



# Comparative Analysis of Economic Evaluation Techniques for Healthcare Initiatives

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**Abstract.** The COVID-19 pandemic of 2020 has highlighted the vulnerability of global health systems and the need for resilient health infrastructures capable of meeting current and emerging challenges. In response, governments around the world are reassessing their health systems and recognizing the urgency of change. This paper provides an overview of economic evaluation techniques used to assess the feasibility of health interventions, particularly relevant in the current context of increased funding for health systems strengthening. Economic evaluation techniques such as Cost-Effectiveness analysis (CEA), Cost-Utility analysis (CUA), Least-Cost Analysis (LCA), and Cost-Benefit Analysis (CBA) are reviewed, each with its limitations and challenges, especially when applied to the complex health sector. The paper highlights the need for critical evaluation of methodologies and suggests future research directions aimed at overcoming these limitations, possibly through integrated approaches or additional quality assessment techniques such as Multi-Criteria Analysis (MCA).

**Keywords:** Economic Appraisal · Healthcare interventions · evaluation · founding sources · decision-making tools

## 1 Introduction

In March 2020, the World Health Organization (WHO) declared a global state of emergency due to the spread of the Coronavirus (COVID-19). Covid-19 was declared a pandemic and the rate of infections, hospitalizations, and deaths worldwide reached levels that health systems were struggling to withstand and absorb.

Health is a fundamental right that institutions must guarantee to their communities, and therefore they must have strong and resilient health systems capable of meeting the needs of their populations. The COVID-19 emergency caused a major public health and economic crisis worldwide [1] and highlighted the vulnerability of health systems unable to cope with an epidemiological crisis of this magnitude [2].

Medical facilities were unprepared and inadequately equipped to deal with a public health emergency [3] demonstrating the failure of the hospital-centric model of health

systems. Due to a lack of technology, training, health workers, and hospital beds, overburdened hospitals were unable to cope with large numbers of patients in a limited time [4]. This crisis exposed the structural dysfunction of health systems around the world, particularly in developing countries [5].

In this context, governments have recognized the urgent need for effective transformation. The health needs of populations are changing and health systems are facing new challenges due to an aging population, the increasing prevalence of chronic diseases, the risk of epidemics, etc. Within this framework, the concept of resilient health systems has emerged, which must be able to cope with health emergencies while continuing to provide care for the population [6].

The concept of resilience is applied in many fields (environmental policy, engineering, infrastructure) and is used in government policy to describe an essential quality of systems to meet today's challenges. This concept has been associated with the health sector in recent years, particularly since 2014, when the WHO called for action to build stronger health systems in the wake of the Ebola outbreak in Africa, [7].

A strong health system is rooted and integrated at the local level [8]; in particular, the health model needs to shift from the centrality of hospitals to an extensive territorial network [9] within which the community can meet its own care needs.

The ambition to build solid health systems requires a range of effective investments, and one constraint is the limited financial resources available [10]. Indeed, the health sector is characterized by ever-increasing costs due to several factors, including i) an aging population, which increases the proportion of the population requiring care; ii) the increasing prevalence of chronic diseases; iii) price inflation of health resources; and iv) technological advances, which are available at higher costs [11].

In response to the problem of limited financial resources, national administrations are seeking tools to help them select interventions that offer the best value for money, maximizing benefits to the population while containing health expenditure [12]. Economic evaluation, for example, supports the decision-making process of those involved in investment decisions, but its application to health investments is a controversial and debated area.

## 2 Aim

Economic evaluation is the most widely used tool for assessing plans and projects that have an impact on the community. The main purpose of economic evaluation is to compare the costs and benefits associated with a plan or project in order to identify the best option from a range of competing alternatives [13, 14]. These evaluations are essential in all contexts, particularly in the health sector, where the increasing pressure on available budgets, combined with the need to reorganize healthcare models, requires analyses to identify the best allocation of limited financial resources [15].

Economic evaluations operate in contexts of uncertainty, are predictive, and have methodological and ethical limitations that are widely discussed in academic research. These limitations are most evident when economic evaluations are applied to the health sector [16]. The difficulty relates to the effects generated by the implementation of a health intervention. The construction of a health facility, the introduction of innovative

technology, or a prevention campaign, are activities that have an impact on a more or less large catchment area or territory and whose beneficial effects are visible over a relatively long time.

This paper aims to provide a framework for the main techniques used to assess the feasibility of a health intervention, given the topicality of the issue, as evidenced by the large number of funding sources. The aim is to outline their main characteristics, differences, and inherent methodological limitations. This process will make it possible to establish a framework that can serve as a starting point for the development of alternative economic evaluation models, or models that combine the techniques currently used, in order to make a significant contribution to the topic.

Section 3 of this document provides an overview of the funding and investment sources currently (2024) being promoted by the European Union (EU) and the Italian government, with a particular focus on the National Recovery and Resilience Plan (NRRP), one of the objectives of which is to rethink and make more efficient the articulation of health services across the territory. Section 4 describes the main economic evaluation techniques used to assess the feasibility of health interventions, highlighting their characteristics and limitations. Section 5 presents the conclusions and future developments of this research.

### 3 European Financial Framework in Healthcare

Economic evaluation in health is important, particularly in the current context of increased focus on health by European and national institutions, which have allocated significant funding in response to the challenges of the COVID-19 pandemic and the need to strengthen health systems. In the context of such funding, economic evaluation has a key role in ensuring that resources are allocated effectively and efficiently. A summary description of the main European and Italian national funding programs aimed at strengthening the health sector is provided below to illustrate the centrality of this issue.

#### 3.1 European Union Strategies

The critical issues and gaps identified in health systems worldwide during the COVID-19 pandemic were highlighted by the EU, which implemented a series of actions and funding plans aimed at Member States to address this issue. EU Member States are responsible for organizing and providing medical care to their citizens, so the actions implemented by the EU aim to complement national plans to join forces and work towards a stronger Health Union.

*EU4Health*<sup>1</sup> [17] is one of the EU's response to the pandemic crisis. It is an unprecedented financial support to Member States, worth €5.1 billion for the period 2021–2027. The program is based on the idea that health is an investment. The aim is to have a healthy and active population that is more productive and has a better quality of life. EU4Health thus complements Member States' health policies and has four general objectives: i)

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<sup>1</sup> Established by Regulation (EU) 2021/522 of the European Parliament and of the Council of 24 March 2021 establishing a Programme for the Union's action in the field of health ('EU4Health Programme') for the period 2021–2027, and repealing Regulation (EU) No 282/2014.

improving and promoting health, ii) protecting people, iii) access to essential medicines, medical devices, and products, and iv) strengthening health systems.

EU4Health is complemented by the *Cohesion Policy* [18], the EU's principal investment policy. Since the establishment of the European Community, now the European Union, there have been significant disparities between Member States and within the regions of Member States. In this context, cohesion policy aims to promote the harmonious development of all Member States by strengthening economic, social, and territorial cohesion.

The European Commission has developed the Cohesion Policy for the period 2021–2027, which is based on five key policy objectives<sup>2</sup>. These objectives are to be achieved through strategic actions implemented by Member States. EU cohesion policy is implemented through the main Structural Funds<sup>3</sup>.

The Cohesion Policy developed by the EU, includes a series of strategic actions to designed to reinforce the health services provided by Member States within their respective territories. The legislation establishing the common rules for the utilization of Structural Funds is Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021<sup>4</sup> [19].

Member States are permitted to utilize the Structural Funds for the implementation of a diverse range of interventions. In accordance with Regulation 2021/1060 [19], the EU develops a list of “*enabling conditions*” to “*ensure the necessary conditions for the effective and efficient use of Union support granted through the Funds*”. Each of the EU's enabling conditions is linked to specific objectives, and it is the responsibility of Member States to develop programs and policies that meet the EU's enabling conditions in order to access funding.

With regard to the health sector, the EU identifies enabling condition 4.6 which is defined as a: ‘*strategic policy framework for health and long-term care*’. This condition is based on the assumption that health crises, aging populations, and technological progress present challenges to the robustness of health systems.

For this reason, European support, through the Structural Funds, is intended to complement the financial resources of each Member State in order to ensure the long-term, efficient, accessible, and sustainable provision of health care for its citizens.

<sup>2</sup> The 5 policy objectives of UE Cohesion Policy: i) a more competitive and smarter Europe, ii) a greener and low-carbon transition towards a net zero carbon economy, iii) a more connected Europe by improving mobility, iv) a more social and inclusive Europe, v) a Europe closer to its citizens by promoting the sustainable and integrated development of all types of territories.

<sup>3</sup> UE Structural funds: i) European Regional Development Fund (ERDF), ii) European Social Fund Plus (ESF +), iii) Cohesion Fund (CF), and iv) Just Transition Fund (JTF).

<sup>4</sup> Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund, and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy.

The long-term budget developed by the European Union (Cohesion Policy 2021–2027) is complemented by an additional and important temporary investment plan promoted by the EU to revive Europe and repair the damage caused by the Covid-19 pandemic: the *Next Generation EU* [20]. The Next Generation EU comprises a number of funds<sup>5</sup>, the largest of which is the *Recovery and Resilience Facility* (RRF) [21]. A significant part of these funds will be allocated to the restructuring of EU Member States' health systems.

The RRF, established by Regulation (EU) 2021/241<sup>6</sup> [22], has areas of intervention structured around six key pillars<sup>7</sup>. One of these is area e) which concerns *health and economic, social, and institutional resilience*. This area includes measures to strengthen crisis response and preparedness.

The relevance and importance of the matter is demonstrated by the series of EU-funded grants which, in the context of the post-pandemic challenges, seek to address the structural difficulties that currently characterize health care provision.

### 3.2 NRRP in Italy, a Focus on Mission 6: Health

The NRRP is a strategic action plan launched by the Italian government within the framework of the RRF established by the EU. The NRRP was approved by the European Commission on 22 April 2021, and is structured around three strategic axes that are shared at the European level: i) digitalization and innovation, ii) environmental transition, and iii) social inclusion. In terms of the plan's structure, the Italian government, in accordance with European guidelines, has divided NRRP into six missions, which are further divided into a total of 16 components [23]. The missions are designated as follow:

- Mission 1: Digitization, innovation, competitiveness, culture and tourism
- Mission 2: Green revolution and ecological transition
- Mission 3: Infrastructure for sustainable mobility
- Mission 4: Education and research
- Mission 5: Cohesion and Inclusion
- Mission 6: Health

One of the purposes of this document is to present a synthesis of the principal characteristics of Mission 6, which includes a series of plans and projects designed to reinforce the national health system and health infrastructure.

<sup>5</sup> Funds under the Next Generation EU investment plan: i) Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU), ii) Horizon Europe, iii) InvestEU, iv) The European Agricultural Fund for Rural Development, v) The Just Transition Fund (JTF), vi) RescEU, and vii) Recovery and Resilience Facility.

<sup>6</sup> Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility.

<sup>7</sup> The scope of application of the Facility shall refer to policy areas of European relevance structured in six pillars: a) green transition, b) digital transformation, c) smart, sustainable and inclusive growth, including economic cohesion, jobs, productivity, competitiveness, research, development and innovation, and a well-functioning internal market with strong SME, d) social and territorial cohesion, e) health, and economic, social and institutional resilience, with the aim of, inter alia, increasing crisis preparedness and crisis response capacity and f) policies for the next generation, children and the youth, such as education and skills

As previously stated, the global pandemic of 2020 demonstrated the universal value of health and highlighted critical structural issues that could be amplified in the future due to the growing demand for care associated with demographic (aging population), epidemiological, and social trends. The NRRP's criticality framework identifies several key areas for improvement, including i) significant territorial disparities in the provision of health services, ii) inadequate integration between hospital services, territorial services, and social services, iii) long waiting times for treatment, and iv) poor ability to achieve synergies in the definition of strategies to respond to environmental, climate and health risks.

Mission 6 of the NRRP is divided into two components [24] defined as follows.

- M6C1- Proximity networks, facilities, and telemedicine for territorial health care; the interventions that form part of this component aim to strengthen the services provided in the territory by reinforcing and creating structures and territorial garrisons (community homes, community hospitals). Another objective is to strengthen home care, develop telemedicine, and improve integration with all social and health services.
- M6C2- Innovation, Research and Digitization of the National Health Service: The actions included in this component will enable the renewal and modernization of existing technological and digital facilities, the completion and dissemination of the Electronic Health Record (EHR), and the improvement of the delivery and monitoring capacity of the Essential Levels of Care (ELC) through more effective information systems. Significant resources will also be devoted to scientific research and promoting technology transfer, as well as strengthening the skills and human capital of the NHS, including through improved staff training.

In particular, the M6C1 component is designed to enhance the capacity of the National Health System (NHS). Italy is currently experiencing an aging population and a prevalence of chronic diseases, with 40% of the population affected. In order to reinforce the healthcare infrastructure across the country, the NRRP plans to establish, by 2026, 1288 Community Homes, which will function as a multi-city center. These centers will be staffed by doctors from various specialties, ensuring that the community is adequately served. Furthermore, the construction of 381 community hospitals across the country is planned, with the objective of alleviating the burden on existing hospitals. The Community Hospitals will be configured as a network of assistance, with the objective of facilitating the admission and treatment of patients requiring low/medium intensity interventions. Finally, it is planned to activate 602 Territorial Operational Centers with the intention of increasing the volume of home-based services, thus promoting the diffusion of telemedicine.

The M6C2 component will fund two distinct lines of action. The first line of action is technological and digital modernization, which will entail the purchase of new equipment, the creation of an electronic health file, and the structural modernization of hospital facilities to bring them into line with current seismic regulations. The second line of action is concerned with training, scientific research, and technology transfer. It is proposed that support for biomedical research be increased and health workers be trained.

## 4 Economic Appraisal in Healthcare

The framework of funding sources activated at the European and Italian national level is useful in understanding the topicality of the issue. In the context of this funding, economic evaluation plays a pivotal role in ensuring that resources are allocated in an optimal manner. It aims to identify the most promising strategies for improving the health of the population and maximizing the impact of funding in the health sector.

Economic evaluations can be employed to assess health infrastructure projects, such as new hospitals or clinics, as well as complex subsystems, such as emergency departments, but also health interventions, such as emergency departments. They can also be used to evaluate health interventions, such as prevention programs or the use of alternative treatments.

It is important to note that economic evaluation models are essential for many of the funding sources announced by the EU under the Cohesion Policy 2021–2027. In accordance with Regulation (EU) 2021/1060 [19], the European Commission requires managing authorities to ensure adequate value for money in the selection of operations to be financed, and Member States are responsible for this. The EU's RRP is designed to provide support to Member States in the implementation of reforms and investments. Member States are responsible for structuring their intervention plans and for making an appropriate selection and prioritization of projects based on a set of criteria, including the results of the Economic Appraisal (EA). The EA is a methodological process through which the value generated by a project for all stakeholders can be understood and determined. This process allows for the assessment of whether society will benefit from the investment.

In this context, the Directorate-General for Regional and Urban Policy<sup>8</sup>, with the support of JASPERS<sup>9</sup>, has developed an *Economic Evaluation Vademecum (EAV)* [25] as a tool to support the implementation of economic evaluations to be carried out for the funding sources made available to the EU in the period 2021–2027. The EAV summarizes good practices for carrying out economic evaluations based on established national and international experience and is also consistent with the EA approach followed by the European Investment Bank. The EAV is complementary to the European Commission's Guide to Cost-Benefit Analysis (CBA) of investment projects for the period 2014–2020 [26].

The European Commission provides financial support for a diverse range of projects, including infrastructure, energy efficiency, healthcare, and research and innovation. The specific approach employed in each sector is dependent on the nature of the project requiring an EA. CBA represents one of the principal techniques in the context of EA. In numerous EU countries, it is the principal instrument employed to identify the optimal design choices that maximize the community's welfare while respecting financial constraints. Nevertheless, the application of CBA is often impractical for smaller projects due to the significant time and financial resources required. In this context, decision-makers

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<sup>8</sup> European Commission department responsible for EU policy on regions and cities.

<sup>9</sup> Join Assistance to Support Projects in European Regions.

may opt to employ alternative techniques, including least-cost analysis (LCA), cost-effectiveness analysis (CEA), cost-benefit analysis (CBA) and multi-criteria analysis (MCA).

The European Commission proposes, by way of example but not exhaustively, the most appropriate EA techniques to be used, diversified according to the project area. The in-depth analysis of the EAV and the scientific literature has revealed that the most prevalent economic evaluation techniques employed in the health sector are: *i) Least-Cost Analysis (LCA)*, *ii) Cost-Effectiveness Analysis (CEA)*, *iii) Cost-Utility Analysis (CUA)*, *iv) Cost-Benefit Analysis*.

This research aligns with the aforementioned context, and an analysis of the scientific literature in this field has enabled an understanding of the mechanisms for implementing economic evaluation techniques in the health sector. A critical reading of this literature has been attempted.

#### **4.1 Comparative Analysis of the Main Used Health Economic Evaluation Techniques**

The selection of the most appropriate economic evaluation technique is contingent upon the purpose and subject of the analysis. CEA, CUA, and LCA are mainly employed in the assessment of health programs, such as the comparison of therapeutic alternatives, prevention plans, and chronic disease screening [27–29]. The use of CBA in the assessment of the feasibility of health programs is marginal [30–32]. The EAV indicates that CBA is the most appropriate tool for evaluating health infrastructure projects, such as the construction of a new hospital or outpatient centers.

It is a common practice for economic evaluators to evaluate the financial implications of a project or program. However, there is considerable variation in the way in which the benefits of such initiatives are quantified [33]. The only exception is LCA, which is the simplest approach. LCA is used to compare two health interventions, typically health programs, whose beneficial effects are known and are equivalent. According to this principle, since the benefits are known and not decisive, only the costs are analyzed in order to select the low-priced alternative [34].

The quantification of benefits in EA is a topic that has been the subject of much debate. In CEA, costs are quantified in monetary units, while benefits are quantified in natural units. Some examples of natural units used to quantify the effectiveness of an intervention are Years of Life Gained (LYG) or Years of Life Lost (YLL) due to mortality. The distinguishing feature of CEA from CUA is the parameter used to quantify the benefit. In particular, the researchers considered that considering solely the number of Years of Life Gained (LYG) was reductive, given that undergoing a life-saving procedure could have consequences such as disability. For this reason, the Quality-Adjusted Life Year (QALY) indicator was introduced. The QALY is a metric that combines “*the effects of health interventions on mortality and morbidity into a single index*”, thus providing a “*common currency*” that allows for comparisons between different disease areas [35]. The calculation of a QALY is a complex process. The objective is to relate the number of years spent in a state of health to the quality of that state, which is derived from Health-Related Quality of Life (HRQoL). Patients are required to rate their health status on a scale of 0 (death) to 1 (excellent health) in order to obtain the requisite data for the



calculation of a complete indicator. This indicator is derived by multiplying the rating by a given quantity (LYG).

To summarize, CEA and CUA are used to compare therapeutic alternatives, procedures, technologies, etc., to determine which alternative provides the greatest health benefit for the cost incurred. This is achieved by calculating the incremental cost and the incremental effectiveness of each alternative in comparison to the next most effective alternative. These calculations lead to the final measure of CEA and CUA, which is the Incremental Cost/Effectiveness Ratio (ICER) or Incremental Cost/Utility Ratio (ICUR) [36, 37].

The primary distinction between CBA and the EA previously described is the unit of measurement employed to quantify the benefits, which in this case is a monetary unit (pounds sterling, dollars, euros). As all the costs and benefits of the project alternatives to be compared are expressed in monetary terms, CBA allows for a more accurate comparison, even between different sectors of the economy, in order to select the most optimal allocation of the available financial resources [38].

The primary challenge in applying CBA to complex contexts, such as health interventions, is the monetization of intangible benefits. The academic literature notes that the monetization of benefits following the implementation of a health intervention is a widely criticized area due to the subjectivity inherent in such valuations. The monetization of health benefits is a challenging aspect of CBA. Approaches used in CBA for monetizing health benefits include i) the human capital approach [39], ii) the revealed preference approach, iii) the Contingent Valuation (CV) approach [40, 41].

The human capital method is based on the principle that a health intervention is an investment because time spent in good health is linked to increased productivity in the labor market. By employing monetary values, such as market wage levels, and associating them with time spent in good health, it is possible to monetize the benefits associated with the project being evaluated. On the other hand, the Revealed Preference (RP) Method analyses the choices made by the consumer. In particular, an example of the RP method is the hedonic wage approach, which analyses the relationship between the health risks associated with a chosen hazardous job and the salary required to accept the job [42, 43]. This type of report therefore highlights the preferences of individuals who accept risks in exchange for money. Finally, the most widely used method for quantifying benefits in monetary terms is the CV, a technique of stated preferences based on the construction of a questionnaire describing a hypothetical market in which (non-market) goods are traded. The monetary valuation of benefits in the CV is measured by the maximum willingness-to-pay (WTP), i.e. the maximum amount of money that users would pay to gain more years of life or a better quality of life by undergoing a health project.

As described above, it can be said that the economic evaluation techniques used in the health field differ mainly in the method of quantifying the benefits associated with an intervention, the outputs of the analysis, and the choice of one or the other depends on the subject of the analysis, i.e. the qualification of the health intervention to be evaluated. The following table (see Table 1) provides a summary of the principal similarities and differences between the various economic evaluation techniques employed to assess the feasibility of interventions in the health sector. of simplification.

**Table 1.** Comparative analysis of the health economic evaluation techniques

	LCA	CEA	CUA	CBA
Project type	Disease prevention/ treatment programmes/ new technology			Healthcare infrastructure
Costs associated with an intervention	Monetary units (\$, €..)			
Benefits associated with an intervention	–	Natural units (YLG, YLL)	QALY	Monetary units (\$, €..)
Final feasibility indicator	–	ICER	ICUR	Net Present Value (NPV); Internal Rate of Return (IRR)

## 4.2 Common Pitfalls of Health Economic Appraisal

It is important to note that each of the EA techniques described has methodological limitations, which become particularly apparent when applied to controversial areas such as health. Critics argue that CEA and CUA fail to capture all the characteristics of the costs and benefits associated with a health intervention, mainly because of a lack of data. Many CEAs and CUAs use decision-analytic models, such as Markov models, to estimate costs and effectiveness. These models incorporate assumptions based on published data and/or expert opinion. If the elements of the model are not accurate, the conclusions may be erroneous. Consequently, the analyses carried out by different evaluators may lead to different conclusions.

A further criticism raised by academic literature is the concept of QALY used as a measure of benefit in CUA. The ethical issues associated with the QALY indicator are among the most frequently cited concerns. The assumption that individuals can assign a value to the quality of their own lives presupposes the existence of life and consciousness, which precludes the consideration of interventions aimed at, for example, fetuses or brain-damaged patients [44]. Furthermore, the QALY metric has been criticized for its inability to measure improvements in the form of minor but clinically significant benefits. This is exemplified by the case of cancer patients who may benefit from treatment even if their life expectancy remains low [45].

The limitations of the indicators employed to quantify benefits in the CUA and CEA are that the calculation method is discriminatory against groups of patients who receive less benefit. In the case of patients receiving palliative care or the elderly, the calculation of QALYs is significantly influenced by the number of years of life associated with these user groups. A similar phenomenon can be observed in patients with disabilities or non-self-sufficiency. While these individuals may experience improvements in their health through specific interventions, they are unable to claim a high level of health status due to the permanent condition that affects them [46].

A further step in the analysis is to move from the indicators used in the CEA and CUA to the final parameter of the analysis (ICER/ICUR). This allows for the identification of intrinsic criticalities. The ICER or ICUR is employed by decision-makers as a means of prioritizing the allocation of available financial resources. This report provides information on the incremental cost per unit of health benefit gained when comparing two competing alternatives. In order to ascertain the acceptability of the ratio value,

it is necessary to compare it with a pre-defined threshold value. In the literature, the threshold is derived from the outcome of some already widely accepted and reimbursed medical and therapeutic strategies. For instance, in the United Kingdom and the United States, values between 50,000 and 75,000 dollars/pounds are considered an acceptable proportion of life-saving expenditure [47]. The establishment of a universally accepted threshold is considered unethical, and no state has set a universally accepted threshold. This naturally leads to subjectivity and arbitrariness in the assessment [48].

However, CBA has many limitations that make it difficult to apply. When applied to the evaluation of a health project, these include the upper limit and the difficulty of quantifying non-market goods and intangible benefits in monetary terms. The assignment of a monetary value to benefits is controversial, and the ethical validity of this issue is debated, as human life, death, quality of life and illness are immeasurable goods. Consequently, the CBAs conducted and reported in the literature frequently result in a mere comparison of costs, with the quantification of benefits being overlooked [49–52].

Furthermore, the absence of active global guidelines frequently results in the exclusion of costs and benefits from the analysis that could be of fundamental importance to the evaluation. For instance, the analysis employs values such as i) hospitalization rates, ii) costs of care, iii) disease incidence rates, iv) mortality rates, and so on. A variety of sources are available for the collection of this information, resulting in inconsistency between the inputs used by evaluators, who may arbitrarily select which information to utilize [53–55].

As mentioned above, CBA uses different methods to assign a monetary value to intangible benefits. The CV, although the most widely used technique, is controversial because of some fundamental implications. There is a possibility that respondents to the questionnaire may not accurately reflect the true value of their WTP for a health benefit, as they may be inclined to report exceedingly high amounts if they are required to assign a value to their health [51]. At the same time, the declared WTP reflects a distortion of the economic capacity of the unit, leading to income discrimination. Units with greater economic capacity are more likely to declare higher amounts, which results in a bias in favor of these units. In contrast, units with lower economic capacity are less likely to declare a WTP [56].

Similarly, the human capital approach also presents certain complications. The monetary value associated with a person's illness is estimated based on lost productivity (absence from work) using wage rates. Consequently, this approach fails to account for the value of lives of individuals who are not employed, whether as unemployed or retired. Furthermore, the labor market is known to be an imperfect market. Indeed, wages reflect inequalities, with lower earnings associated with gender or ethnicity [52].

Concerning the quantified benefits of the revealed preferences approach, the estimated values vary considerably according to the type of employment considered in the analysis, and there is controversy as to which types of workers are more at risk than others.

Based on the critical issues identified in the analysis of the literature, there are therefore many problems that need to be investigated further in order to identify solutions that are more effective in the economic assessment of uncertain contexts.

## 5 Conclusion and Future Insights

The challenges that have arisen in the 2020 global health crisis, which has affected health systems and care provision worldwide, must be addressed. A multitude of regulatory frameworks and sources of funding are available at the European and Italian national levels to address these issues. It is therefore of the utmost importance that these sources of funding, which are available for a limited period (2021–2027) and are limited in number, are used in the most effective manner possible to achieve the greatest possible impact. In this context, economic evaluations are of significant importance as decision-making tools, as they assist in defining the optimal allocation of resources. However, when applied to challenging contexts such as health, economic evaluations demonstrate more clearly the limitations that are characteristic of such contexts.

This research has sought to provide a comprehensive overview of the most commonly employed methods in the health sector, with a view to identifying their inherent limitations. The framework will facilitate further development. The future development of the research anticipates the implementation of an analysis of the limitations of the EA, to propose approaches to overcome them by building a support model for the authorities in the definition of intervention programs.

The authors will investigate the possibility of constructing an integrated approach by combining the techniques employed thus far in the health field, or by combining the methodologies outlined in this document with additional quality assessment techniques, such as multi-criteria analyses, in order to optimize the potential of the model.

**Note.** The research has been developed within the project “MISTRAL - a toolkit for dynaMic health Impact analysiS to predicT disability-Related costs in the Ag”-HORIZON-HLTH-2022-ENVHLTH04 - Grant Agreement Project n. 101095119 of the Polytechnic of Bari (Italy).

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