A Targeted Literature Review into Incorporating Environmental Impact of Healthcare into Health Technology Assessments (HTAs)

HTA117

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BACKGROUND

Many countries have a goal to improve the environment, and healthcare is a source of environmental harm with an opportunity to improve. European countries and the UK are global leaders in addressing climate change. These and other countries may be considering environmental effects of healthcare (Figure 1).

- There is a growing interest in reducing the environmental impact of healthcare, with some countries such as UK and Canada having stated initial goals for incorporating environmental factors into HTA
  - NICE 5-year strategy includes plans to develop a position as a thought leader and active research organisation in HTA methods and guidelines, including environmental impact, by 2026.[1] Particular focus has been shown by NHS UK for reducing emissions in areas including transport sectors alongside healthcare.[2]
  - In Canada, a need has been identified to determine when the assessment of environmental factors becomes a key driver for health decision- and policymakers. CADTH is developing criteria to guide decisions of when to incorporate environmental impact into the HTA decision-making process.[3]
  - Governments in France, Belgium and Quebec have prioritized sustainability, and other public bodies are exploring how to implement changes. However, there is no current focus on reducing environmental impact in the healthcare industry.

Key challenges:
Reducing the environmental impact of healthcare is a future plan that has not been actioned on a large scale in any countries

OBJECTIVE

Several countries have stated initial goals for incorporating environmental factors into their Health Technology Assessment (HTA) with NICE in the United Kingdom aiming to do so as early as 2026. This research aims to broaden the understanding of value of new treatments, with a focus on environmental impact from a health economics perspective.

Figure 1: European countries and the UK are global leaders in addressing climate change. These and other countries may be considering environmental effects of healthcare.

METHODS

A targeted literature review was conducted between January 2012 to March 2022 to identify evidence on the impact of environmental sustainability measures in current and future HTA decisions in key European countries using the process outlined in Figure 2.

Key focus areas of this research included HTA, environmental impact, sustainability, healthcare, and environment.

Figure 2: A targeted literature search was conducted using search terms such as HTA, environmental impact, and sustainability.

A targeted literature review was conducted to identify evidence from January 2012 to March 2022 relating to the role of environmental sustainability measures in current and future health technology assessment (HTA) decisions. Countries included were Germany, Canada, Australia, UK, Singapore, Switzerland, and French-language sources for France, Belgium, and Quebec.

Initial PubMed search was conducted using the following terms: HTA, environmental impact, and sustainability; additional search terms included healthcare and environment.

Environment-related content on HTA websites was searched for the countries of interest.

An iterative snowball/pearl-growing search strategy, including citation mining, was used to identify additional relevant studies in PubMed.

Sources collected included peer-reviewed publications, review articles, and blog posts and books from focused internet searching. Higher priority was given to the most recent sources.

RESULTS

The literature search identified 14 relevant documents of which 7 publications held sufficient details that were included (Table 1). Studies included chronic diseases like diabetes, schizophrenia, asthma and COPD.

3 of the publications examined the environmental impact of medical devices and technologies (Table 2). 4 of the publications adapted clinical-economic models to include environmental outcomes to predict outcomes of different health interventions (Table 3).

Modelling methods examined trade-offs between disposable and reusable inhaler materials, differential carbon emissions via different treatment regimens to simulate disease outcomes for treatment duration to quantify environmental impact across the healthcare supply chain.

Environmental impact was found to be measured in two ways: carbon emissions and materials waste (e.g., single use plastics versus reusable) (Figure 3). 4 (57%) studies quantified the cost of carbon emissions through health economic modelling and 3 (43%) quantified the impact of materials waste.

One study, by Fordham et al., found that improved clinical outcomes can be associated with improved environmental outcomes, demonstrating there does not have to be a clinical versus environmental trade-off. (Figure 4).

Table 1: 7 publications were included in the review

PRIMARY AUTHOR, YEAR	SOURCE TITLE	COUNTRY	SOURCE TYPE	THERAPEUTIC AREA	METHOD
Debaveye et al, 2019[1]	Human health benefit and burden of the schizophrenia health care pathway in Belgium: paliperidone palmitate long-acting injections	Belgium	Article	Psychiatry	Health economic models
Debaveye et al, 2020[2]	Quantifying the handprint—footprint balance into a single score: The example of pharmaceuticals	Belgium, Vietnam	Article	Psychiatry, infectious disease	Medical devices and technologies
Dimmock et al, 2020[3]	PNS193 Capturing Environmental IMPACT in Health Technology Assessment of Medical Devices	UK	Abstract	Medical devices	Medical devices and technologies
Fordham et al, 2020[4]	Effective diabetes complication management is a step toward a carbon-efficient planet: an economic modeling study	UK	Article	Endocrine	Health economic models
Ortsäter et al, 2019a[5]	A Budget Impact Model to Estimate the Environmental Impact of Adopting RESPIMAT Re-usable in the Nordics and Benelux	Nordics and Benelux	Article	Respiratory	Medical devices and technologies
Ortsäter et al, 2019b[6]	Incorporating the Environmental Impact into a Budget Impact Analysis: The Example of Adopting RESPIMAT® Re-usable Inhaler	Germany	Article	Respiratory	Health economic models
Marsh et al, 2016[7]	Incorporating environmental outcomes into a health economic model	UK	Article	Endocrine	Health economic models

Table 2: Medical innovations, including devices and technologies, have reduced environmental impact while maintaining clinical efficacy

PRIMARY AUTHOR, YEAR	DISEASE STATE	METHODS	KEY FINDINGS
Debaveye et al, 2020[2]	Schizophrenia, soil-transmitted helminthiases	A single score burden was used to quantify the full cradle-to-grave environmental footprint of 2 treatments on 3 areas of protection: Human Health, Ecosystems and Resources	For both case studies, including the handprint (improved patient health) in addition to the footprint of health care resulted in a reduced single score burden when treatment was compared to no treatment for both case studies, indicating a relative sustainability benefit rate.
Dimmock et al, 2020[3]	Medical devices	HealthTech Connect submissions were analysed for company claims such as CO_2 reduction and other resource use.	Sustainability claims mostly concerned reduction of CO_2 production related to patient travel and the need for fewer visits to medical facilities: 25.6% made no sustainability claims, 53.8% said their technology could reduce CO_2 emissions, 10.3% claimed a reduction in single use plastics.
Ortsäter et al, 2019a[5]	COPD and asthma	Carbon emissions were derived for each treatment pattern (RESPIMAT disposable and RESPIMAT re-usable) considering the whole life cycle (cradle-to-grave) of the inhaler product.	Introducing RESPIMAT re-usable would result in a reduction of the environmental burden of inhaler use of 4,717 total CO_2e and a decrease in societal cost of €205,888 in Nordics and Benelux - a substantial reduction in CO_2 emissions, leading to savings from a societal perspective.

Figure 3: Sustainability claims and materials waste are key themes for measuring environmental impact in HTA

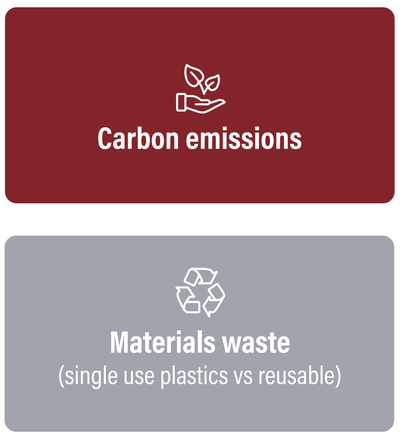

Figure 4: Reduction in total carbon emissions per patient for two treatment scenarios across two T2DM patient populations

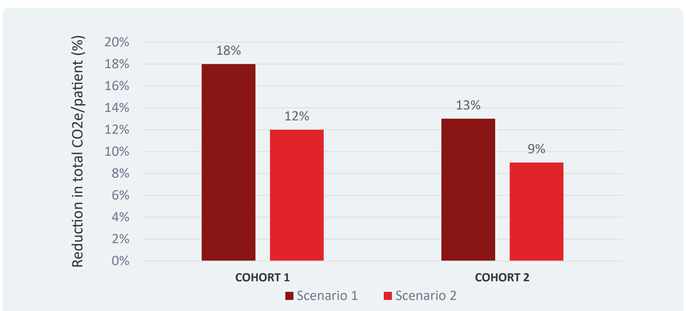

Figure adapted from Fordham R, Dhatariya K, Stancliffe R, et al. *BMJ Open Diabetes Res Care.* 2020;8(1):e001017.
CO_2e: carbon dioxide equivalent, **HbA_{1c}:** glycated hemoglobin, **T2DM:** type 2 diabetes mellitus

Cohort 1: first-line medical therapy. **Cohort 2:** third-line therapy.
Scenario 1: maintaining HbA_{1c} concentration of 7.0%. **Scenario 2:** reducing HbA_{1c} concentration by 1.0% from baseline.

Table 3: Health economic models have been developed in multiple chronic diseases to assess environmental impact of treatment

PRIMARY AUTHOR, YEAR	DISEASE STATE	TYPE OF MODEL	MODEL METHODS	KEY FINDINGS	IMPACT ON RESULTS
Debaveye et al, 2019[1]	Schizophrenia	Life-cycle assessment and Markov model	• Life Cycle Assessment was used to model the environmental Human Health impacts of the pharmaceutical supply chain, administration and disposal of the drug and health care providers • Three patient groups were modeled: medicine coverage of paliperidone palmitate for either one month or three months at a time, and compared to Treatment Interruption as a control group.	The main environmental impacts were visits to the psychiatrist and psychiatric hospitals. The pharmaceutical supply chain had a limited impact. Compared with treatment interruption, monthly or 3-monthly paliperidone palmitate injections reduced the overall environmental burden due to hospitalizations for schizophrenia in Belgium.	By keeping patients more stable, monthly or 3-monthly paliperidone palmitate injections reduced hospitalization—and the associated natural gas emissions and fuel consumption-- and thus reduced the environmental burden.
Fordham et al, 2020[4]	Diabetes	Use of the IQVIA Core Diabetes Model	• Impact of maintaining HbA_{1c} at 7% or reducing it by 1% on total CO_2e/patient and CO_2e/life-year was estimated • Two cohorts of T2DM patients were investigated: those on first-line medical therapy (cohort 1) and those on third-line therapy (cohort 2). • CO_2e was estimated using cost inputs converted to carbon inputs using the UK NHS's carbon intensity factor.	Maintaining HbA_{1c} at 7% reduced total CO_2e/patient by 18% and 13% in cohorts 1 and 2, respectively, and led to a reduction in CO_2e/LY gain of 15% to 20%. Reducing HbA_{1c} by 1% caused a 12% (cohort 1) and 9% (cohort 2) reduction in CO_2e/patient with a CO_2e/LY gain reduction of 11% to 14%.	When comparing people with untreated diabetes, maintaining or improving glycemic control was associated with a reduction in carbon emissions across patient populations.
Ortsäter et al, 2019b[6]	COPD and asthma	Budget impact model	• Inhaler costs and environmental impact over 5 years in Germany in a scenario with RESPIMAT re-usable compared to a scenario without RESPIMAT re-usable were estimated using a budget impact model. • Carbon emissions were derived considering the whole life cycle (cradle-to-grave) of the inhaler product. • Cost of carbon emissions was estimated using a societal cost per ton of carbon emission.	By introducing RESPIMAT re-usable in Germany, it was estimated that by 2023, the number of inhalers used would have decreased by 5,748,750 compared to a scenario without RESPIMAT re-usable.. This measure would reduce the environmental burden of inhaler use while at the same time reducing medical cost of inhalers.	Adopting RESPIMAT® re-usable to the national healthcare services may be a cost-saving option, which has the additional benefit of reducing the societal cost of carbon emissions.
Marsh et al, 2016[7]	Diabetes	Adapted clinical-economic model	• An existing clinical-economic model was adapted to include environmental outcomes (CO_2 emissions) to predict the consequences of adding insulin to an oral antidiabetic (OAD) regimen for patients with T2DM over 30 years, from the UK payer perspective.	The insulin-OAD combination regimen generates more treatment and disease management-related CO_2 emissions per patient (1,686 kg) than the OAD-only regimen (310 kg), but generates fewer emissions associated with treating complications (3,019 kg versus 3,337 kg). Overall, adding insulin to OAD therapy generates an extra 1,057 kg of CO_2 emissions per patient over 30 years.	The model offers a simple approach for incorporating environmental outcomes into health economic analyses, to support a decision-maker's objective of reducing the environmental impact of health care.

Benelux: Belgium, Netherlands, Luxemborg, **CO_2e:** carbon dioxide, **CO_2e:** total carbon dioxide equivalent, **COPD:** chronic obstructive pulmonary disease, **HbA_{1c}:** glycated hemoglobin, **LY:** life year,
OAD: oral antidiabetic, **T2DM:** type 2 diabetes mellitus

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CONCLUSION

HTA bodies are currently exploring ways to incorporate environmental impact into their assessment processes. CADTH (Canada) and NICE (England and Wales) have indicated that this will happen in 3-5 years.[1-3]

Improvements in environmental impact can add value to treatments and be a key differentiator between comparators that may otherwise have similar clinical outcomes and cost effectiveness.

Emerging literature is focused on using carbon emissions as a way of measuring environment impact and methods have been proposed to incorporate this into health economic models. Additionally, quantifying materials waste is another way of measuring environmental impact proposed in the literature.

Pharmaceutical and biotech innovators should start planning now for future HTA submissions that include potential evidence on environmental impact.

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Presented at ISPOR Europe Conference, November 6-9, 2022, Vienna, Austria