

SUMMARY

- This research aims to understand the carbon footprint of the pharmaceutical industry and subsequent responses to mitigate their environmental impact
- Many pharmaceutical companies are investing in renewable sources of energy and incorporating formal green standards of procedure into their drug development cycle, supply chain and distribution
- Changing the life cycle management of the drug development and distribution process from linear to circular can help stakeholders make data-driven decisions to balance their investment in sustainability with long-term cost savings

INTRODUCTION

- The pharmaceutical industry develops and discovers new treatments that improve patient outcomes. However, improper disposal of unused and expired medicines, as well as pollutants from manufacturing, supply chain, and drug delivery systems contribute to a sizeable carbon footprint
- Industry efforts to reduce the environmental impact are expanding from carbon emission reduction alone towards more holistic commitments to long-term sustainable practices

OBJECTIVES

- This literature review aims to report on the global pharmaceutical industry's carbon footprint and understand various strategies for limiting healthcare related emissions and realizing associated cost savings
- Additionally, the research investigates other measures that large pharmaceutical companies are taking in order to reduce and mitigate their impact on the environment, without compromising the accessibility or the quality of their products

METHODS

- The authors conducted a targeted review of published literature on pharmaceutical companies' environmental impact and sustainability goals using PubMed, Google, Google Scholar, and grey literature (presentations, whitepapers, online reports, and articles)
- Key search terms (alone or in combination) included "pharmaceutical sustainability", "environmental sustainability in pharma", "healthcare industry", "pharmaceutical industry environment impact", etc. between January 2002 and December 2022

RESULTS

- Currently, 4.4% of carbon emissions globally are attributed to the healthcare sector, with approximately 71% of those emissions stemming from the supply chain, including production and transport of pharmaceuticals and medical devices
- Between 2010 and 2018, the US healthcare sector's emissions increased by 6%, reaching 1692 kg per capita — the highest rate among industrialized countries¹

Figure 1 | Healthcare Carbon Emissions Across Key Markets Globally²

Key Finding: Healthcare carbon emissions as a percentage of national carbon emissions averages at 4.4% globally. Many countries exceed this with the US at 7.6%, Japan at 6.4%, and the UK at 5.4%.

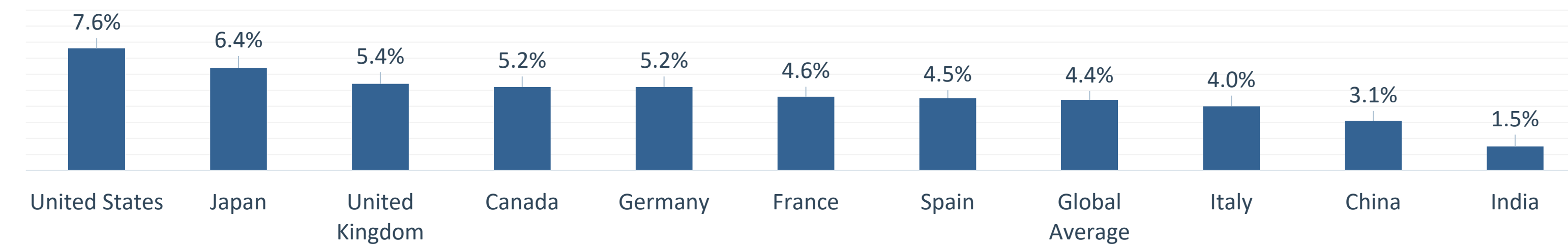


Figure 2 | Scopes of Healthcare-Related Emissions³

- When discussing healthcare-related emissions, both pharmaceutical companies and non-profit research organizations classify carbon emissions into three categories:
- Scope 1 (Direct): Operations of healthcare facilities and associated emissions**
- Scope 2 (Indirect): Indirect effects of energy production**
- Scope 3 (Indirect): Pharmaceuticals, medical devices, waste management, transport, construction, etc.**
- Scope 3 emissions are nearly five times larger than Scope 1 and 2 emissions combined; therefore, it is critical to consider the entire value chain when evaluating the carbon footprint of biotech and pharma

Key Finding: Within Scope 3, pharmaceuticals and chemicals are the largest contributors of carbon emissions, accounting for 18% of total healthcare sector carbon emissions

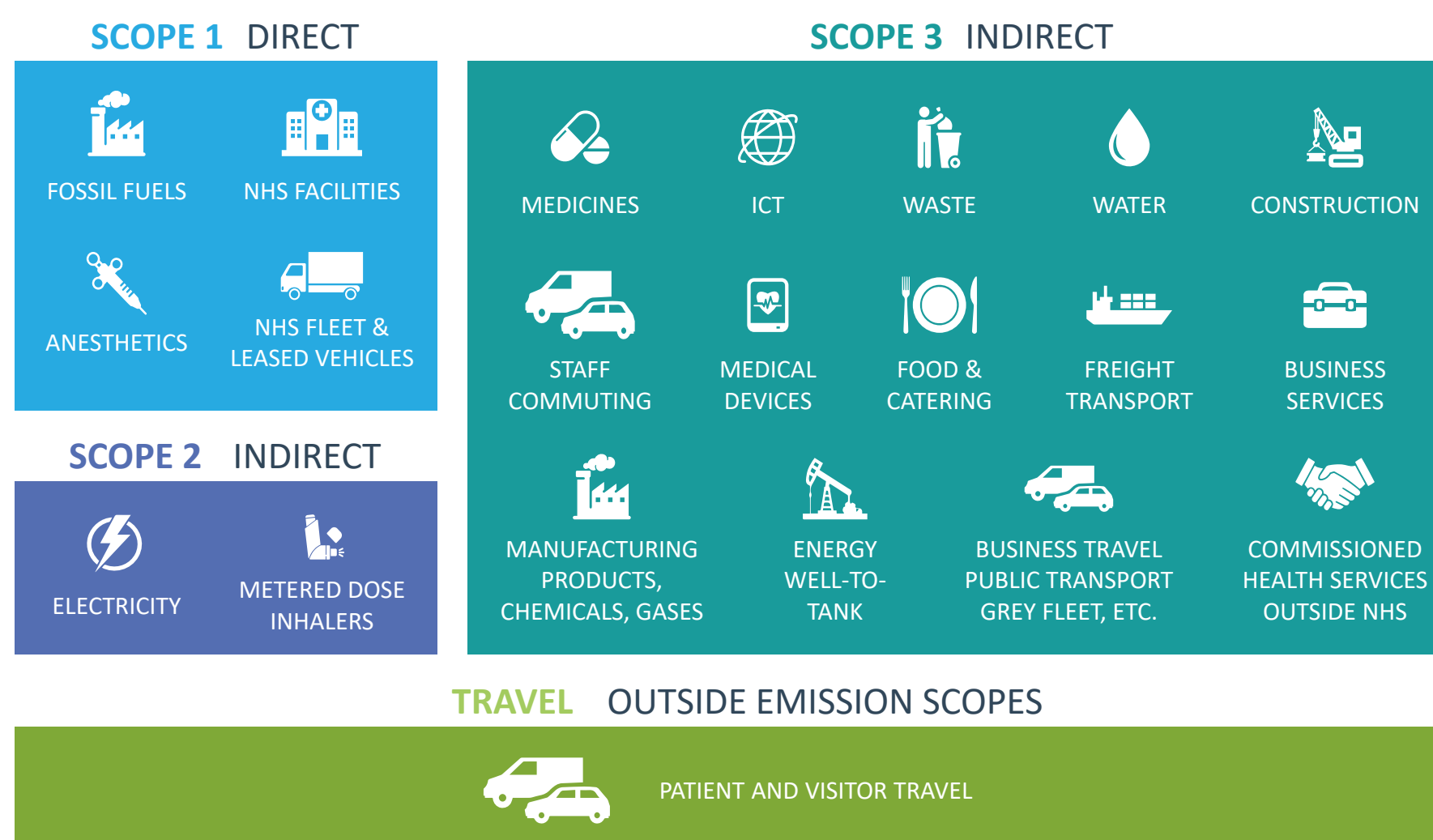
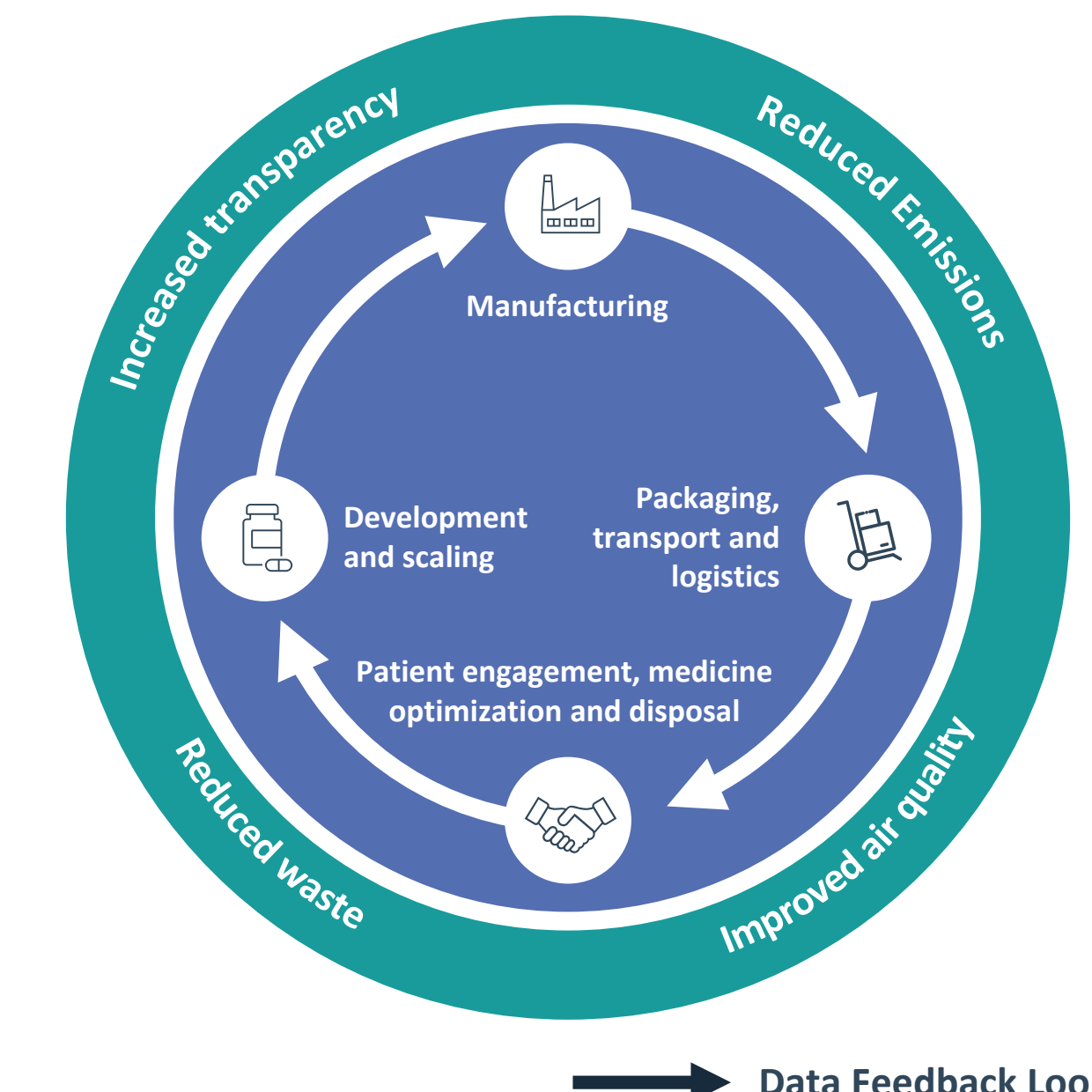


Figure 3 | Circular Life Cycle Management of Medicines⁴

A circular model, in contrast to the 'take-make-waste' linear model, aims to help pharmaceutical companies achieve their environmental and carbon reduction targets in order to increase efficiency and lower costs of production and disposal

Key Finding: Pharma companies should consider taking a comprehensive, data driven end-to-end view of the clinical development process, including waste generation, pollutants, energy use and renewable materials, to identify opportunities for reducing emissions and waste



DISCUSSION & CONCLUSION



Discussion on Industry Response

- Pharmaceutical companies are using a three-pronged approach to reduce carbon emissions: direct, indirect, and supply-chain.⁵ Emissions from the supply-chain fall within Scope 3 and is the largest contributor to carbon emissions in healthcare
 - Considering that 70% of healthcare emissions come from supply-chain in pharmaceutical, continuous instead of batch manufacturing can be effective in curbing carbon emissions⁵
 - Efficient packaging of materials can limit carbon emissions by reducing space in transport vehicles by up to 60%¹¹
- Investing in eco-conscious options in the Pharmaceutical industry can have long-term financial benefits because of reduced waste and more efficient use of resources⁶
 - Principles of a circular economy include reusing and recycling products and materials and regenerating rather than leaving materials to degrade by natural systems
- Climate goals of companies can be broken into 5 tiers, ranging from companies with science-based targets (Tier 1) to those that have no targets (Tier 5); 30% of the top 25 companies are in Tier 2, with Sanofi, Takeda, GSK and Johnson & Johnson leading the way to a net-zero long-term science-based target⁷
- Carbon and waste reduction efforts and other green initiatives in even a single manufacturing site can prevent harmful environmental impacts, in addition to long-term financial gains⁸
 - According to Pfizer's 2021 ESG report, they achieve approximately \$3 to \$5 million in savings through implementation of emission reduction projects⁹
- Collaboration between clinical and commercial teams during early phases of development to find sustainable solutions can help realize the benefits of cost and process efficiency while maintaining quality manufacturing and regulatory compliance



Conclusion

- By looking at the sustainability impact of a product or process in conjunction with the economic implications over its entire life cycle, pharmaceutical companies can balance initial monetary investment in sustainable practices with potential long-term cost savings



Future Research Opportunities

- This research is foundational in understanding the pharmaceutical industry's impact on the environment and what is needed to be more sustainable
- Future research should further investigate the holistic supply chain from drug development to disposal of drugs; more robust data are needed to measure the true environmental impact so better solutions can be applied
- While there are environmentally-centered goals and efforts in place, it can be challenging to quantify sustainable outcomes; therefore, health economics and outcomes research is necessary to support industry claims related to sustainability¹⁰

REFERENCES

- Eckelman MJ, Huang K, Lagasse R, Senay E, Dubrow R, Sherman JD. Health Care Pollution and public health damage in the United States: An update. Health Affairs. 2020;39(12):2071-2079. doi:10.1377/hlthaff.2020.01247
- Health Care Climate Footprint Report. Health Care Without Harm. <https://noharm-global.org/documents/health-care-climate-footprint-report>. Published January 3, 2020.
- 2021 National Healthcare Quality and Disparities Report Data Sources. <https://www.ahrq.gov/sites/default/files/wysiwyg/research/findings/nhqdr/2021qdr-datasources.pdf>.
- The challenge of compliance in life sciences moving from ... - deloitte. <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/life-sciences/health-care/deloitte-uk-challenge-of-compliance.pdf>
- Belkhir L, Elmelig A. Carbon footprint of the global pharmaceutical industry and relative impact of its major players. Journal of Cleaner Production. 2019;214:185-194. doi:10.1016/j.jclepro.2018.11.204
- Climate action playbook for hospitals. Climate Action Playbook for Hospitals. <https://climatecouncil.noharm.org/>
- Blazic E, Wise M, Rowe E. Read @kearney: Are healthcare companies making progress against their climate ambitions? Kearney. <https://www.kearney.com/health/article/-/insights/are-healthcare-companies-making-progress-against-their-climate-ambitions>. Published February 16, 2023.
- Arnum PV. Big Pharma and Sustainability: Tracking Companies' goals. DCAT Value Chain Insights. <https://www.dcatvalue.org/features/big-pharma-and-sustainability-tracking-companies-goals/>. Published January 21, 2022.
- An overview of Pfizer's approach to environment, social, and governance commitments and reporting. An overview of Pfizer's approach to Environment, Social, and Governance commitments and reporting | Pfizer 2021 Annual Report. https://www.pfizer.com/sites/default/files/investors/financial_reports/annual_reports/2021/esg/.
- Brown R. Greenwashing in the medical devices sector: How companies can stand out from the crowd. The PHA Group. <https://thephagroup.com/greenwashing-in-the-medical-devices-sector-how-companies-can-stand-out-from-the-crowd/>. Published November 24, 2022.
- Jimenez D. Cutting the carbon footprint of Pharma's supply chain. Pharmaceutical Technology. <https://www.pharmaceutical-technology.com/features/cutting-carbon-footprint-pharma-supply-chain/>. Published February 3, 2023.

Disclosures: All the authors are employees of Trinity Life Sciences (Waltham, MA), and MOH holds equity in Trinity Life Sciences.