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Executive Summary

A prescription for change

Rethinking plastics use in healthcare to reduce waste, greenhouse gas emissions and costs

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Preface

Plastics have long stood as a symbol of progress in healthcare. Durable, sterile, and affordable, they have enabled safe and scalable care delivery in nearly every clinical setting, from advanced operating theatres to rural health outposts. But today, that advantage is a systemic vulnerability. As climate urgency mounts and resource constraints tighten, the healthcare sector is presented with a unique opportunity to become a steward of planetary health whilst not compromising on patient safety.

Healthcare is now one of the most plastic-dependent sectors – and one of the most overlooked in global circularity and decarbonization agendas – as it is often exempt from the sustainability standards and regulations applied to other industries. Plastic use continues to climb unchecked – escalating waste, straining local systems, and locking the sector into high-emission trajectories.

Yet the opportunity is clear. The healthcare sector is not starting from zero; around the world, hospitals are piloting reusable gowns and surgical trays, manufacturers are redesigning packaging for recyclability, and innovators are recovering hard-to-recycle waste streams. But these efforts remain fragmented and under-resourced, lacking a shared, scalable strategy.

This report fills that gap. It's the first systems-level assessment of single-use plastics in healthcare - integrating material flow modelling, scenario analysis, and real-world case studies to chart a strategic path forward. It demonstrates that deploying a suite of circular economy levers – (1) Refuse, Rethink, Reduce; (2) Reuse; (3) Substitute materials; (4) Improve recycling; and (5) Procure low-GHG emissions plastic – could cut single-use plastic demand by over 50%. It could also reduce associated greenhouse gas (GHG) emissions by nearly half and potentially deliver up to $18 billion (€15 billion) in system savings by 2040 – all without compromising patient care.

But solutions won't arise by default. Structural barriers – from data gaps and procurement rigidity to regulatory inertia – continue to inhibit progress. Overcoming them requires coordinated and sustained action: by governments, through updated regulations and incentives that reflect the need for action; by healthcare providers, by embedding circularity into operations; and by suppliers, with investments in innovation, transparency, and redesign. The global healthcare community is increasingly united in its call for action on plastic pollution. An open letter published by Health Care Without Harm, urging the phase-out of harmful plastics in healthcare, has been endorsed by over 48 million health professionals worldwide – a clear signal of the sector's growing resolve to address plastic pollution.

This report offers more than technical analysis. It provides the foundations of a strategic roadmap – grounded in data, informed by expert input, and shaped by real-world feasibility. It reveals that circular and low-GHG emissions solutions exist today. They are safe, viable, and increasingly cost-effective. What is missing is scale, coordination, and resolve. Whether you are a policymaker, a hospital leader, a clinician, or a manufacturer, you have a role to play. And the time to lead is now.

Let us reimagine a plastics system in healthcare that upholds not only the wellbeing of patients, but also the health of our planet – without compromising on one for the other. By acting decisively now – redesigning products, reforming procurement, investing in infrastructure, and enabling behavioral change – the healthcare sector can lead in building a plastics system that is resilient, decarbonized, and fit for the 21st century.

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About this publication

About this study

Produced jointly by Systemiq and Eunomia with grant funding from Takeda Pharmaceuticals*, this study presents a data-driven vision of how to reduce greenhouse gas emissions and plastic waste from healthcare systems in Europe and North America. It quantifies the environmental and financial impacts of single-use plastics across seven high-volume product categories, identifies the systemic root causes driving current trajectories, and models systems-change scenarios supported by actionable industry interventions, policy levers, and real-world case studies. The research highlights the emissions, waste, and cost implications of inaction, as well as the potential for effective, safe, circular alternatives. With tailored data for North America (USA and Canada) and Europe (EU27 and UK), this report is designed to inform healthcare operators, policy makers, and supply chain leaders seeking practical solutions to decarbonize and modernize healthcare plastics.

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About Systemiq

Systemiq is a systems change company that works with businesses, policymakers, investors, and civil society organizations to reimagine and reshape the systems that sit at the heart of society – energy, nature and food, materials, built environment, and finance – to accelerate the shift to a more sustainable and inclusive economy. Founded in 2016, Systemiq is a certified B Corp with offices in Brazil, France, Germany, Indonesia, the Netherlands, the UK, and the USA. Find out more at www.systemiq.earth or via LinkedIn.

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About Eunomia

Eunomia Research & Consulting, Inc. – established in 2001 – is a consultancy focused on accelerating the transition to a circular, decarbonized economy by working with governments, global brands, investors, and NGOs to align policy, infrastructure, and innovation. A certified B Corp with offices in the United States, United Kingdom, New Zealand, and Belgium, Eunomia delivers evidence-based solutions – powered by engineers, scientists, economists, policy strategists, and circular economy experts – that transform how materials, energy, and resources flow through society. Find out more at https://eunomia.eco/ or via LinkedIn.

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Responsibility for the information and views set out in this publication lies with the authors. Members of the Expert Panel or sponsors endorse the overall project approach and findings, but not all statements in this publication necessarily represent their views and they cannot be held responsible for any use which may be made of the information contained or expressed therein. Nothing in the report should be construed as implying new legal obligations or intended to explore individual approaches to, or involvement in, specific impacts; and nothing in the report should be deemed or construed as statements made individually by any member of the Expert Panel or sponsors.

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Expert Panel

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A panel of experts representing different sectors and stakeholder groups across the value chain was assembled to ensure the directional relevance, practical feasibility, and cross-sector credibility of this study. Data on this topic is often fragmented, difficult to locate, and inconsistent. Convening this group of experts was our deliberate approach to foster cohesiveness and establish a consistent framework for defining the problem statements and envisioning innovative solutions. The Expert Panel reviewed all key assumptions and provided input into the methodology, system model, and conclusions. We are deeply grateful to all the organizations and individuals who contributed their time and deep content expertise to the process.

Expert Panel members endorse the overall project approach and findings, although specific statements made in the report do not necessarily reflect their individual views or those of the organizations they represent.

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Executive summary

Plastic has become an integral part of modern healthcare across all settings, including hospitals, outpatient clinics, pharmacies, and long-term care facilities. From gloves and gowns to syringes and fluid bags, plastics enable hygienic, safe, and scalable care delivery across all levels of healthcare systems – from high-tech operating rooms in major hospitals to remote primary care clinics. Its durability, sterilizability, and low cost have made it the default material choice for countless single-use and multi-use applications since the 1990s, as infection prevention protocols and regulations (linked to HIV, hepatitis, and hospital-acquired infections) have driven a shift from reusable metals and textiles to sterile, single-use polymers.

But this reliance has also created a highly linear system that is increasingly costly for our healthcare systems. It is also environmentally unsustainable; plastic waste generated in healthcare settings is incinerated or landfilled in the vast majority of cases. According to the Healthcare Plastics Recycling Council, almost 15 million tonnes of healthcare plastics were produced globally in 2020[1], generating approximately 5% of total global plastic waste[i]. COVID-19 has exacerbated this trend, driving increases in personal protective equipment (PPE) and single-use medical items. At the peak of the pandemic, the production of PPE rose by 40%[2], with 129 billion masks and 65 billion gloves used monthly worldwide[3] and the consumption of PPE continued to remain elevated past this peak[4].

Despite growing public and regulatory scrutiny around plastic pollution, healthcare remains one of the few sectors largely exempt from plastic-related regulation, such as the Packaging and Packaging Waste Regulation (PPWR) in Europe[5] and ambitious bills like SB-54 in California[6]. Concerns over safety, regulatory standards, and performance requirements continue to slow innovation and restrict change.

This is not just a waste management issue; it is a climate issue. Virgin plastic production is a major source of GHG emissions, and our analysis shows that healthcare's plastic footprint does not align with a net zero pathway or with the 1.5°C climate target set out in the Paris Agreement. Some progressive actors are beginning to act: the National Health Service (NHS) England has committed to reach net zero direct GHG emissions by 2040 and cut 80% by 2028 – 2032[7]; Kaiser Permanente in the United States is targeting full value chain net zero by 2050[8]; and Medtronic, as part of its Scope 3 strategy, has exceeded its goal of reducing plastic packaging for specific product lines by 25% (approximately 130 tonnes)[9]. But such efforts remain fragmented and lack alignment in scope, metrics, and ambition.

Without systemic action, the negative impacts of single-use plastics in healthcare will become severe, with significant implications for waste, healthcare costs, GHG emissions, and public trust. While there is growing recognition that the healthcare sector should undergo a transition – toward a system that minimizes unnecessary plastic use, embraces reusable and recyclable solutions where safe and feasible, and reduces its reliance on virgin fossil inputs – there is no consensus on priority interventions or what their potential impacts could be.

> Without systemic action, the negative impacts of single-use plastics in healthcare will become severe, with significant implications for waste, healthcare costs, GHG emissions, and public trust

i In Breaking the Plastic Wave, an estimated 250 million tonnes of plastics were disposed of in 2020.

This report is a strategic analysis of single-use plastics in healthcare aimed at addressing these issues. Employing a broad product scope, cross-regional modelling, a long-term time horizon, and scenario-based systems analysis, this report provides a roadmap to help the healthcare sector align with climate goals and resource efficiency, while maintaining patient safety. It integrates diverse interventions – from material substitution and reuse to design for recycling and waste stream optimization – offering a shared fact base to support action across the healthcare value chain. It aims to address three key gaps in the current landscape:

- a lack of understanding of plastic volumes in healthcare,
- a fragmented approach to circularity initiatives, and
- a lack of shared vision across public and private sector actors on the future of plastic in healthcare.

The report focuses on the seven highest-volume single-use plastic product categories used in healthcare: tubing and fluid bags; gloves; rigid devices (syringes, venous blood collection tubes, urine sample tubes, and single-use infant bottles); rigid medical device packaging; Personal Protective Equipment (PPE); wipes; and pharmaceutical packaging. These categories are estimated to have a high share of plastic volume[ii] and offer the greatest potential for intervention. Our focus is Europe (EU27 + the United Kingdom) and North America (Canada and the United States of America) – two regions with high healthcare plastics consumption that are well positioned to lead the transition.

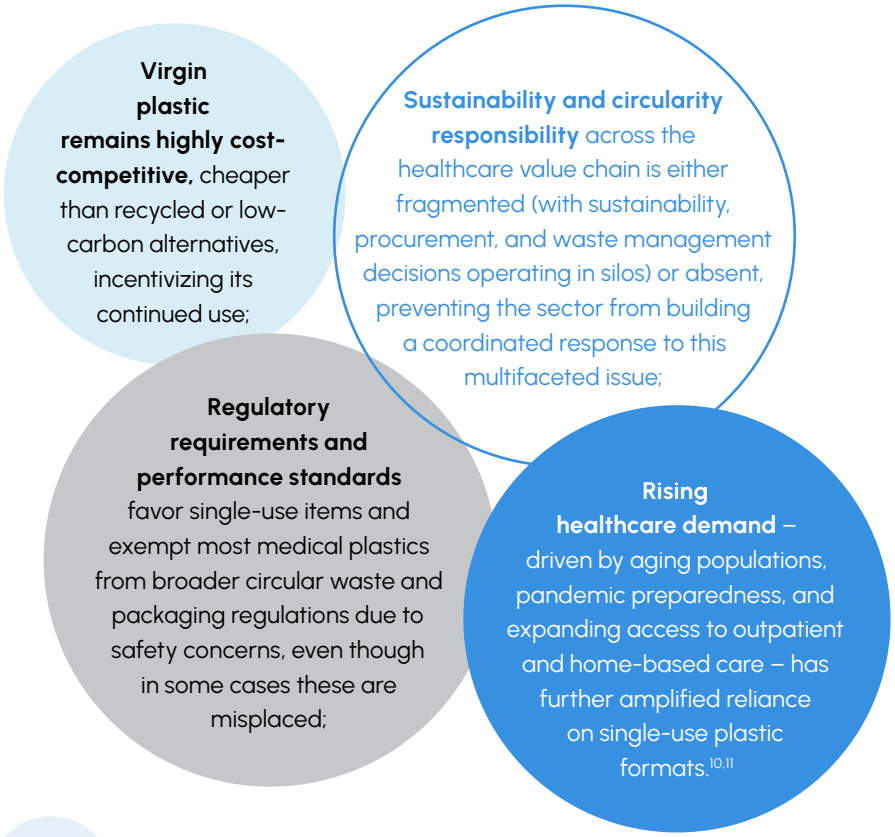
The report employed a systems-level approach, integrating material flow modeling with scenario-based analysis to assess the impact of ambitious and coordinated cross-sector action. A suite of circularity levers – from elimination and reuse to design for recycling and better end-of-life management – was identified and their combined effects were modeled through 2040, drawing on interviews, case studies, literature review, and stakeholder input.

This report aims to provide a first-of-its-kind view on accelerating circularity for single-use plastics in healthcare applications. The following chapters provide a deeper analysis: outlining the current linear trajectory of plastic use in healthcare, the impact of circularity interventions, and the structural transformation needed to achieve a more sustainable and resilient plastic system. This is not just a report on waste management – it is a call to reimagine how materials flow through our healthcare systems and to rethink the economic and environmental implications of the choices.

ii In Measuring and reducing plastics in the healthcare sector, disposable gloves, IV solution bags, disposable PPE, syringes and IV administration systems represented over 50% "of the total plastic used annually".

1 Under Business-as-Usual, the sector is misaligned with 1.5°C and waste reduction goals; single-use plastic waste and associated GHG emissions could grow by 35-40%, over 2023 levels, by 2040[iii]

The current trajectory of healthcare plastics is shaped by four interlocking structural forces;



This current single-use model introduces operational fragility and is not environmentally sustainable. Based on the model developed for this report, in 2023, the healthcare systems of Europe and North America generated around 2.1 million tonnes of single-use plastic waste from seven high-volume product categories across the value chain, as well as GHG emissions of approximately 9.3 million tonnes of CO_2e. Without significant intervention, this figure could rise to more than 2.9 million tonnes of single-use plastic annually by 2040. Plastic waste in Europe is expected to increase by 47%, and in North America by 28%, over the same period. This would result in an additional 3.6 $MtCO_2e$ of GHG emissions across the value chain annually and $21 billion (€18 billion) system cost[iv] (on top of the $56 billion (€47 billion) spent on these categories in 2023), reinforcing a linear system at odds with climate targets and institutional sustainability commitments.

2 Applying circular economy levers will significantly reduce plastic use by up to 53%, GHG emissions by up to 55%, and system costs by up to 24% by 2040

Five core circularity and decarbonization levers – **(1) Refuse, Rethink, Reduce[v]; (2) Reuse; (3) Substitute materials; (4) Improve recycling; and (5) Procure low-GHG emissions plastics[vi]** – can enable a shift toward a more circular and climate-aligned healthcare plastics system, without negative impacts on patient health or safety. Refuse, Rethink, Reduce would involve phasing out unnecessary products or components, such as redundant layers of packaging or over-used products like gloves or syringes. Reuse could introduce durable alternatives in clinical workflows for certain applications, such as reusable gowns and metal trays, where hygiene and performance standards can be maintained. Substitution could replace traditional plastics with alternative materials, including paper-based packaging or compostables, where contamination and performance risks are minimal. Recycling improvements would target product and packaging design for recyclability and expand the segregated collection and processing of non-infectious plastics. Finally, low-GHG emissions plastics[vii] or plastics that leverage Carbon Capture and Storage (CCS) could help reduce upstream carbon footprints where single-use formats are unavoidable.

Together, these interventions could reduce plastic waste by 53% by 2040 compared to Business-as-Usual (BAU), in a High-Ambition Scenario. This would represent 1.6 million fewer tonnes of waste per year and could avoid 7 million tonnes of CO_2e annually. Financially, the healthcare system could realize approximately $18 billion[viii] (€15 billion) in annual cost savings through reduced material purchasing, lower disposal costs, and reduced exposure to volatile fossil-based supply chains. Upstream measures deliver most of the impact, highlighting the importance of avoiding plastic use altogether, rather than focusing solely on waste treatment. The main report presents aggregated data; for regional results, please see supplementary "Regional Zoom" documents.

iii Note, the time period we are modelling for throughout this report is 2023 – 2040

iv System cost reflects the entire cost of producing, converting and disposing of the products within the system boundary of this report. Labor cost is not included during the 'use' phase of these products. In system-change scenarios, this includes the costs associated with enabling reuse systems, such as transportation and sterilization.

v Based on the 10R-Value hill framework that outlines the 10R Circular Economy strategies (Figure 2 of Huijben et al[12])

vi See definitions in Chapter 2. The terminology used aims to be consistent with the common 10R Circular Economy strategies. Some have been grouped for this report to simplify the analysis.

vii Defined in this paper as plastics produced using methods that result in lower GHG emissions compared to traditional fossil-fuel-based production, such as those made with Carbon Capture and Storage (CCS) technologies or biobased feedstocks.

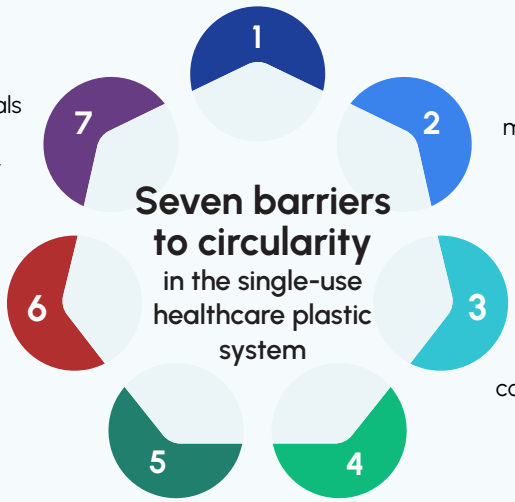
3 Seven system barriers are slowing down circularity in the healthcare sector

Despite the availability of effective solutions, the uptake of circular practices remains slow due to several system barriers identified during expert conversations:

Fragmented and siloed governance
Decentralized decision-making and siloed departments can prevent coordinated action and limit ability to scale successful pilots

Market failures and weak demand signals
Unclear demand and regulatory signals discourage suppliers from investing in circular design and recycling capacity

Data gaps and lack of transparency
The lack of standardized data on materials, waste, and GHG emissions hinders informed procurement and limits value chain visibility



Behavioral norms and operational culture
Infection control protocols, time pressures, and lack of formal support make sustainability initiatives difficult to embed in clinical routines

Short-term cost focus over lifecycle value
Procurement prioritizes low upfront costs, discouraging investment in more sustainable alternatives that carry higher initial costs

Infrastructure and investment gaps
Missing logistics, segregation systems, and funding prevent effective implementation of reuse and recycling models

Regulatory inertia and misaligned incentives
Outdated standards and exemptions for healthcare plastics block innovation and can limit the adoption of circular solutions

These barriers – spanning clinical risk perception, procurement rigidity, cost focus, waste regulation, infrastructure gaps, data limitations, and market misalignment – should be addressed simultaneously to enable meaningful and transformational change.

4 Decisive and coordinated action from all system actors is needed to drive change

To overcome these barriers, healthcare systems should invest in and focus on the foundational capabilities that enable transformation. Clear accountability structures are essential. Most institutions need dedicated leadership, cross-functional coordination mechanisms, and defined responsibilities for circularity within procurement and operational teams. Data infrastructure warrants coordinated investment and governance. Providers should adopt systems to track and reduce plastic use, procurement patterns, and waste flows at the product level, enabling targeted decision-making and transparent performance tracking.

In parallel, value-based procurement criteria should be embedded across all major purchasing processes. This includes factoring in lifecycle emissions, waste implications, and material circularity in tenders and supplier evaluations. Manufacturers would then be incentivized early to develop recyclable or reusable product alternatives. Clinical and operational teams should be equipped with training, decision-support tools, and protocols that allow them to adopt circular solutions safely and efficiently. Waste service providers could expand the infrastructure for decontamination and recycling. Governments can accelerate progress by updating waste and product regulations, supporting innovation, and creating financial mechanisms that reward circular performance.

Acting now is essential. Decisions on procurement, infrastructure, and product design made in the upcoming years will lock in emissions and material flows for years to come. This is an opportunity for the healthcare sector to lead on climate and resource stewardship while reinforcing its mission to protect human health and strengthen system resilience.[13,14]

A presciption for change

Rethinking plastics use in healthcare to reduce waste, greenhouse gas emissions and costs.

A Prescription for Change presents an evidence-based roadmap for transforming the global healthcare plastics system. Building on the analytical foundations of "Breaking the Plastic Wave" and "ReShaping Plastics," this report quantifies the economic, environmental, and operational impacts of seven high-volume single-use plastic categories across Europe and North America. It evaluates five strategic levers for circularity and decarbonization across three scenarios.

The research integrates material flow modeling, cost and emissions analysis, and real-world case studies to provide a clear view of both the cost of inaction and the opportunity of system-wide change. A diverse Expert Panel comprising leaders from clinical practice, procurement, waste management, policy, and manufacturing ensured the practicality and scientific rigor of the findings.

This report is designed to guide policymakers, healthcare executives, procurement consortia, manufacturers, and civil society leaders with the data, scenarios, and strategic direction needed to align healthcare plastics use with climate targets, resource efficiency, and patient safety.

For further information see www.systemiq.earth/a-prescription-for-change or contact plastic@systemiq.earth

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