Planetary health leadership to drive climate action across pharmaceutical supply chains: insights from qualitative research and a call to action

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Planetary health leadership to drive climate action across pharmaceutical supply chains: insights from qualitative research and a call to action

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Abstract

Introduction: Pharmaceutical manufacture, delivery, and use produces an estimated 10-55% of national health care greenhouse gas emissions. Addressing pharmaceutical supply chain emissions is essential to mitigating health care's climate impact. Our research aimed to explore the constraints to pharmaceutical supply chain climate action, and how planetary health leadership can overcome these challenges.

Methods: We conducted 21 narrative interviews with representatives from pharmaceutical companies, and industry and health system stakeholders. Interviews explored perspectives on climate action across pharmaceutical supply chains. Analysis was informed by argumentative discourse analysis enabling identification of key storylines.

Results: Climate action across pharmaceutical supply chains is sporadic and insufficient to achieve health system climate goals. Critical constraints to climate action include: (a) structural constraints, particularly complex, fragmented, global supply chains as well as restrictive net zero infrastructure in some countries where supply chains operate, and (b) conceptual constraints, the 'patient-profit-planet dilemma', where climate action is perceived to conflict with patient wellbeing and financial considerations.

Planetary health leadership can help overcome these constraints in three key ways. Firstly, planetary health leadership can help reconceptualise health care delivery, and the role of pharmaceuticals, to align patient and planetary wellbeing whilst meeting financial pressures. Secondly, planetary health leadership can mobilise collective climate action across pharmaceutical supply chains, reframing climate change as a shared problem, and challenging issues of transparency, competition, and blame. Thirdly, planetary health leadership can challenge wider systems that constrain climate action, leveraging the economic and political power of pharmaceutical supply chains to drive global decarbonisation efforts.

Conclusion: Planetary health leadership must confront considerable constraints to embed planetary health considerations across pharmaceutical supply chains. Leaders in this space must be willing to go against the status quo, challenge entrenched norms and structures, to enable wider spread and support for sustainable health care delivery.

What is already known on this topic:

Pharmaceutical supply chains contribute significantly to health care's greenhouse gas emissions, yet climate action across these supply chains remains limited.

What this study adds:

This study identifies critical constraints to climate action across pharmaceutical supply chains, including global supply chain fragmentation and tensions between ensuring patient or planetary wellbeing whilst meeting financial pressures. It stresses the urgent need for effective planetary health leadership across pharmaceutical supply chains to navigate these constraints and catalyse climate action, through actions such as reconceptualising health care delivery to align patient and planetary wellbeing, mobilising collective action, and influencing wider systemic change.

How this study might affect research, practice, or policy:

Planetary health leadership, from individuals and organisations, must span pharmaceutical supply chains, embedding planetary health concerns in research, practice, and policy. This involves shifting health systems towards prevention, health promotion, and non-pharmaceutical interventions, and integrating planetary health into clinical and supply chain practice and policies. Beyond this, a fundamental rethink of health care delivery, and the role of pharmaceuticals, is needed, driven by effective leadership that challenges the status quo in a world facing planetary crises.

1. Introduction

Health systems produce approximately 5% of global greenhouse gas emissions and can no longer ignore their contribution to climate change[1]. Pharmaceuticals account for 10-55% of national health system emissions. Emissions are released across pharmaceutical supply chains—the individuals, organisations, and activities (e.g., raw material extraction, manufacturing, distribution) involved in delivering pharmaceuticals to health care users[2]. Addressing pharmaceutical supply chain emissions is critical for achieving sustainable health care.

Efforts are underway to decarbonise pharmaceutical supply chains. Health systems are increasingly embedding sustainability criteria into pharmaceutical procurement, and there is a move towards environmentally conscious prescribing[3-6]. Leading pharmaceutical companies are adopting climate targets, transitioning to renewable energy, and implementing environmentally-friendly product design[7]. However, climate action across pharmaceutical supply chains varies significantly and there is a pressing need for planetary health leadership, that recognises the interdependency of human and planetary health, to drive decarbonisation efforts[8-10].

This article examines leadership, of individuals and organisations, as a catalyst for climate action across pharmaceutical supply chains. We ask: what is constraining climate action across pharmaceutical supply chains, and how can planetary health leadership help overcome these constraints? In this paper, we focus on climate change, defining climate action as efforts to reduce greenhouse gas emissions. While planetary health encompasses a range of interconnected crises, including ocean acidification, biodiversity loss, and pollution, we examine planetary health leadership specifically in relation to climate change. However, many of the insights and lessons discussed are likely transferable to addressing other planetary challenges.

2. METHODS

We draw on a dataset from doctoral research being conducted by one of the authors (AB) exploring pharmaceutical companies' climate engagement. This article focuses on the theme of leadership, which emerged as a key finding. Using qualitative methodology, we aimed to generate rich insights on company climate engagement, from narrative interviews with representatives from three multinational pharmaceutical companies, and other industry and health system stakeholders.

2.1. SAMPLING OF PHARMACEUTICAL COMPANIES

Three multinational pharmaceutical companies – GSK, Novo Nordisk, and Teva Pharmaceuticals – were purposively sampled ensuring a mix of branded and generic companies that were active in their climate commitments and engagement. At the time of sampling (2022) GSK and Novo Nordisk were pharmaceutical companies with public net zero (reducing greenhouse gas emissions to zero or a residual level[11]) targets across their supply chains; Teva was a generic company that had science-based climate targets (aligned with the 1.5°C scenario, a global goal to limit warming to 1.5°C above pre-industrial levels[12]).

These companies offered a multinational perspective, with operations spanning diverse geographies. They are all publicly listed entities, with boards of directors, shareholders, and regulatory requirements, and have long-standing histories of scientific research and product development (Supplementary Table 1).

2.2. INTERVIEW SAMPLING AND NARRATIVE APPROACH

Narrative interviews were conducted with 21 representatives (Supplementary Table 2) drawn from the three participating companies (n=4; 2 current and 2 former employees), the wider pharmaceutical industry (n=6), health systems, (n=9; primarily the National Health Service – NHS, given its leading position in sustainability, but also other health systems, for example, the Netherlands and USA), and standards/ regulatory bodies (n=2). Participants were purposively sampled to capture diversity of (a) industry and health system roles (e.g., company sustainability leads, industry collaboratives, policymakers, regulators, health care providers, consultants, academics), (b) geographies (interviewees came from various geographies including the UK, USA, Denmark, Netherlands, France, Spain, South Africa, and India), and (c) perspectives on climate engagement. Interviewees were identified through desk research, company/organisation websites, documents, and snowball sampling[13], based on relevant climate and supply chain roles, approached via email, and consented to participate in a single interview. If there was no response to the initial invitation, a follow-up email was sent once. We approached representatives from other organisations that were not ultimately represented in the final interview set (e.g., Sustainable Healthcare Coalition, Asthma UK, International Federation of Pharmaceutical Manufacturers and Associations). Despite outreach, we were unsuccessful in securing interviews with patient representatives, as those contacted reported having limited awareness of the research area.

Interviews were conducted over seven months (April–November 2023), lasting between 41–116 minutes, with two conducted in person and the remainder online. A narrative approach was used, encouraging participants to share stories and experiences on pharmaceutical company climate engagement, unconstrained by the typical question-answer schema[14]. For example, interviewees were asked how pharmaceutical companies are engaging with their climate impact, with follow-up questions guided by their response and the overarching research aims. Interviews were digitally recorded and transcribed verbatim, with interviewees anonymised and assigned a descriptor (Supplementary Table 2).

2.3. Data analysis

We adapted Hajer's argumentative discourse analysis to identify key storylines around planetary health leadership within the context of pharmaceutical supply chains[15]. This form of discourse analysis serves as a conceptual tool for exploring discussion, meanings, debates, and tensions around complex issues, like climate change. Our analytical process involved iterative reading, writing, exploration of narrative, guided by the research focus, and peer-debriefing to enhance rigor and credibility of findings[16]. Quotations and data extracts are included under each of the storylines identified to provide direct insights into analysis. We employed reflexivity throughout data analysis, recognising our positions as researchers and health care professionals, and how this might influence our interpretation of findings.

2.4. Patient and public involvement

No patients involved.

2.5. Ethics Approval

Ethics approval was obtained from the University of Oxford's Central Research Ethics Committee (R84575/RE001).

3. Results

Pharmaceutical supply chains – spanning companies, suppliers, health providers, regulators, investors – are facing pressure to address their climate impact. These pressures, reputational (e.g., public scrutiny), economic (e.g., incorporation of climate criteria such as carbon reduction plans into NHS pharmaceutical procurement policy, influencing market access), and regulatory (e.g., mandatory greenhouse gas emission reporting under the European Union's Corporate Sustainability Reporting Directive), reflect the urgency for climate action, but also the necessity for pharmaceutical supply chains to decarbonise or risk being edged out of increasingly climate-conscious markets.

Climate action is already underway along pharmaceutical supply chains. The below extract reflects actions that *"proactive"* pharmaceutical companies engage in:

> "More mature [companies] have made a science-based target initiative declaration, they have a team bigger than two, they are able to distinguish between organisational level sustainability and product sustainability, they are talking about things other than carbon…they haven't waited for somebody to tell them to do it, they are not reacting, they are proactive, and they are proactive because they are looking at the science…they are well-resourced…they have lots of opportunity to experiment."
>
> (Sustainability Director, Industry Collaboration)

Pharmaceutical companies that are considered *"ahead of the game"* set science-based climate targets, invest in dedicated sustainability teams, integrate sustainability across organisational and product levels, and their evidence-backed strategies extend beyond emissions reduction, addressing biodiversity, waste, and broader planetary health concerns. However, such efforts remain sporadic and insufficient to achieve climate goals across pharmaceutical supply chains: "*They are not at the scale that's required for the transformation we need"* (Sustainability Expert, Health System).

Our findings surfaced two storylines about critical constraints that hinder climate action across pharmaceutical supply chains: (i) structural constraints, from fragmented global supply chains and restrictive energy infrastructure, and (ii) conceptual constraints, from the prioritisation of patient wellbeing and financial considerations over planetary health. We present findings on these constraints, along with insights from interviews on how planetary health leadership might drive the transformation necessary to mitigate pharmaceutical supply chains climate impact.

3.1.1. SUPPLY CHAIN AND INFRASTRUCTURE CONSTRAINTS

Pharmaceutical supply chains involve thousands of suppliers and customers across multiple geographies. Pharmaceutical supply chain decarbonisation is dependent on action by multiple suppliers, as well as availability of renewable energy infrastructure in countries where supply chains operate. These present structural constraints to climate action across pharmaceutical supply chains.

All three companies in our study, GSK, Novo Nordisk, and Teva, reported over 90% of their greenhouse gas emissions from supply chain activities such as raw material extraction, outsourced production, third-party distribution, as well as pharmaceutical use by health system customers. While reducing supply chain emissions is essential for climate targets, interviewees acknowledged that supply chain complexity, lack of data transparency, and limited influence to drive supplier climate action constrains emission reduction. One interviewee described this challenge:

> "When you look at the complex supply chain, for instance, manufacturing of APIs in China, which are then sent to India where they are produced as generics or for a large pharmaceutical company, packaged and shipped-- there are multiple processes, countries, companies and scopes there, many based on raw material extraction and fossil fuel combustion. It is a huge challenge to even understand the carbon footprint; it's just so complex that very few people really know what it looks like."
>
> (Sustainability Director, Non-Profit Health Organisation)

All interviewees described pharmaceutical supply chains as *"complex*", *"opaque",* and at "*arm's length*", with little direct control over suppliers' activities. Accessing data across supply chains was seen to be challenging, particularly in countries with limited regulatory oversight (e.g., China, India). Many suppliers were noted to lack the expertise or incentive to report climate data. Additionally, pharmaceutical companies were often reliant on a small group of specialised suppliers and had limited power to influence them to decarbonise. One interviewee explained: "*If an individual company asked suppliers to reduce their emissions, they'd likely be ignored by the majority or worst still, told to 'take a high jump' by some"* (Executive, Climate Consultancy).

Pharmaceutical supply chains operate across multiple countries, relying on countries' decarbonisation efforts to advance their own climate action. Renewable energy, for example, is central to climate mitigation, but many pharmaceutical operations occur in countries with limited renewable energy infrastructure. One interviewee explained:

> "A lot of those companies are in South Africa. They are in India. They are in parts of the world that are maybe a little slower to decarbonise their own power generation sector and some of the raw inputs that go into those companies. And so, you mainly get a situation where you have a company that is actually trying to do everything it can. The problem is that it has its factory in India and then it's just a heck of a lot of coal they use still."
>
> (Executive Strategist, Health System)

Geopolitical disruptions (e.g., war, energy crises), and limited electric vehicle infrastructure in some regions further limited climate efforts.

3.1.2. Mobilising collective climate action

Recognising the complexity of global pharmaceutical supply chains and the dependency of decarbonisation on actions by wider systems (e.g., governments), interviewees saw collective climate action across supply chains, and planetary health leadership to mobilise this, as essential to navigating these challenges:

> "There is a high degree of recognition that, actually, some of these substantial issues, particularly around climate, but also others, that they can't all be solved in isolation…it needs collective systemic action."
>
> (Senior Lead, Pharmaceutical Collaboration)

Current efforts to drive collective climate action across pharmaceutical supply chains are provided in Table 1. These include partnerships between pharmaceutical companies (e.g., Pharmaceutical Environmental Group), collaborations with health systems (e.g., Sustainable Markets Initiative Health Systems Task Force), cross-industry collaborations (e.g., ENERGIZE), and supranational collaborations (e.g., World Health Organization Alliance for Transformative Action on Climate and Health). While such efforts appear promising, our analysis surfaced challenges related to transparency, competitive concerns, and communication. One pharmaceutical interviewee noted that agreeing on a single topic *"took us half a year"* due to differing stakeholder perspectives (Sustainability Executive, Pharmaceutical Company). Mistrust between pharmaceutical companies and health systems further constrained action. For example, joint efforts to develop carbon footprint standards were seen by some as an attempt by pharmaceutical companies to be "*masters of their own fate"* and control data disclosure rather than drive transparency (Sustainability Director, Health System).

ENERGIZE Programme[17]: A collaboration between pharmaceutical companies and Schneider Electric to advance supplier access to renewable energy.

Pharmaceutical Environmental Group[18]: A group of sustainability leads from multinational pharmaceutical companies focused on environmental sustainability. https://peghub.org/about **Sustainable Markets Initiative Health Systems Taskforce**[19]: A collaboration between pharmaceutical companies and health systems to decarbonise health care. https://www.sustainable-markets.org/taskforces/health-systems-taskforce/ **WHO Alliance for Transformative Action on Climate and Health (ATACH)[20]:** A global initiative supporting health systems, including pharmaceutical supply chains, in achieving climate resilience and net zero emissions. https://www.who.int/initiatives/alliance-for-transformative-action-on-climate-and-health/

Table 1: Current climate collaborations across pharmaceutical supply chains

Interviewees drew attention to the urgent need for planetary health leadership – within and beyond companies – to transform these collaborations into genuine spaces for collective climate action. One pharmaceutical interviewee noted: *"If you want to go fast, go alone; if you want to go far, go together"* (Sustainability Executive, Pharmaceutical Company). One health system interviewee who worked with pharmaceutical company leadership teams in some collaborations noted the need for a cultural shift, moving beyond the blame game to recognise climate change as a *"shared problem"* (Sustainability Expert, Health System). Pharmaceutical interviewees emphasised that collaborations worked best when planetary health was embedded within senior leadership strategy. One pharmaceutical interviewee remarked, "*If a CEO [Chief Executive Officer] wants to do that and the senior leadership want to do that then it happens*" (Senior Sustainability Director, Pharmaceutical Company).

An example of a successful collaborative effort, flagged by one interviewee, was a partnership between NHS England and Novo Nordisk to develop a sustainable insulin cold chain (i.e., a temperature-controlled supply chain for medicines requiring cold storage and transport). Here, Novo Nordisk provided innovation and financing, while the NHS assured future purchases. The importance of overcoming public-private distrust through this partnership was stressed: *"Let's* *not just yell at each other... Let's talk seriously about how we are going to run a low-carbon cold chain and think about the innovation pathway to get there"* (Executive Strategist, Health System). Diverse actor participation across supply chains and the importance of collaborations driving concrete actions, such as efforts towards sustainable cold chains, were cited as crucial by both pharmaceutical and health system interviewees.

Individuals and organisations within pharmaceutical supply chains have power to drive collective climate action of wider systems, displaying planetary health leadership beyond supply chains. Recognising national infrastructure constraints, for example, some pharmaceutical companies were pressuring governments to expand renewable energy access across countries. One example was provided: "*This pharmaceutical company is pressuring the Indian government and saying, come on I would like this to be more renewable*" (Executive Strategist, Health System). This illustrated a ripple effect of climate action beyond pharmaceutical supply chains, influencing wider system change towards planetary health.

3.2.1. The patient-profit-planet dilemma

Pharmaceutical supply chains are expected to facilitate patient wellbeing (i.e., by delivering safe, effective medicines), meet financial expectations (e.g., maintaining company profit and minimising health care cost), and increasingly, ensure planetary health (e.g., by reducing climate impact). Interviewees all reported that climate action was frequently constrained as patient and profit were prioritised.

Patient wellbeing, and ensuring access to safe, effective pharmaceuticals, was a persistent priority emphasised across our interviews. Pharmaceutical representatives stressed that "*serving patients should always come first*" (Sustainability Executive, Pharmaceutical Company), health system interviewees emphasised their duty to fund and deliver high-quality medicines, while a medicines regulator echoed that ensuring safe, effective medicines is the "*top priority"* (Scientific Director, Regulatory Agency).

This commitment often clashed with climate efforts, with climate action framed as a trade-off against patient wellbeing. One interviewee stated: *"When it's positioned as a choice of health or the environment, it's always going to be a struggle"* (Director Pharmaceutical Portfolio, Climate Consultancy). Interviewees described the inherent challenges of reducing emissions from lifesaving but emission-intensive medicines. For example, metred-dose inhalers contain greenhouse gas propellants but are essential for many asthma patients. Procurers were reluctant to discontinue procurement of emission-intensive pharmaceuticals if it risked patient care: *"We are not going to remove the supply of medicines to patients who particularly need them"* (Sustainability Director, Health System). One prescriber reinforced this view, stating that patient wellbeing would always take precedence in prescribing over environmental considerations.

Beyond patient care, pharmaceutical supply chains face financial pressures. For example, companies need to ensure profit, as described: *"They have got shareholders to satisfy... It's a business-oriented model"* (Sustainability Expert, Health System). Additionally, health systems interviewees emphasised the need to prioritise supply of low-cost pharmaceuticals, while meeting financial pressures in other areas of health care delivery.

Financial considerations shaped climate action. For example, companies were seen to favour low-cost climate efforts (e.g., packaging optimisation) or those that "*pay back*" (i.e., offer financial return on investment) over potentially more impactful but expensive measures (e.g., product carbon footprints). Limited resources were cited to constrain some companies' climate action: "*Some [companies] have only got one person who does everything, which includes environment, health, and safety"* (Sustainability Director, Industry Collaboration). Through this lens, climate action was framed as a financial privilege, with companies leading in climate efforts described as *“well-resourced*” with *“lots of opportunity to experiment”* (Sustainability Director, Industry Collaboration).

The broader economic system in which pharmaceutical supply chains operate was regarded by some interviewees to conflict with climate action: *“At the moment, sickness pays… as long as the health sector is based on a financial mechanism that rewards having medicines or that rewards activity, we are never going to be able to actually get to net zero* (Sustainability Expert, Health System). This financial model was seen to benefit actors across supply chains. For example, one pharmacist noted that financial incentives encouraged excessive prescribing. In short, climate action was regarded as inexorably constrained by an economic model that favours pharmaceutical production and prescription, driving emissions.

3.2.2. RECONCEPTUALISING HEALTH CARE DELIVERY

Planetary health leadership can help move beyond the patient-profit-planet dilemma. Such leadership involves revisiting health care's *“fundamental purpose*” and confronting entrenched narratives around patient and profit (Sustainability Expert, Health System, May 2023). Leaders in this space were cited as willing to *“go against the status quo”,* “*be unpopular*”, “*speak truth to power”* (Scientific Director, Regulatory Agency), and act with “*integrity*” and “*vision*” (Senior Environmental Strategist, Pharmaceutical Company) to align patient, profit, and planetary health concerns across supply chains. Several interviewees argued that health systems have become too focused on illness and need to refocus on *“supporting good health*” (Sustainability Expert, Health System, May 2023) and keeping people “*well, happy, and healthy*” by investing in *“social infrastructure”* and addressing the *“wider determinants of health”* (Sustainability Director, Health System, June 2023). By keeping people healthy, demand for pharmaceuticals, and their associated emissions, can be reduced, offering climate co-benefits and saving health systems money. One interviewee summarised this: *"win for the patient outcomes, win for being a business, and win for the environment"* (Environmental Lead, Healthcare Insurance Company).

Some interviewees advocated for rethinking the centrality of pharmaceuticals in health care. For example, one health insurance interviewee suggested that low-carbon, non-pharmaceutical alternatives, like social prescribing or natural therapies[21], could offer climate and health co-benefits. Personalised medicine (tailoring treatment to an individual) was also suggested to reduce pharmaceutical emissions by ensuring more effective treatment[22]. Pharmaceutical companies were suggested to have a role in transforming health care, by leveraging their *"innovation and scientific capabilities"* to support good health (Senior Lead, Pharmaceutical Collaboration). Novo Nordisk's participation in Cities Changing Diabetes was cited as a leading example of how companies can contribute to preventative health care[23].

Aligning the financial model of pharmaceuticals with patient and planetary wellbeing was considered crucial. For example, one health system expert suggested financial incentives for companies that focus on supporting good health rather than treating disease. Embedding climate metrics alongside patient-focused (e.g., safety, efficacy) and financial ones (i.e., cost) in pharmaceutical procurement guidelines was another financial lever suggested for scaling climate action across pharmaceutical supply chains. Health system leadership that embeds planetary health concerns into decision-making was shown to lead to initiatives that align financial incentives with climate action. For example, a key reason for the shift from metered-dose inhalers to less-polluting dry-powder inhalers in the UK was that the NHS "*incentivised a shift in prescribing"* (Sustainability Expert, Health System). In these ways, preventive practices, as well as low-carbon pharmaceuticals might be prioritised through procurement or prescribing incentives, aligning patient, profit and planet.

4. Discussion

Pharmaceutical supply chains are deeply entangled in the planetary health crisis. Our research surfaced critical constraints to pharmaceutical supply chain decarbonisation: complex global supply chains, limited renewable energy infrastructure, and a tension between patient, profit, and planetary health. Effective planetary health leadership is needed by individuals and organisations across pharmaceutical supply chains; leadership that redefines health care delivery, aligning patient and planetary health, mobilises collective action across supply chains, and challenges the broader structures that constrain climate efforts.

The scale and fragmentation of global pharmaceutical supply chains presents structural constraints to decarbonisation. Challenges in accessing supplier emission data and influencing their climate action, as well as limited renewable energy infrastructure in geographies where supply chains operate, illustrate the dependency of decarbonisation on a complex network of individuals, organisations, and nations[24]. The perceived conflict between patient, profit, and planet presents a deeper conceptual constraint to climate action. This conceptualisation reinforces climate trade-offs as inevitable and acceptable to ensure patient wellbeing. It neglects the reality that patient and planetary health are inextricably linked, and that climate change is already affecting global health[25]. Underlying patient and planetary concerns are financial tensions (e.g., meeting patient needs within health system financial boundaries or ensuring profitability of companies) with climate action framed within what is considered financially feasible.

These constraints are significant, but not insurmountable. Effective planetary health leadership, by individuals and organisations across pharmaceutical supply chains, is urgently needed to navigate these challenges, and, in a landscape of evolving climate regulation and market expectations, is increasingly essential for maintaining competitiveness. We offer three suggestions for how such leadership can catalyse climate action across pharmaceutical supply chains.

Firstly, planetary health leadership can help reconceptualise health care delivery and the role of pharmaceuticals. This requires challenging the patient-planet dichotomy, recognising the interconnection of patient and planetary health, and moving towards a health care model that offers benefits to both[26, 27]. Leaders in this space (e.g., policymakers, health care providers) can reinforce preventive and non-pharmaceutical approaches, challenging pharmaceuticals as the default treatment option, procuring and using lower-carbon alternatives where possible, and incorporating non-pharmaceutical treatments into patient care[28]. This approach reduces pharmaceutical demand, and by extension, their emissions, aligning patient and planetary health. It is important to recognise that ongoing global pharmaceutical shortages pose challenges to low-carbon procurement practices. In crisis contexts, pharmaceutical availability may understandably be prioritised over climate impact. Nonetheless, sustainable supply chains can support long-term pharmaceutical resilience, aligning rather than conflicting with patient care.

Pharmaceutical companies might display leadership in this reconceptualisation, leveraging their resources and research capabilities to optimise health, or aligning product development and marketing with health promotion rather than driving reliance on pharmaceuticals. This reconceptualisation is challenged, however, by a system that is structurally oriented toward pharmaceutical solutions. The large market for semaglutides (e.g., Ozempic and Wegovy), described as 'miracle drug[s] for weight loss', provides an example of how entrenched health care practices and financial incentives drive pharmaceutical overconsumption at the expense of public health campaigns addressing the root cause of ill health[29].

Secondly, planetary health leadership can mobilise collective climate action. Leadership across pharmaceutical supply chains, within health systems and companies, is required to cultivate collaboration and overcome issues of transparency, competition, and blame that currently inhibit collective efforts. This is particularly important in light of previous climate initiatives that fell short due to insufficient engagement from all stakeholders, for example, GSK's inhaler recycling scheme, which was discontinued due to low return rates[30]. This highlights the need for broader participation from stakeholders such as health care providers and patients in collaborative efforts to enable and reinforce pharmaceutical supply chain actions. Acknowledging organisational constraints to climate action (e.g., financial resources, human expertise) collective efforts might also involve supporting stakeholders who lack capacity for climate action. Initiatives such as the ENERGIZE programme, which assists suppliers in procuring renewable energy, present early examples of how this could be achieved at scale.

Thirdly, planetary health leadership can play a role in challenging wider systems that constrain climate action. Pharmaceutical supply chains wield substantial economic and political influence. This influence should be leveraged by leaders in this space to drive broader systemic changes considered crucial for global decarbonisation, including regulatory reforms, shifts in financial incentives, and renewable energy infrastructure[31]. Health care providers, for example, hold a unique position of credibility and influence; leveraging this influence to push for broader systemic change embodies planetary health leadership. Pharmaceutical companies might also use their lobbying power to advocate for policies that align patient and planetary health. Planetary health leadership might challenge the wider economic model of pharmaceuticals, advocating for a shift from financial incentives driving pharmaceutical consumption toward systems promoting health, aligning with a reconceptualised health care model[32].

We acknowledge several limitations inherent to this qualitative study. Our sample comprised pharmaceutical companies that publicly reported climate action which may have skewed findings towards more favourable examples of leadership. This sampling approach was purposive, however, as our aim was to derive insights on how planetary health leadership can drive climate action across pharmaceutical supply chains. Our findings also reflect a geographical bias towards UK, USA, and European perspectives, largely due to the concentration of multinational pharmaceutical company headquarters and health system sustainability initiatives in these regions. We relied on interviewees perspectives which is subject to reporting bias, particularly among pharmaceutical company representatives who may have vested interest in portraying their company's actions positively. We sought to mitigate this by interviewing a range of stakeholders, including both past and current pharmaceutical company employees. Finally, our study focused specifically on planetary health leadership in the context of climate change. We acknowledge that pharmaceutical supply chains also generate other environmental impacts, such as waste, and that initiatives to address these, like Novo Nordisk's insulin pen recycling scheme, are underway and can serve as models for other stakeholders. Given the interconnected nature of environmental crises, it is important for planetary health leadership to consider both the co-benefits (e.g., reduced emissions and waste through packaging optimisation) and trade-offs (e.g., increased electronic waste from digital solutions aimed at optimising supply chain logistics) associated with broader environmental actions. While our aim was not to provide a comprehensive overview of all environmental initiatives, but rather to explore the constraints to climate action and the role of leadership in overcoming them, we believe the insights offered are likely transferable to other environmental challenges facing pharmaceutical supply chains.

5. Conclusion

This work offers a lens into what it means to lead for the planet. Planetary health leadership is both a concept, and something that needs to be enacted by individuals and organisations across health systems, supply chains, and wider society. Planetary health leadership is a way of redefining health care delivery, emphasising patient and planetary interconnections. It involves galvanising collective action, challenging entrenched structures and norms, going against the status quo, and speaking truth to power. Much research and work remain to be done to envisage and materialise sustainable health systems that truly balance patient and planetary health. We conclude by echoing the sentiment from the series editors: if we are not leading for planetary health, what on Earth are we leading for?

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