Advancing a Greener Ecosystem in Health Technology Assessment: A Review of Environmental Integration as an Additional Value Driver

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Background

- The healthcare sector accounts for ~4.4% of total greenhouse gas emissions globally[1]—if it was a country, it would rank as the fifth largest emitter of greenhouse gases.[2,3]
- Key drivers of this environmental impact (EI) include medical equipment (often disposable), health technology supply chains, and the production and use of pharmaceuticals.[2,3]
- Health technology assessment (HTA) plays a central role in guiding resource allocation and reimbursement decisions. Hence, incorporating EI considerations into HTA as an additional value driver is an emerging topic.

Objective

- This systematic literature review aimed to map the current landscape of environmental sustainability considerations in HTA, identify emerging frameworks and methodologies, and to highlight opportunities for further integration into decision-making processes.

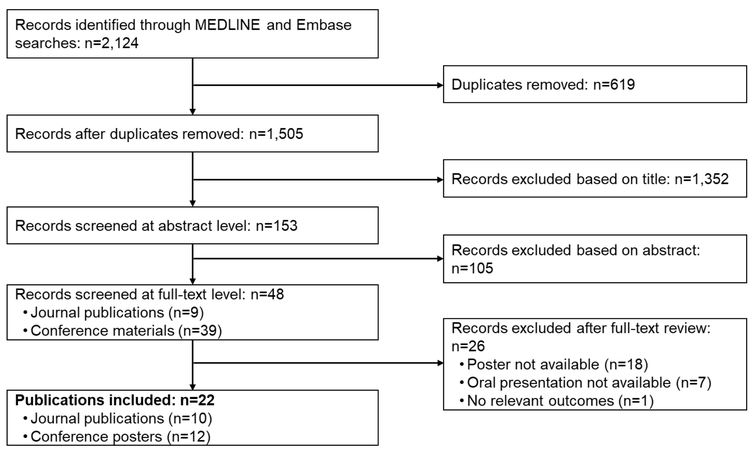
Methods

- Embase and MEDLINE were searched in March 2025 for English-language publications dating to 2015.
- A broad search strategy was employed, incorporating a combination of terms related to sustainability (e.g., sustainability, sustainab*, environmental, environment*), and HTA (e.g., HTA, health technol*, health technology assessment).
- Publicly accessible full texts or conference proceedings providing context on EI and sustainability integration into HTA were included.
- Screening at the full-text stage and data extraction were conducted by two reviewers.
- Included literature was qualitatively analyzed to identify common themes, gaps, and the extent to which sustainability has been integrated into HTA processes.

Results

- Ten peer-reviewed, full-text publications and 12 conference posters were included (Figure 1). The majority (n=11) were literature reviews of various types and the rest comprised perspectives (n=5), case studies (n=4), and surveys (n=2).
- Thematic analysis categorized the identified literature into the following areas: theoretical frameworks guiding the integration of EI into HTA, methodology used to measure and quantify EI of health technologies, approaches or methods to integrate EI into HTA, and the status quo of considering the EI of health technologies by HTA agencies (Figure 2).
- Six HTA decisions (as part of one conference publication) were identified to consider EI (NICE: n=3; HAS, ICER, OHTAC: n=1 each), most of which assessed single-use devices. However, EI was not the main value/decision driver.[4]

Figure 1. Literature attrition diagram



Conclusions

- Advancing green HTA will require not only technical innovation but also institutional commitment and inclusive dialogue.
- Value elements of HTA must be reassessed, and robust, standardized methods and guidelines developed to measure and incorporate EI.
- In the short term, pragmatic trade-offs, such as partial lifecycle analyses or prioritizing high-impact technologies, may be necessary.
- Ultimately, integrating sustainability into HTA is both a methodological challenge and a moral imperative for ensuring healthcare systems are effective, equitable, and environmentally responsible.

Results

Figure 2. Emerging themes of sustainability from the HTA ecosystem

Theoretical frameworks

- **Responsible Innovation in Health framework** defines six value domains with multiple attributes to quantitatively measure the value and degree of responsibility of an innovation.[7]
- **Comprehensive Environmental Assessment framework** integrates quantitative and qualitative data, includes various stakeholder perspectives, and highlights trade-offs and prioritization between health technology options.[3,8]
- Concept of **intrinsic** (i.e., specific to health technology) **versus generic** (e.g., fossil fuel use in manufacturing/ transport) **environmental risks** of a health technology allows selection for HTA.[9]

Approaches and methods to incorporate EI into HTA

- **Information conduit:** HTA agencies re-publish any environmental data submitted by sponsors or available publicly without further assessment; limitation: data are not included in HTA decision-making.[5,6]
- **Parallel evaluation:** HTA agencies analyze and present EI data alongside standard economic evaluation (CEA unchanged); limitation: lack of transparency or guidance as to when EI should influence the decision (trade-offs between health/cost outcomes and EI).[5,6]
- **Integrated evaluation:** EI fully integrated into HTA process, using methods already established in HTA (CUA, CBA, CEA); limitation: accuracy of financial conversion rates is critical, requires decision rule (e.g., how much health loss can be traded to gain one unit of environmental benefit [and vice versa]?)[5,6]
- **Environment-focused evaluation:** HTA agencies consider only EI in their deliberations for interventions with no health or cost benefits, providing no incentives to improve those.[5,6]

Measures to quantify EI

- **Lifecycle analysis** is a broadly accepted, systematic method for estimating the EI of a product or process across a part or its entire lifecycle.[3,5,10-13]
- **Environmentally extended input-output analysis** can be used to assess the EI of a whole sector (e.g., hospital-wide emission).[3,10-13]
- Metrics integrated in these analyses are mostly **carbon footprint or greenhouse gas emissions** (direct and/or indirect, i.e., related to supply chains etc.). Other important environmental spillovers (e.g., impact on water, waste, biodiversity loss) are often neglected due to lack of data.[5,13-15]

HTA agencies with green initiatives

- National Institute for Health and Care Excellence (England)
- Canada's Drug Agency (Canada)
- Agency for Healthcare Research and Quality (United States)
- National Health Care Institute (Zorginstituut Nederland) (Netherlands)
- Spanish Agency of Medicines and Medical Devices (Spain)
- Haute Autorité de Santé (France)
- Denmark, Iceland, and Norway
- The Dental and Pharmaceutical Benefits Agency (Sweden)

Challenges

- **Data-related**: Limited availability and granularity of emissions data, lack of EI data beyond carbon emission
- **Methodological**: Lack of standardized and widely accepted tools for quantifying EI and methods to incorporate into HTA
- **Ethical**: Lack of guidance on how to value and trade off environmental outcomes against health and financial outcomes

Abbreviations: CBA, cost-benefit analysis; CEA, cost-effectiveness analysis; CUA, cost-utility analysis; EI, environmental impact, HAS, Haute Autorité de Santé; HTA, health technology assessment; ICER, Institute for Clinical and Economic Review; NICE, National Institute for Health and Care Excellence; OHTAC, Ontario Health Technology Advisory Committee

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*Denotes any number of missing letters following the term