlled Trials was conducted. The search targets for comparative economic evaluations were applied in the KSA setting for the past 10 years (January 2010 to December 2020). The searches performed in PubMed used the following MeSH terms: "cost-effectiveness" OR "cost-benefit" OR "cost-utility" OR "cost-minimization" OR "return investment" OR "cost-consequences" OR "multicriteria decision analysis" OR "deliberative process" OR "economic analysis" OR "economic evaluation" OR "economic assessment" AND "Saudi Arabia." We excluded systematic reviews, meta-analyses, and cost studies defined as cost descriptions. An example includes cost-of-illness studies, as these do not involve a comparator and therefore provide insufficient data for decision making.²⁰ Duplicates were identified through a manual search because of limited studies on CEA conducted in the KSA. The identified studies were initially screened by the primary reviewer and then reviewed by another for data extraction and analysis. The PRISMA-P (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) 2015 checklist was used to develop the methodology for the systematic review.²²

Data Extraction

To assess the quality of reporting in economic studies that met the inclusion criteria, we used a consolidated health

economic evaluation reporting standards (CHEERS) statement.¹⁷ The checklist consisted of 24 items for the reporting of health economic evaluations. Data extraction focused on the study population, intervention with the comparator, perspectives, the selection of models from which the model was adopted, the selection of health outcomes, model input parameters, the estimation of costs and resources, and limitations and generalizability as reported by the authors of the studies. Data were extracted and compiled in Microsoft Excel version 2016.

Data Synthesis and Reporting Results

Data were collected with the reported limitations according to the CHEERS criteria. Each criterion was compared across analyses and presented in percentages. Limitations that were commonly reported by the authors of the respective studies are considered to be essential to extract and assess, as they reflect the challenges facing researchers when they perform economic evaluations. The reported limitations were classified into 4 domains according to CHEERS criteria: the definition of perspectives, identification of comparator/s, estimation of costs and resources, and use of the incremental cost-effectiveness ratio (ICER) threshold. Each domain was assessed on how it was approached (identified/defined/estimated) throughout the analysis. The institutions were classified into public and private facilities. The perspectives were classified as stated in the article and then reclassified by the current reviewer in reference to the KSA health care system according Kim et al.²³ with categorization into the payer, health care payer, limited societal, and societal perspective definitions. Costing approaches were assessed according to O'Sullivan et al.²⁴ and classified as involving micro, unit, and gross costing. Comparators, resource estimates and costs, and the ICER threshold were classified according to the article. The discussion of the reported limitation in relation to the KSA's national transformation program was built on systematic reviews with cost and cost-effectiveness outcomes by the International Society for Pharmacoeconomics and Outcomes Research task force and major government sources, including the MOH and Council of Cooperative Health Insurance.²⁰

Results

The initial screening retrieved 1440 records from a database search. Screening the titles and abstracts led to the identification of 21 records that met the screening criteria and went on for a full text review. Of these 21 articles, 12

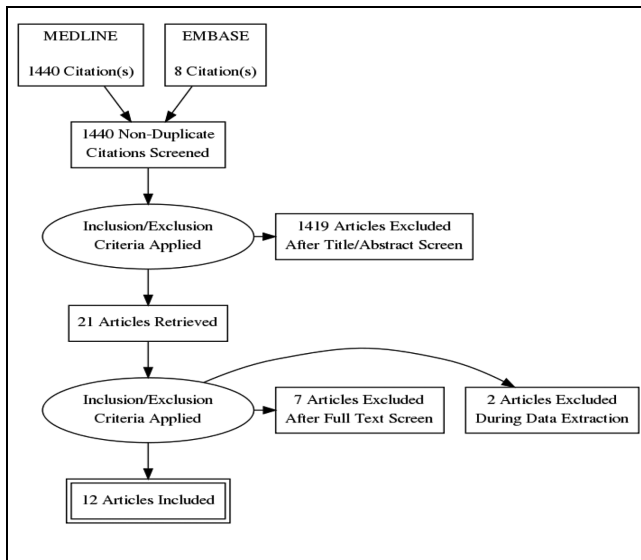


Figure 1 PRISMA flow chart.

full economic evaluations were identified to meet the inclusion criteria, and these were selected for inclusion in this review. The PRISMA flow chart shown in Figure 1 presents the screening details.

Quality of Reporting Using the CHEERS Checklist

The included studies and key CHEERS details are summarized in Table 1. The 12 studies were published between 2015 and 2020, and none were identified before 2014. The main method for economic evaluation was identified as CEA, and only 1 cost-minimization analysis (CMA) was found. For CEA, the decision analytic model was used in most studies (82%), whereas only 2 (18%) studies used a CEA of cohort studies. Within the model structure, missing data were identified in 25% for time horizons, 65% for cycle lengths, and 27% for utility. Clinical data were derived from the literature (60%), while the remaining data (40%) originated from a single-center study/institutional registry/hypothetical cohort. All analyses performed under the payer perspective used health costs and resources, whereas the societal perspective also used travel and/or productivity loss costs of “nonhealth”. Most analyses (75%) used the US dollar as the common currency for the analysis, but a large amount of missing data was identified for the price year, the conversion exchange rate, and consideration of inflation. All analyses used sensitivity analysis, and only 1 analysis adopted budget impact analysis.

Limitation Domains Reported by the Authors of the Respective Studies

According to the CHEERS criteria, limitations reported by the authors of the respective studies are summarized in Table 2.

Definition of perspectives. Half of the studies stated a payer perspective (50%), while the remaining adopted a societal (25%) or patient perspective (8%) or did not specify a perspective (17%). Regardless of the stated perspective, the adopted perspectives were later defined from a public or private “institutional” health care sector perspective (~70%), whereas the rest were not clearly reported. The institutional perspective was chosen because data input and assumptions for benefits and costs in the given model were collected from 1 or multiple institutions in the KSA. CEA studies that used a societal perspective only included productivity loss and/or traveling costs. Given the definition provided by Kim et al.²³ and with our attempt to reclassify the perspectives, all societal perspectives were reclassified as limited societal perspectives. While all payers’ perspectives in the public sector were kept the same, those in the private sector were reclassified as belonging to the health care payer. Accordingly, 42% were reclassified, 42% remained the same, and 16% could not be assessed by the current reviewer.

Identification of the comparator. Clear information on the comparator was found to be limited among the analyses (17%). In the remaining analyses, the choice of the comparator was recognized or assumed by the current reviewer within the flow of the analytical text in the given manuscript. Accordingly, descriptions for the comparator judged within the text were classified as follows: published model choice (50%), institutional standard practice within the KSA (33%), and published clinical trial/meta-analysis choice (17%).

Estimation of costs and resources. All analyses used direct costs, but only 2 considered future costs related to the disease of interest. Most data obtained from the resource approach were estimated by the authors of the respective study (67%), whereas the rest were based on expert opinion (33%). Data on cost sources were mostly (75%) from hospitals (public or private), including the MOH, whereas a small fraction were estimated by experts (25%). Given the definition of O’Sullivan et al.,²⁴ all studies used unit costing (~90%) except for one, which used gross costing. The SFDA remained the official source of pharmaceutical costing.

Table 1 Summary of Studies and Key Details^a

Study	Almaslami et al. ²⁵	AlRuthia et al. ²⁶	Almalki et al. ²⁷	Al-Semami et al. ²⁸	Hersi et al. ²⁹	Knott et al. ³⁰	Cara et al. ³¹	Alsaqa'ahy et al. ³²	Al-Aidarous et al. ³³	Gupta et al. ³⁴	Joosub et al. ³⁵	Nasef et al. ³⁶
Methodology												
Target population (base-case)	Inflammatory bowel disease	Cardiovascular disease	Ischemic stroke	Nonvalvular atrial fibrillation	Traumatic brain injury	MDR pneumonia	Multiple sclerosis	Birth cohort	Type 2 diabetes	Moderate to severe infections	Osteoarthritis	
Setting and location	KSA	KSA	KSA	KSA	KSA and other countries	KSA	KSA	KSA	KSA and other countries	KSA	KSA	
Study design	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CMA	CEA	
Study perspective	Societal	Payer	Societal	Payer/MOH	Payer	Payer	Payer	Societal	NR	Payer	Patient	
Intervention	In vitro fertilization	Intensive BP strategy	Ischemic stroke care program	Apixaban	Epoetin alfa	High-dose colistin	DMD	Rotavirus vaccination	Switching between insulins	Impipenem	Celecoxib	
Comparator	Intrauterine insemination	Less intensive BP strategy	Current stroke care	Other anticoagulants	Control	Low-dose colistin	5 different DMDs	No vaccination	Switching to other insulins	Meropenem	Nonselective NSAID	
Model												
Choice of model	Decision analytic model	Retrospective cohort studies	Markov model	Markov model	Retrospective cohort studies	Decision analytic model	Markov Model	Markov model	Markov model	NA	Markov model	
Time horizon	1 y	NR	15 y	Lifetime	1 y	NA (short)	20 y	Lifetime	30 y	NR	NR	
Cycle length	NR	NR	NR	6 wk	NR	NR	1 y	1 mo	NR	NR	NR	
Choice of health outcomes	ICER	HRQoL, ICER	ICER	ICER	ICER	ICER	ICER, NMB	QALYs, cost- neutrality level	ICER	Total daily cost	ICER	
Input parameter												
Clinical data and duration (trial)	1-y hospital single-center cohort study	3-y hospital EHR/ IBD registry	Meta-analysis of literature	Clinical trial, literature	Clinical trial, literature	3-y single-center cohort study	Clinical trial, literature	5-y hypothetical cohort	1-y literature	1-y single-center cohort study	Clinical trial literature	
Preference-based outcome (utility)	NR/assumption (live birth rate)	HRQoL, done in the analysis	NR	UK published catalogue	UK time/tradeoff tariff	NR	Literature	Literature	Literature	NA	Published model scores and literature	

(continued)

Table 1 (continued)

Study	Almashami et al. ²⁵	AlRuthia et al. ²⁶	Almalki et al. ²⁷	Al-Senami et al. ²⁸	Hersi et al. ²⁹	Knott et al. ³⁰	Cara et al. ³¹	Alsaqaby et al. ³²	Al-Aidarous et al. ³³	Gupta et al. ³⁴	Joosub et al. ³⁵	Nasef et al. ³⁶
Costs/resources												
Costs and resources considered	Health and nonhealth: travel, productivity losses	Health only	Health only	Health and nonhealth: productivity losses	Health only	Health only	Health only	Health only	Health and nonhealth: productivity losses	Health only	Health only	Health only
Currency	USD	SAR and USD	USD	USD	USD	USD	SAR	SAR and USD	SAR	USD	SAR	USD
Discount rate	NR (NA)	NR	3%/3%	3%/3%	3.5%/3.5%	NA	NA	3%/3%	3%/3%	NR	NA	3%/3%
(effect/cost)												
Price date	2016	NR	2018	2019	2013	2014	2016	2015	2012	2013	2013	2013
Conversion	Reported	NR	Reported	Reported	NR	Reported	NA	Reported	NA	NR	NR	Reported
Exchange rate	NR	NR	NR	NR	NR	NR	NA	NR	NR	Reported	Reported	Reported
Adjustment	OECD PPP	NR	NR	NA	UK consumer price index	OECD PPP	NR	3.2% (global medical trend rates report)	NA	NR	NR	Reported
costs for inflation	conversion rates					conversion rates						
BIA	NR	NR	NR	NR	NR	NR	NR	NR	Over a period of 10 y	NR	NR	NR
Sensitivity analysis used	Monte Carlo simulation, PSA	PSA, Nonparametric bootstrapping	Univariate (1-way) sensitivity analyses	PSA	PSA	Bootstrap procedures	Univariate (1-way) sensitivity analyses	Deterministic and PSA	Univariate sensitivity analysis	Short-term analysis	One-way sensitivity analysis	PSA

^aBIA, budget impact analysis; BP, blood pressure; CEA, cost-effectiveness analysis; CMA, cost-minimization analysis; DMD, disease-modifying drugs; EHR, electronic health record; HRQoL, health-related quality of life; ICER, incremental cost-effectiveness ratio; KSA, Kingdom of Saudi Arabia; MDR, multidrug resistant; MOH, Ministry of Health; NA, not applicable; NMB, net monetary benefit; NR, not reported; NSAID, nonsteroidal anti-inflammatory drug; OECD, Organization for Economic Co-operation and Development; PPP, purchasing power parities; PSA, probabilistic sensitivity analysis; QALY, quality-adjusted life-year; SAR, Saudi Arabian Riyal; UK, United Kingdom; USD, United States dollar.

Table 2 Limitation Domain Summary Details

Domain for Key Limitations ^a	Corresponding Limitations as Reported by Authors of the Respective Studies
Definition of perspective	Single center, private versus governmental center, generalizability
Identification of comparator(s)	The assumed comparator, generalizability
Estimation of costs and resources	Lack of epidemiology, clinical, costing, and utility local data; model assumptions that affect ICER; adopted model from existing models
Use of the ICER threshold	Generalizability

^aAs classified per consolidated health economic evaluation reporting standards (CHEERS) criteria. ICER, incremental cost-effectiveness ratio.

Use of the ICER threshold. Almost all reports stated that the KSA had no explicit threshold. Only half used an estimated value in the analysis, whereas the other half did not report using any threshold to determine whether the health treatment being evaluated was cost-effective. Of the reported estimated values, some referred to the World Health Organization (WHO), One to Three Times a Country's Gross Domestic Product (CHOICE), recommendations (50%), or hypothetical estimates (50%) adopted from previous CEA publications in the United States ranging from US \$50,000 to 100,000/quality-adjusted life-year (QALY). Regardless of the source considered, wide variation in the proposed number between studies was found (US \$25,000–100,000/QALY).

Discussion

The aim of this review was to identify the technical approaches and the reported limitations in the economic evaluations performed for the KSA. Missing or unclear data were observed frequently. The limitations reported by the authors of the respective studies were classified under the following domains: the definition of perspectives, identification of comparators, estimation of costs and resources, and use of the ICER threshold. In summarizing these limitations, 70% of reports defined perspectives as belonging to the “institutional” health care setting, 42% had to have the study's perspective reclassified, more than 80% did not clearly state the choice of the comparator, and approximately 67% had resources estimated by the authors of the respective study and 75% of the costing data were obtained from institutions (hospitals), among which 90% used unit costing. Finally, although all reports stated no explicit ICER threshold for the country, 25% used the WHO value, 25% used the United States as a reference, and 50% did not provide a threshold. A lack of local data was identified by the authors of the respective studies as a common theme in all limitation domains, broadly including epidemiological, clinical, and costing data. The studies were all

recently published, yet none used a checklist for reporting economic evaluation studies, such as CHEERS.

From a reporting perspective, private hospitals may not represent a payer perspective but rather a health care sector perspective. This is applied to insurance under the Council of Cooperative Health Insurance, which does not cover medical services such as the treatment of infertility or artificial insemination, as per the analyses by Al Maslami et al.²⁵ In this scenario, patients pay out-of-pocket expenses for specific medical services excluded by insurance. The second scenario occurs when uninsured personnel pay for elective services from the private sector in the KSA instead of the public sector. Until recently, performing CEA from a patient perspective was considered appropriate if the analysis was performed in a private hospital, as described by Nasef et al.³⁶ Specialized “institutional” hospitals—as part of the public sector—usually cover all monetary costs without out-of-pocket patient payments. Therefore, in principle, the institutional perspective may represent the payers' perspective for CEA analysis.

Stating the definition of the preferred choice of comparator is key to successful analysis in the country of research. All plausible comparators should be included considering the setting and current practice.³⁷ Adopting a comparator from a published reference or previous model does not guarantee that the comparator is relevant to the country under study, especially if most analyses are done from an institutional perspective. Institutions generally have their own formulary that is not relevant to the entire health care field across health facilities in the KSA. However, tertiary institutions may be used as references when defining comparators, thereby guiding the HTA entity in the future. In fact, specialty hospitals are probably the most useful source, particularly for highly specialized diseases such as cancer and metabolic diseases. The use of a comparator from an institutional standard practice was limited. Nevertheless, this is likely a favorable means to ensure the proper identification of the comparator within the KSA system. Regardless of whether the above comparator assumptions are valid,

Table 3 Limitation Domain Summary Details^a

	Almaslami et al. ²⁵	AlRuthia et al. ²⁶	Almalki et al. ²⁷	Al-Senami et al. ²⁸	Hersi et al. ²⁹	Knoff et al. ³⁰	Cara et al. ³⁰	Alsaqraby et al. ³²	Al-Aidarous et al. ³³	Gupta et al. ³⁴	Joosath et al. ³⁵	Nasef et al. ³⁶
Perspective	Societal	NR	Payer	Societal	Payer	Payer	Payer	Payer	Societal	NR	Payer	Patient
Study perspective	Institutional	Institutional	Institutional	Undetermined	Institutional	Undetermined	Institutional	Institutional	Undetermined	Undetermined	Institutional	Institutional
Reported definition of perspective	Private hospital	Public hospital	Private hospitals	Health care payer	Public hospital	Undetermined	Public hospital	Public hospital	Undetermined	Undetermined	Public hospital	Public hospital
Reclassification according to the KSA health care system	Limited societal	Payer	Health care payer	Limited societal	Same	Undetermined	Same	Same	Limited societal	Undetermined	Same	Same
Comparator	NR	NR	NR	NR	Reported Published model	NR	NR	NR	NR	NR	NR	Reported Published model
Identification of the comparator	Institutional standard practice	Institutional standard practice	Clinical trial/ Meta-analysis	Published model	Published model	Clinical trial	Institutional standard practice	Published model	Published model	Published model	Institutional standard practice	Published model
Comparator judged from the texts	standard practice	standard practice	Meta-analysis	Published model	Published model	Clinical trial	Institutional standard practice	Published model	Published model	Published model	Institutional standard practice	Published model
Resources and costs considered	Direct	Direct	Direct	Direct and future	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct and future
Resource estimation sources	Experts	Author estimation	Author estimation	Experts	Author estimation	Author estimation	Author estimation	Author estimation	Experts	Expert	Author estimation	Author estimation
Cost sources	Private hospital	MOH	5 private hospitals, SFDA for drugs	MOH	Published model	NR	NR	Public hospital	Experts	Expert	Public hospital	7 private hospitals
Costing approach judged from the text	Unit costing	Unit costing	Unit costing	Unit costing	Gross costing	Multipled by cost ratio 0.533, SFDA for drugs	Public hospital	Unit costing	Unit costing	Unit costing	SFDA for drugs	MOH for drugs
ICER threshold	US \$60,000/QALY	NR (stated not available)	US \$60,000/QALY	NR	US \$20,000–30,000/QALY	US \$50,000/QALY	NR	US \$100,000/QALY	NR	NR	NR	US \$25,961/QALY
Threshold estimate source	WHO	NA	WHO	NA	Hypothetical	Hypothetical (rationale not stated)	NA	Hypothetical US range \$50,000–100,000/QALY	NA	NA	NA	WHO
Threshold estimate source	3 × GDP/capita	3 × GDP/capita	3 × GDP/capita	3 × GDP/capita	in US and £20,000/QALY in UK	in US and £20,000/QALY in UK	in US and £20,000/QALY in UK	in US and £20,000/QALY in UK	in US and £20,000/QALY in UK	in US and £20,000/QALY in UK	in US and £20,000/QALY in UK	1 × GDP/capita

^aGDP, gross domestic product per capita; KSA, Kingdom of Saudi Arabia; MOH, Ministry of Health; NA, not applicable; NR, not reported; QALY, quality-adjusted life-years; SFDA, Saudi Food and Drug Authority; UK, United Kingdom; US, United States; WHO, World Health Organization.

the definition and criteria for choosing the comparator are not clearly stated within the analyses.

Estimating costs should include payers' and societal perspectives in the reference case, as described in the second panel.¹⁹ Most of the studies performed costing through an "institutional" facility, since costing data can be easily collected. Specialty hospital data for cost analysis can be overestimated. Many factors are considered for cost estimation in these advanced health care deliveries. Costs for resource estimation can be high due to operational costs and equipment costs, along its maintenance, as shown in one institutional study.³⁸ Using patient-level resources and electronic health records (EHRs) could have major limitations due to incomplete or missing data. This approach may also require a request for access to ensure patient confidentiality. Conversely, EHRs can be a good source for estimating nonhealth resources if provided by the institution—such as transportation and cumulative sick leave—to calculate productivity loss. Variations in costs are expected across the KSA, which makes gross costing appealing. Further effort should be encouraged in future research.

The first publication of the willingness-to-pay (WTP) threshold for the KSA was done by Bazarbashi et al.,³⁹ who proposed a country estimate of US \$25,600 and \$32,000 from the demand-side approach that represents societal WTP. The proposed threshold provided in this analysis is close to the lower range of the WHO CHOICE recommendations (1 times the GDP per capita). The review identified only 2 analyses that had employed the same range. Any threshold value may be considered too high or low. If it is too low, this may result in not funding many technologies with higher marginal costs per QALY. Eventually, some countries agreed to adopt a higher threshold than the estimated threshold to improve access to technologies with great benefits.^{40,41} Setting a WTP threshold is a challenge for many jurisdictions. Future work from the KSA should focus on empirically estimating a WTP from the supply side. The supply-side approach may suggest thresholds even lower than the lower end of the WHO range. However, under Vision 2030, public funding programs for health care are clearly generous, which may shift the supply-side WTP thresholds to higher estimates.^{42–42} This may especially suggest that a single cost-effectiveness threshold may not be the best scenario owing to the different funding streams. Instead, it may be interesting to consider a different opportunity cost of health for public and private systems and what this implies for determining a single cost-effectiveness threshold for the KSA.

Multiple studies have identified technical difficulties in reporting economic evaluations due to a lack of local

data pertinent to the analysis. This is especially true in countries with known health economy structures, education, and practices in their infancy and in middle- or low-income countries.⁴⁶ A similar review of the Gulf Region identified a lack of published economic evaluations.⁴⁷ In a recent workshop established to understand pharmaceutical companies' insights for upcoming HTAs, a major discussion concerned HTA methods and the local data sources required for economic models within submissions.⁷ This was a clear call to create guidance and definitions when assessing the value of technology in the KSA's health care structure. Establishing a future HTA in the KSA would encourage more research in CEA studies. A recent study published by the Vision 2030 realization office of the MOH evaluated the expectations of establishing the HTA entity as a national agency for the KSA. A lack of data was identified as a common issue among local experts.⁴⁸ The study revealed the importance of having an HTA entity. Such an entity may have to focus on HTA services considering the deliberation context/process for analytical assessment and starting the implementation of high-impact technologies. It was also emphasized that broad partnership with other decision makers in the KSA—such as the SFDA and leading hospitals such as the KFSH&RC and others—was necessary. The current decision makers' debate on the future HTA entity within the KSA can make the greatest contribution to developing good practices for decision making.

Limitations

This review has some limitations, including its focus on publications in English, on a 10-y period, and on the databases searched. We aimed to collect and analyze data from analyses of publications' details that may be changed if judged by different reviewers or not provided due to limited information within the publication. The reported limitations were those stated by the respective study authors. However, other limitations may be present despite not being reported. Therefore, they are not discussed in this review.

The classification of the reported limitations into various domains may have resulted in other reported limitations not falling under any judged domains.

Conclusions and Future Directions for Research

Efforts to assess the value for money of new health technologies are emerging around the globe. The CEA approach is used for the health economic evaluation of


HTA but considers other financial allocation factors in many countries. Therefore, multiple frameworks suggest different analytical approaches beyond the CEA, whereas others promote additional certain or novel value elements for economic assessment to capture these factors.^{49,50} The KSA's direction has already been declared by establishing the HTA entity. In response to identifying the approach for economic evaluation within the KSA, a collective effort from health economic advocates should shape economic practice within the growing health care system. Future research should define conceptual foundations and identify the appropriate approach for assessing the value of health technologies.

Authors' Contributions

FM conceptualized and designed the manuscript and conducted the review with data analysis and interpretation. HT performed the second review and critically reviewed the manuscript. PS oversaw the analysis and critically reviewed the manuscript. SB reviewed the manuscript and its relevance to the KSA health care system. All authors approved of the final version of the manuscript.

ORCID iDs

Fatma Maraiki  <https://orcid.org/0000-0001-6875-1095>

Paul Scuffham  <https://orcid.org/0000-0001-5931-642X>

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