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HTA23

Broadening the Evidence Base: Incorporating Environmental Considerations Into HTAs

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Background

- Healthcare systems account for 4–5% of national GHG emissions, impacting climate and public health.[1]
- Rapid healthcare technology advancements present growing environmental challenges, particularly in carbon footprint (CF).[2]
- Pharmaceuticals contribute 10–55% of healthcare GHG emissions through high energy use and waste across their lifecycle.[1,3]
- Medical devices require significant resources for production and disposal; 90% of device waste comes from single-use products.[4]
- Integrating Environmental Sustainability (ES) considerations into HTA supports more holistic and financially sustainable healthcare decision-making.[5]

Objectives

- This systematic review investigates how ES metrics, particularly CF analyses, are incorporated into HTA and research practices.
- It seeks to determine how these approaches can enhance the quality and scope of evaluations, supporting more comprehensive decision-making.

Methods

Literature Search
- Databases: MEDLINE (via PubMed), PsychInfo, Scopus, CINAHL Plus, EconLit, and EMBASE.
- Timeframe: From inception to October 2023.
- Focus: Integration of ES into HTA and related analysis around decision making in health care contexts.

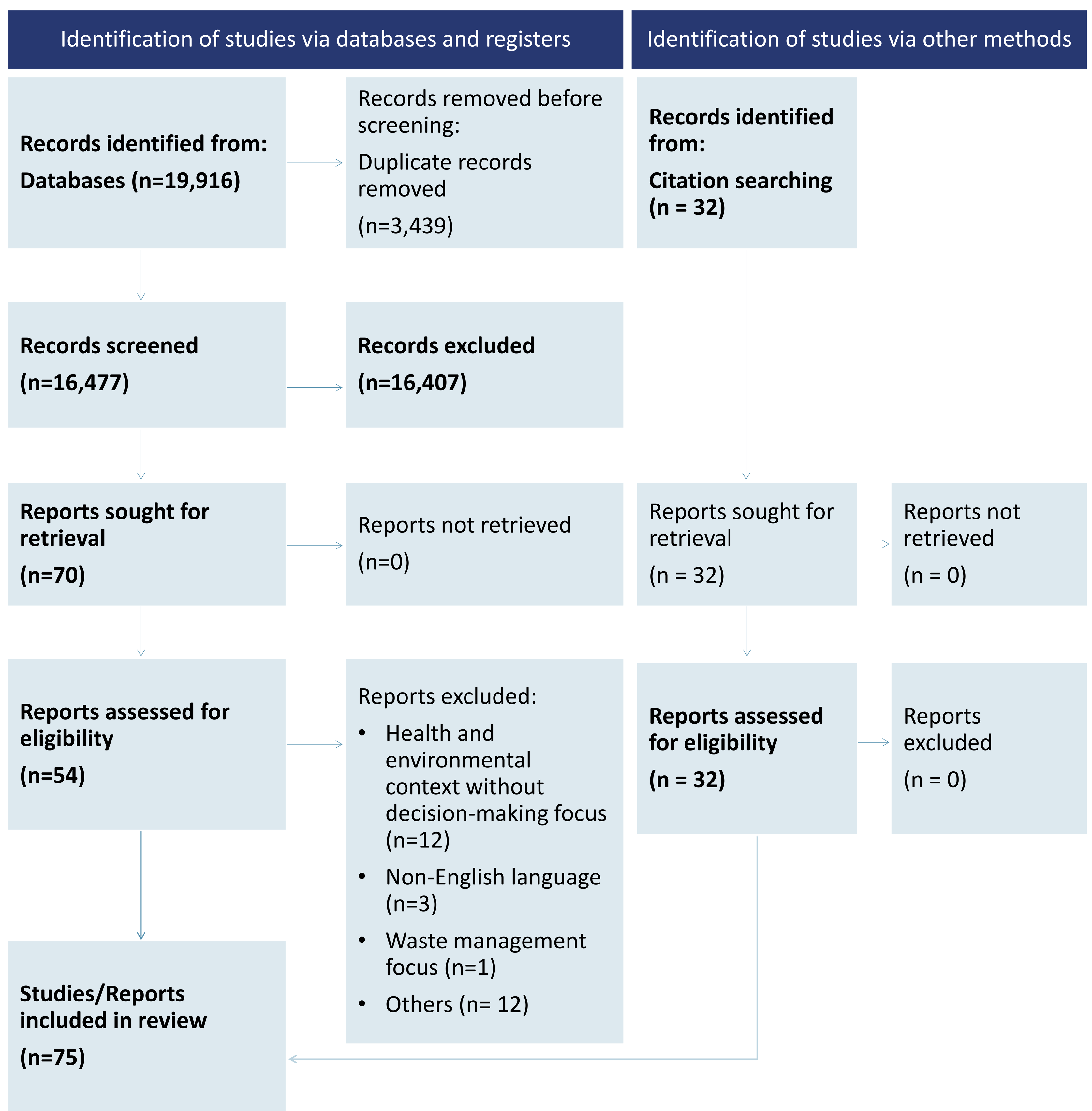
Eligibility Criteria
- Included studies integrating ES into HTA or broader healthcare evaluations.
- English-language publications only.

Screening and Data Extraction
- Two reviewers independently screened titles, abstracts, and full texts.
- Discrepancies resolved through discussion
- Data extracted on study design, environmental metrics, methods, key findings, and impacts on healthcare decision-making.

Thematic Analysis
- Structured around 22 targeted questions covering EIA definitions, integration into decision-making, financial sustainability, challenges, and case studies.

Reporting
- Review process adhered to PRISMA 2020 guidelines.

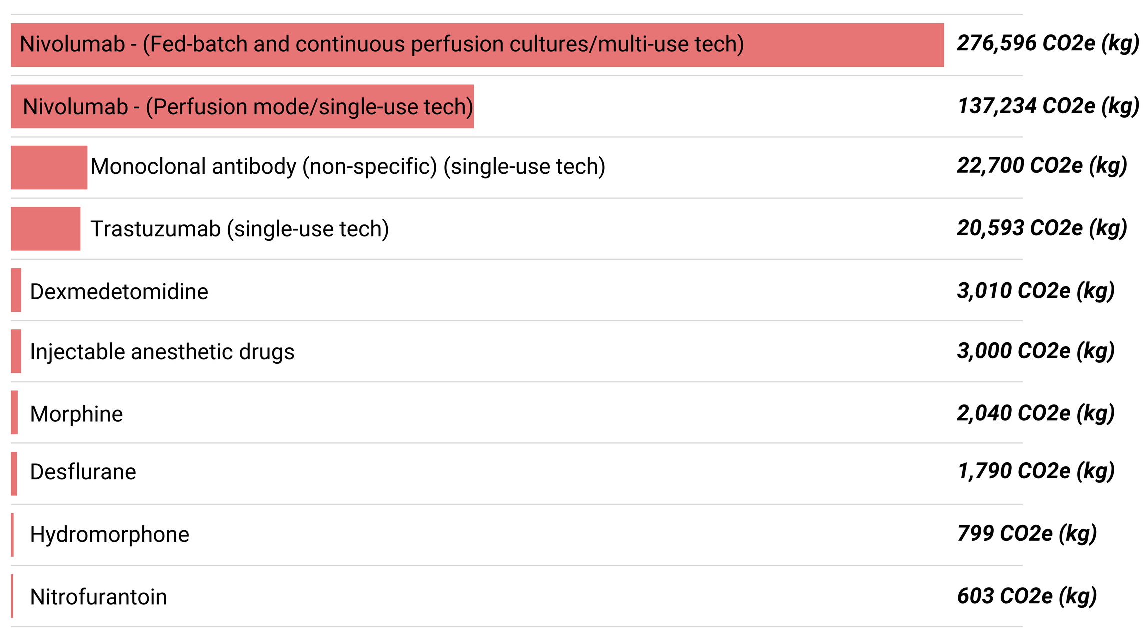
PRISMA 2020 flow diagram



RESULTS

- Life Cycle Assessments (LCA), carbon footprinting, and Environmentally extended input-output (EEIO) analysis are the most methods used to quantify GHGs of pharmaceuticals, medical devices, and procedures.
- The CF of pharmaceuticals showed stark disparities, ranging from 276,596 kg CO2e/kg API for nivolumab to just 0.67 kg CO2e/kg API for Paracetamol—a difference exceeding 400,000-fold.
- These values varied widely due to differences in production methods, usage patterns, and geographic contexts.
- Recent HTA reports, particularly from PBAC and CDA, often focused on drug wastage to address environmental concerns, reflecting a limited scope.
- Many studies demonstrated that incorporating ES metrics into HTA improved decision-making, sometimes yielding long-term financial and clinical benefits.
- Emerging frameworks propose linking clinical outcomes with ES data to guide technology adoption, but inconsistent metrics and reporting hinder comparability and policy action.

Top 10 High-Emission Pharmaceuticals Per kg API



Comparative CO_2e Emissions of Vaccines, MedTech, and Medical Procedures: Heatmap Analysis

	Product/Procedure Details	CO_2e (kg)*	Unit*
Vaccines**	COVID-19 Vaccine - COMIRNATY® (Pfizer/BioNTech) (cradle to grave) - multiple countries	0.134 to 0.466	Treatment Course
	COVID-19 Vaccine - mRNA-1273 (Moderna) (cradle-to-grave) - multiple countries	0.023 to 0.108	
	COVID-19 Vaccine - COVISHIELD® (AstraZeneca) (cradle-to-grave) - multiple countries	0.013 to 0.048	
	COVID-19 Vaccine - Ad26.COV2.S (J&J / Janssen) (cradle-to-grave) - multiple countries	0.007 to 0.024	
MedTech	Reusable Ureteroscope	4.47	Use
	Single-use Ureteroscope	4.43	
	Single-use metal laryngoscope handle	1.6	
	Single-use plastic laryngoscope handle	1.41	
	Single-use Gowns	0.905	
	Disposable Laryngeal Mask Airway	0.285	
	Face Shield	0.231	
	Reusable stainless steel laryngoscope handle (sterilization)	0.23	
	Reusable Laryngeal Mask Airway	0.185	
	Cup Fit Filtering Facepiece (FFP) Respirator	0.125	
	Total emissions from PPEs over 12 months during COVID-19	212,956,000	Year
	Medical gloves - production	11,000,000	
	Scenario without the Respimat® Re-usable	3,196,250	
	Scenario with the Respimat® Re-usable	2,017,000	
	Robotic Rehabilitation Exoskeleton (AGREE Robot)	2,233	
	Surgical Instruments Sector	18	100 USD spent
	Patient-led surveillance (patient-performed teledermoscopy with dermatologist feedback)	16	Participant
	Telemedicine	13	Televisit
Medical Procedures	Individual surgical procedures (non-specific)	1,007	Procedure/Operation
	Hysterectomy	424	
	Cataract Surgery - phacoemulsification - UK	181.8	
	Cataract Surgery - phacoemulsification - New Zealand	151.9	
	Cataract Surgery - phacoemulsification - Hungary	130	
	Cardiac surgery (e.g., single valve repair or replacement)	124.3	
	Cataract Surgery - phacoemulsification - Mexico	121	
	Cataract Surgery - phacoemulsification - France	81.1	
	Atrial fibrillation catheter ablation	76.9	
	Robotic staging procedure for endometrial cancer	40.3	

*Heatmap created in Excel with color gradients based on sample mean and distribution. For varied units, only values and units are shown.
**Ranges reflect cross-country differences in manufacturing, regulation, and efficiency.

Conclusions

- Integrating ES metrics into HTA enhances value-based decision-making by identifying opportunities for sustainable innovation and cost savings.
- Coordinated collaboration among providers, policymakers, manufacturers, and regulators is essential to avoid silos, prevent double counting, and ensure standardised methods.
- Embedding ESG principles within HTA and public procurement frameworks will drive the adoption of greener technologies and reduce GHG emissions.
- Future efforts should focus on assessing high-emission technologies (e.g., monoclonal antibodies) and expand beyond CF to include impacts on other domains such as water use, waste, and biodiversity.
- Advancing these initiatives will make healthcare systems more environmentally sustainable and contribute to global climate and public health goals.

References

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Abbreviations

Active Pharmaceutical Ingredient, API; Canadian Drug Agency, CDA; Carbon Footprint, CF; Environmental Sustainability, ES; Environmental, Social, and Corporate Governance (ESG); Environmentally extended input-output (EEIO) Analysis; Greenhouse Gas Emissions, GHGs; Health Technology Assessment (HTA); Life Cycle Assessment, LCA; Pharmaceutical Benefits Advisory Committee, PBAC

Contact Information

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