Healthcare Value Assessment: A Critical Review of Economic Outcome Metrics and Future Directions

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Abstract

This paper provides a critical review of economic outcome metrics used in healthcare value assessment, emphasizing the evolving landscape of resource allocation, patient-centered approaches, and standardization efforts. With healthcare costs rising globally, the efficient allocation of limited resources is essential. Metrics like Quality-Adjusted Life Years (QALYs), Disability-Adjusted Life Years (DALYs), Incremental Cost-Effectiveness Ratios (ICERs), and Cost-Benefit Analysis (CBA) are central to guiding funding decisions, influencing insurance coverage, and shaping treatment prioritization. Emerging trends, such as the integration of artificial intelligence (AI) and big data, are enhancing the precision of these assessments, while patient-centered metrics underscore the importance of patient satisfaction and quality of life. Additionally, there is a growing push for the standardization of these metrics to create consistent frameworks across diverse health systems. This paper explores case studies, practical applications, and future directions to provide insights into how healthcare systems can adopt more effective, globally aligned economic assessments.

Keywords: ICER, PROs, NHB, Economic Outcome Metrics, Artificial Intelligence (AI), Incremental Cost-Effectiveness Ratio, Cost-Benefit Analysis, Patient-Centered Metrics, Global Standardization.

1. Introduction

Healthcare value assessment systematically evaluates the benefits and costs of medical technologies and interventions, helping to allocate resources effectively in a budget-constrained environment. Often referred to as health technology assessment (HTA), this approach integrates methods from medicine, epidemiology, and economics to determine the value of healthcare interventions by comparing benefits with associated costs (Linthicum et al., 2020; Michaels, 2021). Healthcare value assessment is vital in guiding resource allocation, enhancing healthcare quality, and ensuring that decisions are grounded in clinical and economic evidence (Bradley et al., 2017). By incorporating patient-centered analyses and fostering a patient-focused research environment, value assessments can more accurately capture societal benefits and reflect the outcomes most relevant to patients (Linthicum et al., 2020; Armstrong & Mullins, 2017).

Value assessments provide evidence-based insights for policymakers and payers, helping to shape coverage and reimbursement policies for new therapies. This can reduce clinical variation and control healthcare costs by highlighting settings where optimized patient outcomes are achieved at lower costs (Bradley et al., 2017). Healthcare providers benefit from value assessments when selecting treatments, as these assessments consider clinical attributes (e.g., safety, efficacy) alongside patient costs and administration routes. Integrating patient values through shared decision-making ensures alignment with patient preferences and priorities, fostering more personalized care (Diaby et al., 2018). Value assessments that account for health status measures can improve clinical care by facilitating the integration of patient-reported data into practice. This data, gathered through tools like web portals or automated telephonic systems, enhances patient-centered care by incorporating broader value aspects such as QALYs and societal benefits, which support comprehensive care delivery (Antoñanzas et al., 2016).

Importance of Economic Outcome Metrics

Connection Between Healthcare Costs, Outcomes, and Quality

Economic outcome metrics are fundamental in linking healthcare costs, patient outcomes, and quality. Value in healthcare is typically defined by the quality of care provided in relation to costs incurred. Quality in this context is measured by patient outcomes, encompassing clinical endpoints, quality of life, and patient satisfaction (Lee, Austin, & Pronovost, 2016; Bradley et al., 2017). For example, cardiovascular care value is assessed by comparing patient outcomes with costs to identify settings where optimal outcomes are achieved more efficiently (Bradley et al., 2017). Despite high healthcare expenditures, particularly in the U.S., better outcomes are not always achieved, highlighting the need for a value-based approach to focus on improving outcomes while controlling costs (Scheurer et al., 2016). Economic evaluations, such as cost-effectiveness and cost-utility analyses, support informed healthcare decisions by systematically comparing the costs and outcomes of various treatments (Blumenschein & Johannesson, 1996; Robinson, 1993).

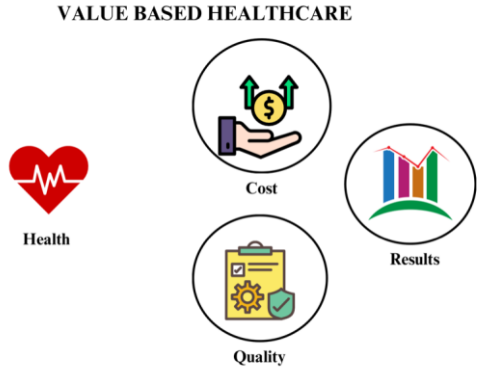

Figure 1. This illustrates Value-Based Healthcare focuses on enhancing patient health, reducing costs, improving outcomes, and maintaining high-quality standards in care delivery.

Economic Metrics in Healthcare Value Assessment

Economic metrics such as cost-effectiveness ratios, cost-utility analyses, and cost-benefit analyses serve as vital tools for evaluating healthcare value. These metrics offer a structured approach to compare costs and outcomes across healthcare interventions (Blumenschein & Johannesson, 1996; Robinson, 1993). For instance, cost-utility analysis, which uses quality-adjusted life years (QALYs), assesses both the quantity and quality of life gained from healthcare interventions (Wailoo et al., 2017). Incorporating economic metrics enables decision-makers to evaluate healthcare interventions' value and make resource allocation decisions that maximize health outcomes within financial constraints (Idris et al., 2023; Alaujan et al., 2021). Additionally, these economic evaluations can guide policy decisions around coverage and reimbursement for new therapies, with the goal of enhancing patient outcomes while containing costs (Scheurer et al., 2016; Bradley et al., 2017). This connection between costs, outcomes, and quality underscores the role of economic metrics in fostering a value-based healthcare system, ultimately guiding resource use to improve patient care efficiently.

Fundamental Concepts in Healthcare Value Assessment

Healthcare Value Assessment: A Paradigm Shift in Contemporary Healthcare

Healthcare value assessment represents a transformative approach, integrating patient outcomes relative to costs, fundamentally reshaping healthcare economics and delivery models (Looi et al., 2021). This concept moves beyond traditional cost-benefit analyses, establishing a tripartite framework that includes payer efficiency metrics, provider clinical standards, and patient-reported outcome measures, creating a complex ecosystem for determining value (Kini & Ho, 2019).

The value-based healthcare (VBHC) model revolutionizes traditional fee-for-service systems by directly linking provider compensation with measurable patient outcomes, driving significant changes in healthcare delivery while tackling accessibility and affordability issues (Bernstein et

al., 2019). Integral to this transformation are Integrated Practice Units (IPUs), which bring together multidisciplinary teams to address specific patient conditions or population health needs comprehensively, enhancing both resource allocation and treatment efficacy (Nuño-Solínis, 2019). Contemporary research highlights that effective VBHC implementation requires advanced outcome measurement systems that capture both quantitative clinical metrics and qualitative patient-reported outcomes, including psychosocial well-being and functional status improvements (Lewis, 2019). Cost-control mechanisms are also essential to ensure sustainability while maintaining quality (Salvatore et al., 2021).

This integration of diverse perspectives and methodologies has established a comprehensive framework prioritizing patient-centered outcomes, ensuring fiscal responsibility and clinical excellence. This holistic approach promotes systematic improvements in healthcare delivery, population health, and patient satisfaction metrics, creating a dynamic platform for continuous innovation (Musina et al., 2021). The VBHC model's focus on measurable outcomes that matter to patients is central to its goal of fostering innovation while enhancing patient care and health system efficiency (Cohen, 2011).

Economic Outcome Metrics in Healthcare: Evaluating Interventions Effectively

Economic outcome metrics are essential tools for measuring and evaluating the effectiveness and value of healthcare interventions. Among these, Quality-Adjusted Life Years (QALYs) stand out as a cornerstone metric in healthcare economics, integrating both the quantity of life (longevity) and the quality-of-life improvements into a singular framework. This dual focus makes QALYs a fundamental component in cost-effectiveness analyses (CEAs) and cost-utility analyses (CUAs), allowing for a more comprehensive understanding of intervention efficacy (Whitehead & Ali, 2010). Despite their utility, QALYs have notable limitations, particularly concerning comprehensiveness and equity implications. Critics argue that while QALYs provide valuable insights, they may not adequately capture the diverse perspectives of different populations or health conditions (Kim et al., 2020).

To address these gaps, Disability-Adjusted Life Years (DALYs) offer a complementary perspective by quantifying the burden of disease through a combination of years lost to premature mortality and years lived with disability. This metric is particularly valuable in both microeconomic evaluations and broader policy-making contexts, as it encapsulates the full spectrum of health loss (Davidović et al., 2021). The Cost-Benefit Analysis (CBA) framework elevates economic evaluation to a monetary level, allowing for explicit decision criteria based on benefit-cost comparisons. However, this approach faces challenges in standardizing the monetary values assigned to health outcomes, which can vary significantly across different healthcare contexts (Shah et al., 2022).

While each of these metrics has its imperfections, together they provide a robust framework for healthcare economic evaluation. This collective approach facilitates evidence-based decision-making in resource allocation and policy formulation, ensuring that healthcare interventions are evaluated on both economic and human value grounds (Hirth et al., 2000). The ongoing refinement and integration of these metrics reflect the healthcare sector's commitment to developing sophisticated tools for measuring and optimizing interventions, even as

methodological challenges and theoretical debates surrounding their application persist (Feng et al., 2020; Rankin et al., 2019).

Metrics Measuring Effectiveness, Cost Efficiency, and Health Outcomes

QALYs and DALYs

Quality-Adjusted Life Years (QALYs) and Disability-Adjusted Life Years (DALYs) represent fundamental approaches to measuring health outcomes. Whitehead & Ali (2010) provide a comprehensive overview of QALYs, describing them as a measure combining both length and quality of life into a single value. Their research demonstrates that QALYs have become the predominant outcome measure in health economic evaluations, particularly in developed countries. A comparative analysis by Feng et al. (2020) examined the interchangeability of QALYs and DALYs, finding that while methodological differences exist, both metrics often lead to similar policy conclusions. Their study of multiple health interventions revealed correlation coefficients exceeding 0.85 between QALY and DALY measurements.

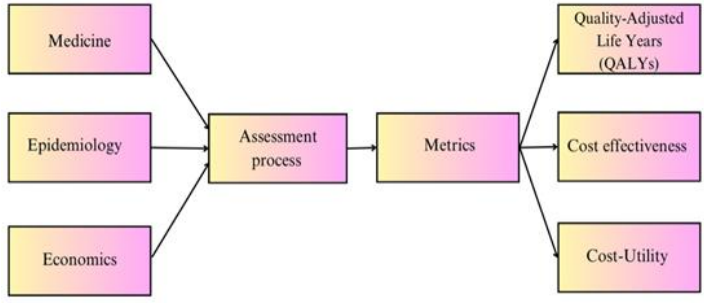

Figure 2. This diagram demonstrates the assessment process in healthcare integrates inputs from medicine, epidemiology, and economics to evaluate metrics such as Quality-Adjusted Life Years (QALYs), cost-effectiveness, and cost-utility for informed decision-making.

Methodological Considerations

Davidović et al. (2021) conducted a model analysis for breast cancer screening, comparing DALYs averted versus QALYs gained. Their research highlighted that while both metrics effectively measure health outcomes, they can yield different results depending on the intervention context and population characteristics. The authors emphasize the importance of selecting appropriate metrics based on the specific healthcare intervention being evaluated.

Cost Efficiency Evaluation

Economic Analysis Methods

Kim et al. (2020) analyzed cost-effectiveness studies from 1974-2018, revealing significant evolution in costing methodologies. Their research demonstrated that individual-level costing dominated 92% of studies, while the healthcare sector perspective remained prevalent in 71% of analyses. The authors noted substantial variation in societal perspective usage across different countries and intervention types.

Resource Allocation and League Tables

Shah et al. (2022) developed a comprehensive league table of cost-utility ratios for India, demonstrating the value of systematic compilation of cost-effectiveness evidence in supporting evidence-based policy making. Their work illustrated how league tables facilitate standardized comparison across diverse health interventions while highlighting the significant influence of local context on cost-effectiveness thresholds.

Health Outcomes Assessment

Utility Measurements

Rankin et al. (2019) conducted a systematic review of QALY derivation methods in heart failure trials. Their analysis revealed the existence of multiple instruments for measuring health-related quality of life, noting that method selection significantly impacts final QALY calculations. The authors identified ongoing challenges in standardizing measurement approaches across different healthcare contexts.

Comparative Analysis

Augustovski et al. (2017) examined two preventive interventions using both DALYs and QALYs. Their research concluded that the choice of measure can affect the magnitude of estimated benefits, while context-specific factors influence metric selection. The study confirmed the strong validity of both measures when applied in appropriate contexts.

Implementation Considerations

Economic Thresholds

Hirth et al. (2000) analyzed willingness-to-pay for a QALY, identifying substantial variation across different methodological approaches, geographic regions, and healthcare system types. Their work underscores the importance of considering local economic conditions when establishing cost-effectiveness thresholds.

Practical Application

Rushby & Hanson (2001) provided guidance on calculating and presenting DALYs in cost-effectiveness analysis. Their work emphasized the importance of transparent methodology, standardized reporting, and careful consideration of local contexts in result interpretation. The reviewed literature suggests several key areas for advancement in health outcome measurement. Methodological standardization represents a critical priority, encompassing consistent approaches to utility measurement, standardized reporting formats, and clear guidelines for metric selection. Context-specific considerations emerge as another crucial area, requiring attention to local healthcare system characteristics, population-specific factors, and economic conditions in threshold determination.

Integration strategies constitute the third major area for development, focusing on combining multiple outcome measures when appropriate, considering both short and long-term impacts, and incorporating broader societal impacts where relevant. The literature demonstrates strong evidence supporting the use of both QALYs and DALYs in health outcome measurement. While

methodological challenges persist, these metrics provide valuable frameworks for healthcare decision-making. Future research should focus on improving standardization and context-specific application of these measures, while maintaining flexibility to accommodate diverse healthcare settings and populations.

Quality-Adjusted Life Years (QALYs)

Quality-Adjusted Life Years (QALYs) represent a fundamental metric in health economics, integrating both quantitative and qualitative aspects of life into a unified measurement system. This comprehensive analysis examines the theoretical foundations, practical applications, and ongoing debates surrounding QALYs in healthcare decision-making.

Theoretical Framework and Calculation Methodology

Quality-Adjusted Life Years operate on the principle that health outcomes can be quantified by combining survival duration with quality-of-life measures. The basic premise assigns a value of 1.0 to a year of perfect health, while death is valued at 0.0. Health states between these extremes receive intermediate values, reflecting their relative desirability.

The calculation process involves several steps:

1. Health state measurement using validated instruments

2. Transformation of health states into utility values

3. Integration of these values with survival data

4. Aggregation into final QALY scores

Research by Whitehead and Ali demonstrates that this methodology enables standardized comparisons across diverse medical conditions and interventions, though the process requires careful attention to methodological consistency.

Implementation in Healthcare Systems

QALYs serve as a cornerstone in cost-utility analyses, enabling healthcare providers and policymakers to compare interventions across different medical domains. As highlighted by Kind et al., this standardization facilitates more informed resource allocation decisions. In clinical settings, QALYs inform treatment choices by providing quantifiable measures of expected health outcomes. Bergmo's systematic review reveals their particular utility in evaluating emerging healthcare delivery methods, such as telehealth interventions.

The QALY framework offers several notable advantages:

By incorporating both mortality and morbidity measures, QALYs provide a more complete picture of health outcomes than singular metrics. This comprehensive approach, as noted by Salomon, enables more nuanced healthcare evaluation. QALYs establish a common currency for health benefit measurement, facilitating comparisons across different diseases, treatments, and healthcare programs. This standardization, according to Rodríguez et al., has proven particularly valuable in health technology assessment.

2. Methodological Challenges and Limitations

Versteegh and Brouwer highlight the ongoing debate regarding whose preferences should inform QALY calculations - patients or the general public. This choice can significantly impact evaluation outcomes and subsequent resource allocation decisions. Rankin et al.'s research in heart failure evaluations reveals considerable variability in QALY calculation methods, potentially compromising comparability across studies. The QALY framework has been criticized for potentially undervaluing treatments for certain patient groups, particularly those with chronic conditions or disabilities. This limitation, documented by Carlson et al., necessitates careful consideration in policy applications. Developing more consistent approaches to utility value derivation and QALY calculation would improve comparability across studies and healthcare systems.

Augustovski et al. suggest combining QALYs with complementary measures like DALYs (Disability-Adjusted Life Years) to provide more comprehensive health outcome assessments. Incorporating explicit equity weights or alternative evaluation frameworks could help address concerns about fairness in resource allocation decisions. Quality-Adjusted Life Years remain a vital tool in healthcare evaluation and decision-making, despite acknowledged limitations. Their continued refinement and thoughtful application, guided by emerging research and methodological improvements, will enhance their utility in promoting efficient and equitable healthcare resource allocation.

Disability-Adjusted Life Years (DALYs) are a vital measure for assessing the burden of disease and injuries globally, combining both mortality and morbidity to provide a comprehensive estimate of health loss. This metric sums Years of Life Lost (YLLs) from premature mortality and Years Lived with Disability (YLDs) due to illness or injury, creating a unified view of disease impact across populations (Murray et al., 2012; Kassebaum et al., 2016). YLLs are calculated based on the number of deaths and expected life span at the age of death, while YLDs depend on disease prevalence and disability severity, using established disability weights to quantify impact (Devleesschauwer et al., 2014). The Global Burden of Disease (GBD) studies leverage DALYs to compare health loss across countries and time, providing insight for prioritizing health resources and policies (Kyu et al., 2018). This measure aids in evaluating health interventions and monitoring progress, though it faces challenges, such as ethical concerns around disability weights and methodological debates over age weighting (Arnesen & Nord, 1999). Accurate DALY calculation requires robust data, which can be challenging in regions with limited health data availability, potentially affecting comparability (Hay et al., 2017). Overall, DALYs offer a crucial tool in understanding and addressing global health needs, despite limitations in data quality and ethical considerations.

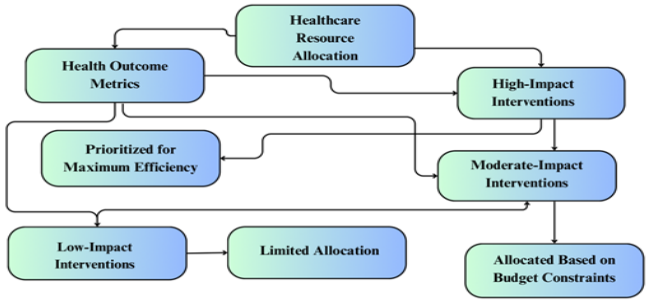

Figure 3. This diagram shows. In healthcare resource allocation, interventions are prioritized based on health outcome metrics to ensure maximum efficiency, with high-impact interventions receiving priority, moderate-impact interventions allocated within budget constraints, and low-impact interventions given limited allocation.

The Role of Incremental Cost-Effectiveness Ratio (ICER) in Health Economics

The Incremental Cost-Effectiveness Ratio (ICER) is a fundamental metric in health economics, employed to assess the cost-effectiveness of medical interventions by comparing the additional costs associated with an intervention to the additional health outcomes it generates. This ratio is particularly influential in informing healthcare funding and policy decisions, especially concerning new drug approvals and cancer screening initiatives. Often, these evaluations reference threshold values linked to a country's GDP, reflecting the willingness-to-pay thresholds (Gafni & Birch, 2006; Wong et al., 2016).

While the threshold-based framework of ICER is widely accepted in many healthcare systems, it has faced criticism for its lack of transparency and justification, which can lead to suboptimal resource allocation. For instance, the value of ICER can fluctuate significantly between countries, complicating global comparisons and sometimes resulting in inconsistent decision-making across different healthcare contexts (Oliveira et al., 2020; Sussman et al., 2020). Additionally, the inherent complexity of ICER and its dependence on incremental costs may introduce biases, making consistent application challenging in diverse healthcare environments (Yuan et al., 2022). In response to these criticisms, the Net Monetary Benefit (NMB) approach is increasingly advocated as a more straightforward alternative to ICER. NMB offers a linear relationship with costs, making it easier to apply practically (Paulden, 2020; Trippoli, 2017). Critics also highlight that ICER often fails to adequately account for opportunity costs, limiting its comprehensiveness in resource allocation (Simoens, 2010).

While ICER remains central to cost-effectiveness evaluations, the adoption of alternative measures like NMB, alongside a more nuanced approach to opportunity costs, may provide decision-makers with enhanced tools for optimizing healthcare resource allocation. These alternatives may help facilitate more effective and equitable healthcare decision-making. Net benefit frameworks, including Cost-Benefit Analysis (CBA) and Cost-Utility Analysis (CUA), are essential in health economics for assessing the value of healthcare interventions. CBA evaluates both costs and benefits in monetary terms, making it advantageous for understanding

the broader economic impact on society, including productivity gains and non-health-related outcomes (Brent, 2023; Hauber et al., 2001). However, monetizing health benefits presents challenges, as it may fail to capture intangible values and societal preferences (McIntosh et al., 1999).

In contrast, CUA focuses on healthcare-specific outcomes using metrics like quality-adjusted life years (QALYs), combining life quality and longevity for a holistic health measure, which is highly relevant for clinical decisions (Cohen, 2012; Earle et al., 2000). While CUA's focus on health outcomes aligns well with healthcare priorities, its assumptions of fixed budget constraints and methodological complexity (e.g., accurate utility measurement and discounting) can complicate real-world applications (Chang & Henry, 1999). Both CBA and CUA require robust methods, including sensitivity analysis and discounting, to address uncertainties and adequately reflect societal preferences (Listl & Faggion, 2016). Ultimately, the choice between CBA and CUA should be based on the context and goals of the evaluation, balancing comprehensive economic assessment with healthcare-specific relevance to support informed decision-making.

Emerging Metrics in Economic Assessments

In recent years, healthcare economic assessments have begun to integrate newer metrics, such as Patient-Reported Outcomes (PROs) and Net Health Benefit (NHB), which enrich the traditional evaluation frameworks. PROs capture quality of life and well-being directly from patients' perspectives, making them valuable for economic evaluations in mental health, where multisectoral and multinational elements complicate assessments (Łaszewska et al., 2021). They are also critical for benchmarking and improving healthcare system performance, as seen in the NHS PROMs Programme and Sweden's quality registers for procedures like hip and knee arthroplasty. While these programs demonstrate the potential of PROs to enhance care quality, challenges persist in the standardization and application of PROs in everyday clinical settings (Péntek, 2019; Prodinger & Taylor, 2018).

The Net Health Benefit (NHB) metric, often used in conjunction with quality-adjusted life-year (QALY) cost-effectiveness analyses, further advances economic evaluations by comparing marginal costs and benefits to determine a healthcare intervention's net value. This approach is particularly recommended by the ISPOR Special Task Force for its utility in capturing a broad array of value components, including financial risk protection and the value of hope, thus offering a more comprehensive assessment than cost-per-QALY alone (Garrison et al., 2019). Together, PROs and NHB represent a shift toward more patient-centered and nuanced economic evaluations, although their effective implementation requires continued refinement in measurement and methodology. Economic outcome metrics are invaluable in healthcare, offering standardized tools for assessing the cost-effectiveness and overall impact of interventions, aiding both policy and clinical decisions. They enable a systematic evaluation of health outcomes relative to costs, which supports resource allocation and intervention comparisons.

Strengths

Metrics such as cost per quality-adjusted life-year (QALY) offer a uniform measure of health outcomes, allowing comparisons across diverse diseases and populations (Torgerson & Raftery,

1999). Additionally, Patient-Reported Outcomes (PROs) enhance benchmarking by capturing direct feedback from patients on their care experiences (Péntek, 2019). Cost-effectiveness ratios based on clinical and quality-of-life endpoints help compare various treatments by translating different clinical outcomes into comparable economic values (Drummond & O'Brien, 1993). Mapping techniques also link clinical outcomes to utility measures, making cost-utility assessments more comprehensive (Wailoo et al., 2017).

Limitations

Economic evaluations can struggle with comparing treatments with distinct endpoints, such as mortality. QALY-based measures also fail to capture certain health benefits and raise equity concerns, often relying on assumptions that may not always align with real-world health dynamics (Whitehead & Ali, 2010). Economic evaluations are susceptible to variations in data sources and model specifications, which can impact outcomes significantly (Gallet & Doucouliagos, 2017). Additionally, applying traditional statistical principles to economic data demands judgments on both statistical and economic importance, complicating interpretations.

There is a shortage of validated PRO tools in some regions, limiting their application in international research and healthcare collaborations (Péntek, 2019). Economic outcome metrics play a critical role in standardizing value assessments and enabling cross-intervention comparisons. Nonetheless, challenges in measuring diverse health outcomes, data variability, and tool validation highlight the need for methodological advancements to improve the precision and reliability of economic evaluations.

Explanation of Metrics Across Health Systems

Table 1. This table outlines the application of five health economic metrics Quality-Adjusted Life Years (QALYs), Disability-Adjusted Life Years (DALYs), Incremental Cost-Effectiveness Ratio (ICER), Cost-Benefit Analysis (CBA), and Patient-Reported Outcomes in the United States, United Kingdom, and developing nations. It highlights their roles in pharmaceutical evaluations, public health funding, policy-making, and patient care, reflecting the varying priorities and resource availability in different healthcare systems.

Criteria	Quality-Adjusted Life Years (QALYs)	Disability-Adjusted Life Years (DALYs)	Incremental Cost-Effectiveness Ratio (ICER)	Cost-Benefit Analysis (CBA)	Patient-Reported Outcomes
U.S.	Used primarily in pharmaceutical cost-effectiveness studies to evaluate new treatments, particularly in cancer and rare diseases [66].	Less commonly used due to focus on high-resource, specialized treatments rather than global burden [67].	Applied widely by insurers, like CMS, for Medicare coverage decisions on interventions [68].	Used in public health funding, particularly for infrastructure and environmental health projects [69].	Increasingly used by healthcare providers to monitor treatment satisfaction and quality of life [70].
UK	Integral to NICE's appraisal of new medications and treatments for National Health Service (NHS) reimbursement [71].	Occasionally used for public health to address disease burden in lower-income populations [72].	Central to NHS policy; NICE uses ICER to establish treatment cost-effectiveness thresholds [73].	Applied mainly in economic evaluations of infrastructure, with focus on overall cost savings [74].	Routinely used for chronic disease management to monitor health-related quality of life [75].
Developing Nations	Less frequently applied due to resource constraints, though increasingly in pilot programs funded by global organizations [76].	Widely used, especially in WHO projects, to prioritize high-burden diseases like HIV and malaria [76].	Limited application due to cost data scarcity, though pilot projects are expanding [77].	Gaining traction in cost assessments for public health projects, with help from international funding [78].	Limited usage due to resource challenges; often collected through NGO health programs [79].

Applications of Health Economics Metrics in Different Regions

U.S. Applications

In the U.S. healthcare system, QALYs are often employed in pharmaceutical cost-effectiveness analyses, particularly for high-cost treatments. Although payers like Medicare are legally restricted from using strict cost-effectiveness thresholds, QALYs inform evidence-based pricing and funding decisions for new interventions (Weinstein et al., 2009).

The use of DALYs is limited in the U.S. due to its focus on high-resource treatments and specialty care, rather than public health burdens typical of low- and middle-income countries (LMICs). Nevertheless, DALYs have been used in select studies to assess the economic impact of chronic diseases, providing insights into long-term resource needs (Murray et al., 2012). Agencies like the Institute for Clinical and Economic Review (ICER) utilize incremental cost-effectiveness ratios to guide payer decisions. This approach offers a comparative understanding of new treatments in relation to existing standards of care (Neumann et al., 2014).

Cost-Benefit Analysis (CBA) is used in the U.S. primarily to justify investments in public health and infrastructure, where financial benefits, such as reduced hospitalization costs or improved environmental health, can be more easily quantified (Drummond et al., 2015). There is growing recognition of the importance of patient satisfaction and quality of life. Institutions like the Veterans Health Administration utilize patient-reported outcome measures (PROMs) to monitor well-being across various conditions (Basch, 2010).

UK Applications

The UK's National Institute for Health and Care Excellence (NICE) extensively employs QALYs to evaluate the availability of new treatments through the NHS, often using a specific QALY threshold (£20,000–£30,000 per QALY) to guide resource allocation within budget constraints (NICE, 2013). While not central to UK health assessments, DALYs are sometimes used in public health efforts targeting underserved or immigrant populations to address specific high-burden conditions (Salomon et al., 2015). ICER is integral to NICE's assessment process, underpinning cost-effectiveness evaluations for treatments proposed for NHS funding. NICE's rigorous ICER-based reviews ensure that only the most efficient therapies receive support (Sanders et al., 2016). CBA is applied in the UK for infrastructure and public health initiatives, such as vaccine distribution programs, where direct financial impacts are straightforward to measure (Gold et al., 1996). PROMs are routinely used for managing conditions like diabetes and mental health, allowing the NHS to tailor care models to patient needs and improve chronic disease management (Akca et al., 2022).

Applications in Developing Nations

The application of QALYs is constrained in developing nations due to data and resource limitations. However, global health agencies, such as the Global Fund, have initiated pilot programs to implement QALY-based frameworks for evaluating HIV and tuberculosis treatments (World Health Organization, 2016). DALYs serve as a primary metric in LMICs for prioritizing health interventions targeting high-burden diseases like HIV/AIDS, malaria, and tuberculosis. Organizations such as the World Health Organization (WHO) rely on DALYs for

resource allocation and health prioritization (Vos et al., 2020). The limited availability of health economic data makes ICER less frequently applied in LMICs. Nevertheless, pilot projects are being developed to create baseline data, especially in urban areas where costs and benefits can be quantified more effectively (Debellut et al., 2021). CBA is primarily utilized in LMICs for infrastructure projects funded by international aid organizations, focusing on justifying the financial sustainability of initiatives aimed at clean water, sanitation, and infectious disease prevention (Jain et al., 2024). PROMs are not routinely collected in LMICs due to limited resources. However, NGOs often gather qualitative data in specific health initiatives to evaluate patient satisfaction and perceived quality of care (Ronat et al., 2021).

Table 2. This table summarizes the definitions, use cases, effectiveness in resource allocation, strengths, limitations, and example applications of five crucial health economic metrics: Quality-Adjusted Life Years (QALYs), Disability-Adjusted Life Years (DALYs), Incremental Cost-Effectiveness Ratio (ICER), Cost-Benefit Analysis (CBA), and Patient-Reported Outcomes. Each metric provides unique insights into healthcare interventions, aiding in informed decision-making and prioritization of resources within health systems.

Criteria	Quality-Adjusted Life Years (QALYs)	Disability-Adjusted Life Years (DALYs)	Incremental Cost-Effectiveness Ratio (ICER)	Cost-Benefit Analysis (CBA)	Patient-Reported Outcomes
Definition	Measures the quantity and quality of life gained from a healthcare intervention [66].	Measures years of healthy life lost due to illness or premature death [67].	Compares additional cost per additional health benefit of an intervention [68].	Compares costs with the monetized benefits of an intervention [69].	Reflects patient-reported quality of life and satisfaction [70].
Use Cases in Health Systems	Widely used in the UK (NICE) and increasingly in the U.S. [71].	Often used in global health and by WHO for burden-of-disease studies [72].	Common in high-income countries for cost-effectiveness comparisons [73].	Primarily used in project evaluation and economic impact studies [74].	Gaining traction as part of patient-centered care models [75].
Effectiveness in Resource Allocation	Aids in prioritizing treatments that provide the best quality of life gains [76].	Useful for identifying high-burden diseases and prioritizing resources [77].	Helps decide whether a new intervention offers value for the cost [68].	Supports decision-making based on whether benefits outweigh costs [69].	Improves understanding of patient priorities in treatment decisions [78].
Strengths	Standardized metric; allows for comparison across treatments and diseases [76].	Helps target resources where the health burden is greatest globally [67].	Objective comparison of incremental costs and benefits [73].	Simple to understand; allows for clear economic comparisons [74].	Patient-centered, providing direct insight into quality of life [75].
Limitations	May not capture full patient experience; ethical concerns with valuation [66].	Less applicable in high-income countries; does not consider quality of life [72].	Can oversimplify cost-effectiveness; based on assumptions [68].	Limited by the difficulty in monetizing health benefits [69].	Subjective and may lack standardization across populations [70].
Example Applications	Evaluating new drug therapies or treatments for chronic diseases [71].	Assessing impact of infectious diseases in low- and middle-income countries [77].	Used in new drug assessments to determine reimbursement coverage [73].	Infrastructure investment in public health; environmental health [74].	Patient satisfaction studies for chronic disease management [78].

Effectiveness in Resource Allocation

Economic outcome metrics, such as Quality-Adjusted Life Years (QALYs), Disability-Adjusted Life Years (DALYs), and Incremental Cost-Effectiveness Ratios (ICERs), are essential for guiding resource allocation within healthcare systems. These metrics quantify the value of treatments and interventions concerning their costs, thereby supporting informed funding

decisions, influencing insurance coverage determinations, and aiding in the prioritization of treatments especially in resource-constrained settings. For instance, QALYs and ICERs enable decision-makers to compare the benefits of new treatments with existing ones, helping insurance providers and public health agencies allocate limited funds to interventions that yield the highest impact on population health and overall economic efficiency (Weinstein et al., 2009).

Case Studies of Influence

A clear example of the practical influence of these metrics can be seen in case studies from organizations like the National Institute for Health and Care Excellence (NICE) in the UK and the Centers for Medicare and Medicaid Services (CMS) in the U.S. NICE routinely applies QALY thresholds to evaluate the cost-effectiveness of new medications and treatments, which determines their coverage under the National Health Service (NHS) (NICE, 2013). This systematic approach has resulted in policy decisions that prioritize high-impact interventions, ensuring that only those treatments offering substantial health improvements relative to their costs receive NHS funding (Neumann et al., 2014). In the U.S., ICERs have played a significant role in shaping CMS decisions, particularly regarding Medicare coverage for innovative yet expensive treatments. This balance between innovation and economic sustainability allows the healthcare system to evaluate the value of new therapies while maintaining financial viability (Neumann et al., 2014).

DALYs in Developing Countries

In developing countries, DALYs have a profound impact on global health initiatives targeting high-burden diseases such as malaria, HIV/AIDS, and tuberculosis. Organizations like the World Health Organization (WHO) utilize DALYs to assess disease burden and prioritize interventions, ensuring that resources are directed toward conditions with the most considerable public health impact (Vos et al., 2020). This focus has led to health policies that concentrate on high-mortality and high-morbidity conditions, which are often under-resourced in low-income settings (Vos et al., 2020). Collectively, these case studies illustrate how economic outcome metrics shape healthcare policies and clinical guidelines globally. By ensuring that resources are allocated efficiently, these metrics contribute to achieving the greatest possible health outcomes in various healthcare contexts.

3. Emerging Trends and Future Directions

Integration of AI and Big Data in Value Assessment

The integration of artificial intelligence (AI) and big data analytics is transforming economic outcome assessments in healthcare. AI has the potential to analyze vast datasets from electronic health records, real-world evidence, and genomic data, refining economic evaluations by providing more precise, patient-specific insights into treatment effectiveness and cost. For example, machine learning algorithms can predict patient responses to therapies based on genetic markers or lifestyle factors, enhancing the accuracy of metrics like Quality-Adjusted Life Years (QALYs) and Incremental Cost-Effectiveness Ratios (ICERs) (Rajkomar et al., 2019). Furthermore, AI-driven models can rapidly adapt to new information, enabling continuous

updates to cost-effectiveness assessments that incorporate emerging clinical evidence and market conditions. This capability ultimately helps healthcare systems allocate resources more effectively (Topol, 2019).

Patient-Centered Outcome Metrics

There is a growing emphasis on including patient-centered outcome metrics in healthcare evaluations. Unlike traditional metrics that primarily focus on clinical or cost parameters, patient-centered metrics incorporate elements such as patient experience, quality of life, and satisfaction with care. This shift reflects the recognition that patient well-being extends beyond clinical outcomes and encompasses broader aspects of life quality, including emotional and social factors. Tools such as Patient-Reported Outcomes Measures (PROMs) are increasingly used in health technology assessments and have been shown to align closely with value-based care models, where the patient's perspective is paramount (Basch, 2010). By prioritizing the patient's voice, these metrics support more holistic care models and contribute to improved treatment adherence and satisfaction.

Global Perspectives on Standardization

Efforts are underway to standardize economic outcome metrics globally, aiming to create universal measures or region-specific adaptations that reflect diverse healthcare contexts. The World Health Organization (WHO) and other global health bodies are working to harmonize metrics such as QALYs and DALYs, recognizing that a unified framework could enhance comparability across nations and streamline international health interventions (Salomon et al., 2015). However, this initiative faces challenges, as healthcare systems, resource availability, and disease burdens vary significantly worldwide. For instance, low- and middle-income countries often prioritize DALYs due to a focus on high-burden diseases, while high-income nations may concentrate more on QALYs for evaluating advanced treatments. Despite these barriers, global alignment presents opportunities, such as collaborative data sharing and unified funding models, that could support efficient and equitable healthcare allocation (World Health Organization, 2016).

Abbreviations

QALYs: Quality-Adjusted Life Years

DALYs: Disability-Adjusted Life Years

ICER: Incremental Cost-Effectiveness Ratio

CBA: Cost-Benefit Analysis

AI: Artificial Intelligence

PROMs: Patient-Reported Outcomes Measures

WHO: World Health Organization

NICE: National Institute for Health and Care Excellence

CMS: Centers for Medicare and Medicaid Services

4. Conclusion

Economic outcome metrics have become indispensable tools in healthcare decision-making, providing data-driven guidance for resource allocation, insurance policies, and treatment prioritization. These metrics not only streamline funding decisions but also allow healthcare systems to prioritize interventions with the greatest potential impact. The integration of AI and big data is poised to refine these assessments further, making them more adaptable and precise. Additionally, the inclusion of patient-centered outcome metrics signifies a shift towards more holistic healthcare models that prioritize patient satisfaction and quality of life. Efforts toward global standardization could enhance the comparability and effectiveness of healthcare assessments across diverse regions, though challenges remain due to varying healthcare needs and resources. Embracing these emerging trends can lead to a more equitable, efficient healthcare system that balances innovation, sustainability, and patient-centered care.

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WORKS CITED

1.Linthicum, M., dosReis, S., Slejko, J., Mattingly, T., & Bright, J. (2020). The Importance of Collaboration in Pursuit of Patient-Centered Value Assessment. The Patient, 14, 381–384. https://doi.org/10.1007/s40271-020-00446-3

2.Bradley, S., Strauss, C., & Ho, P. (2017). Value in cardiovascular care. Heart, 103, 1238–1243. https://doi.org/10.1136/heartjnl-2016-309753

3.Michaels, J. (2021). Value assessment frameworks: who is valuing the care in healthcare? Journal of Medical Ethics, 48, 419–426. https://doi.org/10.1136/medethics-2020-106503

4.Armstrong, M., & Mullins, C. (2017). Value Assessment at the Point of Care: Incorporating Patient Values throughout Care Delivery and a Draft Taxonomy of Patient Values. Value in Health, 20(2), 292–295. https://doi.org/10.1016/j.jval.2016.11.008

5.Diaby, V., Ali, A., & Montero, A. (2018). Value Assessment Frameworks in the United States: A Call for Patient Engagement. PharmacoEconomics Open, 3, 1–3. https://doi.org/10.1007/s41669-018-0094-z

6.Antoñanzas, F., Terkola, R., & Postma, M. (2016). The Value of Medicines: A Crucial but Vague Concept. PharmacoEconomics, 34, 1227–1239. https://doi.org/10.1007/s40273-016-0434-8

7.Lee, K., Austin, J., & Pronovost, P. (2016). Developing a Measure of Value in Health Care. Value in Health, 19(4), 323–325. https://doi.org/10.1016/j.jval.2014.12.009
8.Blumenschein, K., & Johannesson, M. (1996). Economic Evaluation in Healthcare. PharmacoEconomics, 10, 114–122. https://doi.org/10.2165/00019053-199610020-00003
9.Torgerson, D., & Raftery, J. (1999). Measuring outcomes in economic evaluations. BMJ, 318, 1413. https://doi.org/10.1136/BMJ.318.7195.1413
10.Robinson, R. (1993). Economic evaluation and health care. What does it mean? British Medical Journal, 307, 670–673. https://doi.org/10.1136/bmj.307.6905.670
11.Wailoo, A., Hernández-Alava, M., Manca, A., Mejía, A., Ray, J., Crawford, B., Botteman, M., & Busschbach, J. (2017). Mapping to Estimate Health-State Utility from Non-Preference-Based Outcome Measures: An ISPOR Good Practices for Outcomes Research Task Force Report. Value in Health, 20(1), 18–27. https://doi.org/10.1016/j.jval.2016.11.006
12.Idris, A., Nwoko, M., Umar, S., Iyoha, E., & Maduako, K. (2023). Economic evaluation of cost and outcomes of healthcare services: A guide for optimal healthcare decision-making. Corporate Governance and Organizational Behavior Review. https://doi.org/10.22495/cgobrv7i2sip2
13.Scheurer, D., Crabtree, E., Cawley, P., & Lee, T. (2016). The Value Equation: Enhancing Patient Outcomes While Constraining Costs. The American Journal of the Medical Sciences, 351, 44–51. https://doi.org/10.1016/j.amjms.2015.10.013
14.Alaujan, S., Almazrou, S., & Al-Aqeel, S. (2021). A Systematic Review of Sources of Outcomes and Cost Data Utilized in Economic Evaluation Research Conducted in the Gulf Cooperation Council. Risk Management and Healthcare Policy, 14, 209–220. https://doi.org/10.2147/RMHP.S285359
15.Igarashi, A. (2023). Life and Money? Life or Money? Health Economic Assessment and Value Assessment for Oncology Medications. Gan to Kagaku Ryoho. Cancer & Chemotherapy, 50(4), 421–427.
16.Looi, J., Bastiampillai, T., Kisely, S., & Allison, S. (2021). Whose values are represented in value-based healthcare? Australian & New Zealand Journal of Psychiatry, 56, 589–590. https://doi.org/10.1177/00048674211056006
17.Kini, V., & Ho, P. (2019). Toward Patient-Centered Healthcare Value. Circulation: Cardiovascular Quality and Outcomes. https://doi.org/10.1161/CIRCOUTCOMES.119.005801
18.Bernstein, D., Nwachukwu, B., & Bozic, K. (2019). Value-based Health Care: Moving Beyond “Minimum Clinically Important Difference” to a Tiered System of Evaluating Successful Clinical Outcomes. Clinical Orthopaedics & Related Research. https://doi.org/10.1097/CORR.0000000000000741
19.Nuño-Solínis, R. (2019). Advancing Towards Value-Based Integrated Care for Individuals and Populations. International Journal of Integrated Care, 19. https://doi.org/10.5334/ijic.5450
20.Lewis, S. (2019). Value-based healthcare - meeting the evolving needs of our population. Australian Health Review, 43(5), 485. https://doi.org/10.1071/AHV43N5_ED
21.Ramos, P. (2020). Value-Based Healthcare. Bioethics in Medicine and Society. https://doi.org/10.5772/intechopen.93378
22.Salvatore, F., Fanelli, S., Donelli, C., & Milone, M. (2021). Value-based health-care principles in health-care organizations. International Journal of Organizational Analysis. https://doi.org/10.1108/ijoa-07-2020-2322
23.Musina, N., Omelyanovskiy, V., Gostischev, R., Sukhorukikh, O., Fedyaeva, V., Sisigina, N., & Shchurov, D. (2021). Concept of value-based healthcare. Farmeconomia. Health Economics and Therapeutic Pathways, 13, 438–451. https://doi.org/10.17749/2070-4909/FARMAKOEKONOMIKA.2020.042
24.Cohen, A. (2011). What is value in health care? The New England Journal of Medicine, 364(13), e26; author reply e26. https://doi.org/10.1056/NEJMc1101108
25.Whitehead, S., & Ali, S. (2010). Health outcomes in economic evaluation: the QALY and utilities. British Medical Bulletin, 96, 5–21. https://doi.org/10.1093/bmb/ldq033
26.Kim, D., Silver, M., Kunst, N., Cohen, J., Ollendorf, D., & Neumann, P. (2020). Perspective and Costing in Cost-Effectiveness Analysis, 1974–2018. PharmacoEconomics, 38, 1135–1145. https://doi.org/10.1007/s40273-020-00942-2
27.Davidović, M., Zielonke, N., Lansdorp-Vogelaar, I., Segnan, N., Koning, H., & Heijnsdijk, E. (2021). Disability-Adjusted Life Years Averted Versus Quality-Adjusted Life Years Gained: A Model Analysis for Breast Cancer Screening. Value in Health, 24(3), 353–360. https://doi.org/10.1016/j.jval.2020.10.018

28.Shah, K., Singh, M., Kotwani, P., Tyagi, K., Pandya, A., Saha, S., Saxena, D., & Rajshekar, K. (2022). Comprehensive league table of cost-utility ratios: A systematic review of cost-effectiveness evidence for health policy decisions in India. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.831254
29.Hirth, R., Chernew, M., Miller, E., Fendrick, A., & Weissert, W. (2000). Willingness to Pay for a Quality-adjusted Life Year. Medical Decision Making, 20, 332–342. https://doi.org/10.1177/0272989X0002000310
30.Rushby, J., & Hanson, K. (2001). Calculating and presenting disability adjusted life years (DALYs) in cost-effectiveness analysis. Health Policy and Planning, 16(3), 326–331. https://doi.org/10.1093/HEAPOL/16.3.326
31.Feng, X., Kim, D., Cohen, J., Neumann, P., & Ollendorf, D. (2020). Using QALYs versus DALYs to measure cost-effectiveness: How much does it matter? International Journal of Technology Assessment in Health Care, 36, 96–103. https://doi.org/10.1017/S0266462320000124
32.Rankin, J., Rowen, D., Howe, A., Cleland, J., & Whitty, J. (2019). Valuing health-related quality of life in heart failure: a systematic review of methods to derive quality-adjusted life years (QALYs) in trial-based cost–utility analyses. Heart Failure Reviews, 24, 549–563. https://doi.org/10.1007/s10741-019-09780-7
33.Augustovski, F., Colantonio, L., Galante, J., Bardach, A., Caporale, J., Zárate, V., Chuang, L., Pichón-Riviere, A., & Kind, P. (2017). Measuring the Benefits of Healthcare: DALYs and QALYs – Does the Choice of Measure Matter? A Case Study of Two Preventive Interventions. International Journal of Health Policy and Management, 7, 120–136. https://doi.org/10.15171/ijhpm.2017.47
34.Kassebaum, N. et al. (2016). Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet, 388, 1603–1658. https://doi.org/10.1016/S0140-6736(16)31460-X
35.Kyu, H. et al. (2018). Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet, 392, 1859–1922. https://doi.org/10.1016/S0140-6736(18)32335-3
36.Hay, S. et al. (2017). Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet, 390, 1260–1344. https://doi.org/10.1016/S0140-6736(17)32130-X
37.Murray, C. et al. (2015). Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition. The Lancet, 386, 2145–2191. https://doi.org/10.1016/S0140-6736(15)61340-X
38.Murray, C. et al. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The Lancet, 380, 2197–2223. https://doi.org/10.1016/S0140-6736(12)61689-4
39.Murray, C., & Acharya, A. (1997). Understanding DALYs (disability-adjusted life years). Journal of Health Economics, 16(6), 703–730. https://doi.org/10.1016/S0167-6296(97)00004-0
40.Devleesschauwer, B., Havelaar, A., Noordhout, C., Haagsma, J., Praet, N., Dorny, P., Duchateau, L., Torgerson, P., Oyen, H., & Speybroeck, N. (2014). Calculating disability-adjusted life years to quantify burden of disease. International Journal of Public Health, 59, 565–569. https://doi.org/10.1007/s00038-014-0552-z
41.Arnesen, T., & Nord, E. (1999). The value of DALY life: problems with ethics and validity of disability adjusted life years. BMJ, 319, 1423–1425. https://doi.org/10.1136/bmj.319.7222.1423
42.Chen, A., Jacobsen, K., Deshmukh, A., & Cantor, S. (2015). The evolution of the disability-adjusted life year (DALY). Socio-Economic Planning Sciences, 49, 10–15. https://doi.org/10.1016/J.SEPS.2014.12.002
43.Praet, N., Devleesschauwer, B., Dorny, P., Duchateau, L., & Speybroeck, N. (2013). What are Disability-Adjusted Life Years? European Journal of Public Health, 23, 131. https://doi.org/10.1093/EURPUB/CKT126.323
44.Gafni, A., & Birch, S. (2006). Incremental cost-effectiveness ratios (ICERs): the silence of the lambda. Social Science & Medicine, 62(9), 2091–2100. https://doi.org/10.1016/J.SOCSCIMED.2005.10.023

45. Paulden, M. (2020). Why it's Time to Abandon the ICER. PharmacoEconomics, 38, 781–784. https://doi.org/10.1007/s40273-020-00915-5
46. Oliveira, F., Oliveira, E., Lopes, G., & Lima, J. (2020). Systematic review and meta-analysis of incremental cost-effectiveness ratio (ICER) for new cancer drugs. Journal of Clinical Oncology. https://doi.org/10.1200/jco.2020.38.29_suppl.66
47. Wong, C., Lang, B., Guo, V., & Lam, C. (2016). Possible Impact of Incremental Cost-Effectiveness Ratio (ICER) on Decision Making for Cancer Screening in Hong Kong: A Systematic Review. Applied Health Economics and Health Policy, 14, 647–657. https://doi.org/10.1007/s40258-016-0266-x
48. Sussman, M., Yu, J., & Menzin, J. (2020). Do Research Groups Align on an Intervention's Value? Concordance of Cost-Effectiveness Findings Between the Institute for Clinical and Economic Review and Other Health System Stakeholders. Applied Health Economics and Health Policy, 18, 477–489. https://doi.org/10.1007/s40258-019-00545-9
49. Simoens, S. (2010). How to Assess the Value of Medicines? Frontiers in Pharmacology, 1. https://doi.org/10.3389/fphar.2010.00115
50. Edney, L., Afzali, H., Cheng, T., & Karnon, J. (2018). Estimating the Reference Incremental Cost-Effectiveness Ratio for the Australian Health System. PharmacoEconomics, 36, 239–252. https://doi.org/10.1007/s40273-017-0585-2
51. Yuan, F., Bangdiwala, S., Tong, W., & Lamy, A. (2022). The impact of statistical properties of incremental monetary net benefit and incremental cost-effectiveness ratio on health economic modeling choices. Expert Review of Pharmacoeconomics & Outcomes Research, 23, 69–78. https://doi.org/10.1080/14737167.2023.2144838
52. Trippoli, S. (2017). Incremental cost-effectiveness ratio and net monetary benefit: Current use in pharmacoeconomics and future perspectives. European Journal of Internal Medicine, 43, e36. https://doi.org/10.1016/j.ejim.2017.05.015
53. Brent, R. (2023). Cost-Benefit Analysis versus Cost-Effectiveness Analysis from a Societal Perspective in Healthcare. International Journal of Environmental Research and Public Health, 20. https://doi.org/10.3390/ijerph20054637
54. Cohen, B. (2012). Discounting in Cost-Utility Analysis of Healthcare Interventions. PharmacoEconomics, 21, 75–87. https://doi.org/10.2165/00019053-200321020-00001
55. Hauber, A., Bala, M., & Fehnel, S. (2001). WW6: Conducting cost-benefit and cost-utility analyses: A conjoint analysis approach. Value in Health, 4, 190–191. https://doi.org/10.1046/J.1524-4733.2001.40203-5.X
56. Nagaoka, M., Koreki, A., Kosugi, T., Ninomiya, A., Mimura, M., & Sado, M. (2023). Economic Evaluation Alongside a Randomized Controlled Trial of Mindfulness-Based Cognitive Therapy in Healthy Adults. Psychology Research and Behavior Management, 16, 2767–2785. https://doi.org/10.2147/PRBM.S406347
57. Chang, W., & Henry, B. (1999). Methodologic principles of cost analyses in the nursing, medical, and health services literature, 1990–1996. Nursing Research, 48(2), 94–104. https://doi.org/10.1097/00006199-199903000-00008
58. Earle, C., Chapman, R., Baker, C., Bell, C., Stone, P., Sandberg, E., & Neumann, P. (2000). Systematic overview of cost-utility assessments in oncology. Journal of Clinical Oncology, 18(18), 3302–3317. https://doi.org/10.1200/JCO.2000.18.18.3302
59. Boos, N. (2009). The impact of economic evaluation on quality management in spine surgery. European Spine Journal, 18, 338–347. https://doi.org/10.1007/s00586-009-0939-3
60. Listl, S., & Faggion, C. (2016). Valuing the Clinical Effectiveness of Therapeutics. The Journal of Evidence-Based Dental Practice, 16(2), 86–89. https://doi.org/10.1016/j.jebdp.2016.01.001
61. McIntosh, E., Donaldson, C., & Ryan, M. (1999). Recent Advances in the Methods of Cost-Benefit Analysis in Healthcare. PharmacoEconomics, 15, 357–367. https://doi.org/10.2165/00019053-199915040-00003
62. Łaszewska, A., Helter, T., Nagel, A., Perić, N., & Simon, J. (2021). Patient-reported outcome measures suitable for quality of life/well-being assessment in multisectoral, multinational and multiperson mental health economic evaluations. Evidence-Based Mental Health, 25, 85–92. https://doi.org/10.1136/ebmental-2021-300334
63. Péntek, M. (2019). Patient-reported outcomes: opportunities and challenges in Central Europe. The European Journal of Health Economics, 20, 1–3. https://doi.org/10.1007/s10198-019-01057-y

64. Prodinger, B., & Taylor, P. (2018). Improving quality of care through patient-reported outcome measures (PROMs): expert interviews using the NHS PROMs Programme and the Swedish quality registers for knee and hip arthroplasty as examples. BMC Health Services Research, 18. https://doi.org/10.1186/s12913-018-2898-z
65. Garrison, L., Neumann, P., & Willke, R. (2019). Reflections on the ISPOR Special Task Force on U.S. Value Frameworks: Implications of a Health Economics Approach for Managed Care Pharmacy. Journal of Managed Care & Specialty Pharmacy, 25(11), 1185–1192. https://doi.org/10.18553/jmcp.2019.25.11.1185
66. Weinstein, M.C., Torrance, G., & McGuire, A. (2009). QALYs: The Basics. Value in Health, 12(Suppl 1), S5–S9.
67. Neumann, P.J., Cohen, J.T., & Weinstein, M.C. (2014). Updating cost-effectiveness—the curious resilience of the $50,000-per-QALY threshold. New England Journal of Medicine, 371(9), 796–797.
68. Drummond, M.F., Sculpher, M.J., Claxton, K., et al. (2015). Methods for the Economic Evaluation of Health Care Programmes (4th ed.). Oxford University Press.
69. Basch, E. (2010). Patient-reported outcomes—harnessing patients' voices to improve clinical care. New England Journal of Medicine, 373(2), 105–108.
70. National Institute for Health and Care Excellence (NICE). (2013). Guide to the Methods of Technology Appraisal.
71. Salomon, J.A., Haagsma, J.A., Davis, A., et al. (2015). Disability weights for the global burden of disease 2013 study. Lancet Global Health, 3(11), e712–e723.
72. Sanders, G.D., Neumann, P.J., Basu, A., et al. (2016). Recommendations for conduct, methodological practices, and reporting of cost-effectiveness analyses. JAMA, 316(10), 1093–1103.
73. Gold, M.R., Siegel, J.E., Russell, L.B., & Weinstein, M.C. (1996). Cost-Effectiveness in Health and Medicine. Oxford University Press.
74. Akca, N., Saygili, M., & Ture, A.K. (2022). The relationship between the perception of chronic disease care and health-related quality of life in adults with chronic kidney disease. Chronic Illness, 18(4), 874–888.
75. World Health Organization. (2016). Global strategy on human resources for health: workforce 2030.
76. Vos, T., et al. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet, 396(10258), 1204–1222.
77. Debellut, F., et al. (2021). Evaluating the potential economic and health impact of rotavirus vaccination in 63 middle-income countries not eligible for Gavi funding: a modelling study. The Lancet Global Health, 9(7), e942–e956.
78. Jain, S., et al. (2024). The cost of inaction: a global tool to inform nutrition policy and investment decisions on global nutrition targets. Health Policy and Planning, 39(8), 819–830.
79. Ronat, J.B., et al. (2021). AMR in low-resource settings: Médecins Sans Frontières bridges surveillance gaps by developing a turnkey solution, the Mini-Lab. Clinical Microbiology and Infection, 27(10), 1414–1421.
80. Rajkomar, A., Dean, J., & Kohane, I. (2019). Machine learning in medicine. New England Journal of Medicine, 380(14), 1347–1358.
81. Topol, E.J. (2019). High-performance medicine: the convergence of human and artificial intelligence. Nature Medicine, 25(1), 44–56.