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Shifting the discourse on multinational pharmaceutical companies' climate action to support net zero progress: an adapted argumentative discourse analysis

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This thesis is submitted, November 2025, to the Nuffield Department of Primary Care Health Sciences, University of Oxford, in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Translational Health Science

Declaration of originality

I, Amy Booth, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Acknowledgements

Embarking on this research has been one of the most rewarding experiences of my life. It is a rare privilege to have the time, space, and support to question, reflect, and ponder – and then to gain the skills, knowledge, and tools to offer insights into a topic that matters. To that end, I am deeply grateful to those who made this journey possible.

To my primary supervisor: Professor Sara Shaw, thank you for taking a chance on an inexperienced South African doctor with a broad interest in making health care more sustainable. Your guidance has shaped me as a researcher, helped me learn to probe deeper, unpack findings, think critically, and apply theory. You have given me the space to explore, network, and partake in ancillary work that has made my DPhil journey so fulfilling. It has been an honour to have engaged with you in wider research, teaching, module development, and book authorship, that I truly believe has had tangible impacts in driving more sustainable health care. I hold the utmost respect for your incredible capacity as a researcher, but also for who you are as a person.

To my co-supervisors: Professor Liz Breen, thank you for ensuring that my research always aimed to move beyond academic theorising to offer contributions to policy and practice – your support, insight, and networks in this space have been invaluable; and Dr Sietse Wieringa, thank you for sharpening my critical thinking and argumentation, and for supporting me to move beyond my clinical training to engage deeply with critical analysis.

Doctoral research can often be isolating, but I have never felt alone thanks to the support of a wider academic and social community. In particular, I am grateful for the supportive intellectual environment, as well as the space to think and write that Green Templeton College (GTC) offered me – from the library to college lunches to the beautiful gardens and invaluable croquet set. I am especially thankful to GTC Fellow, Dr Chris Winchester, whose thoughtful conversations helped

shape the direction of my research; to my College Advisor, Dr SanYuMay Tun, for her support, guidance, and generous sharing of contacts in this field; to Senior Academic Tutor, Dr Alison Stenton, who was there for me in times of need; and to all the college staff, from the lodge to the kitchen, whose warm smiles and kind words of encouragement made a real difference throughout this journey.

I am indebted to my family: my parents, Dawn and John; my brother, Ross; my aunts, uncle, and cousins, Jean, Hazel, Egidijus, Eric, and Egle; and my grandmother and late grandparents, who instilled in me a love and respect for our Earth and its precious life and who always encouraged me to pursue work with purpose. My friends have been a vital part of this journey, and I cannot express enough gratitude for the deeply intellectual conversations we have had, and – just as importantly – the moments that took me away from thinking about my thesis. I am especially thankful to Amelia, Will, Joe, and Daniela for reading drafts of my thesis and making sure I 'dotted the i's and crossed the t's'.

This work would not have been possible without financial support. I am immensely grateful to the Rhodes Trust for the life-changing opportunity they have provided me – both financially and otherwise; and to Green Templeton College, the Goodger Schorstein Bursary, and the Medical Sciences Division for supporting me financially in my final year.

Finally, my thanks go to all the interviewees who generously shared their time and insights. This research would not have been possible without their contributions.

It is impossible to name everyone who has supported me over this wildly fulfilling four-year journey. So, to all who have helped in ways big and small – thank you.

Table of Contents

DECLARATION OF ORIGINALITY 2

ACKNOWLEDGEMENTS 3

ABBREVIATIONS 11

GLOSSARY OF TERMS 13

LIST OF FIGURES 21

LIST OF TABLES 22

LIST OF BOXES 23

ABSTRACT 24

CHAPTER 1: INTRODUCTION 26

1.1. INTRODUCTION 26

1.2. MY STORY 27

1.3. THE ANTHROPOCENE 28

1.3.1. Unpacking climate terminology 29

1.3.2. Unpacking anthropogenic climate change 32

1.4. RESEARCH FOCUS 35

1.5. THESIS OUTLINE 36

1.6. CHAPTER SUMMARY 41

CHAPTER 2: THE PHARMACEUTICAL INDUSTRY AND CLIMATE CHANGE 42

2.1. INTRODUCTION 42

2.2. OVERVIEW OF THE PHARMACEUTICAL INDUSTRY 43

2.2.1. The rise of Big Pharma 44

2.2.2. The emergence of generic pharmaceuticals 47

2.2.3. The pharmaceutical industry and corporate responsibility 49

2.3. THE PHARMACEUTICAL INDUSTRY AND CLIMATE CHANGE 50

2.3.1. The climate impact of pharmaceuticals 50

2.3.2. Reducing the climate impact of pharmaceuticals 53

2.4. GAPS, AIMS, AND RESEARCH QUESTIONS 56

2.5. CHAPTER SUMMARY 58

CHAPTER 3: PHARMACEUTICAL COMPANY CLIMATE ACTION: CONTENT ANALYSIS OF PUBLIC REPORTS FROM 20 PHARMACEUTICAL COMPANIES 60

3.1. INTRODUCTION 60

3.2. METHODS 61

3.2.1. Sampling 61

3.2.2. Data collection 62

3.2.3. Data analysis and synthesis 63

3.3. FINDINGS 64

3.3.1. Overview of included pharmaceutical companies 64

3.3.2. Location of climate data 65

3.3.3. Reported climate targets 65

3.3.4. Progress on targets: Scope 1, 2, and 3 emissions and reported change from baseline 66

3.3.5. Emissions reduction strategies 68

3.4. CHAPTER SUMMARY 73

CHAPTER 4: METHODOLOGY AND METHODS 75

4.1. INTRODUCTION 75

4.2. RESEARCH APPROACH 76

4.2.1. Argumentative discourse analysis 77

4.2.2. Impression management 79

4.3. METHODS 81

4.3.1. Desk research and helicopter interviews 83

4.3.2. Selection of pharmaceutical companies 85

4.3.3. Document sampling and collection 88
4.3.3.1. Document sampling 88
4.3.3.2. Data collection 91

4.3.4. Interview sampling and narrative approach 91
4.3.4.1. Interview sampling 92
4.3.4.2. Interview approach 96

4.3.5. Data analysis and interpretation 97

4.3.6. Reflexivity 104

4.4. ETHICAL CONSIDERATIONS 107

4.5. A NOTE ON GEOGRAPHY 108

4.6. CHAPTER SUMMARY 109

CHAPTER 5: CLIMATE ACTION CONFLICTS WITH PATIENT WELLBEING 110

5.1. INTRODUCTION 110

5.2. INSTITUTIONALISED BIOMEDICAL DISCOURSE ON PATIENT WELLBEING 111

5.3. CLIMATE ACTION CONFLICTS WITH PATIENT WELLBEING 113

5.4. CLIMATE ACTION IS INTEGRAL TO PATIENT WELLBEING 118

5.5. CHAPTER SUMMARY 124

CHAPTER 6: CLIMATE ACTION IS CONTINGENT ON FINANCIAL VIABILITY 127

6.1. INTRODUCTION 127

6.2. CLIMATE ACTION IS CONTINGENT ON FINANCIAL VIABILITY 129

6.3. INSTITUTIONALISED ECONOMIC DISCOURSE SHAPING CLIMATE ACTION ACROSS DOMAINS OF COMPANY PRACTICE 131

6.3.1. Regulatory compliance 131

6.3.2. Reputation management 134

6.3.3. Market positioning 136

6.3.4. Operational resilience 139

6.4. CLIMATE ACTION IS CONTINGENT ON MAXIMISING PROFIT 141

6.5. MOBILISING ECONOMIC DISCOURSE IN SUPPORT OF CLIMATE ACTION 146

6.5.1. Reforming and standardising regulation 147

6.5.2. Leveraging financial mechanisms 149

6.6. CHAPTER SUMMARY 152

CHAPTER 7: CLIMATE ACTION AS EMISSIONS QUANTIFICATION AND DISCLOSURE.. 154

7.1. INTRODUCTION 154

7.2. CLIMATE ACTION AS EMISSIONS QUANTIFICATION AND DISCLOSURE 155

7.2.1. Company-level emissions quantification and disclosure 156

7.2.2. Product-level emissions quantification and disclosure 164

7.2.3. Patient care pathway emissions quantification and disclosure 169

7.3. EMISSIONS QUANTIFICATION AND DISCLOSURE AS CLIMATE INACTION 172

7.4. CHAPTER SUMMARY 176

CHAPTER 8: CLIMATE ACTION REQUIRES MORE COLLABORATION 178

8.1. INTRODUCTION 178

8.2. CLIMATE ACTION REQUIRES MORE COLLABORATION 179

8.2.1. More collaboration is required to drive innovation 180

8.2.2. More collaboration is required to enable company decarbonisation 184
8.2.2.1. Efforts to decarbonise operational emissions 185
8.2.2.2. Efforts to decarbonise supply chain emissions 188

8.3. CLIMATE-RELATED PHARMACEUTICAL COLLABORATIONS 192

8.3.1. Intra-industry collaborations 194

8.3.2. Cross-sector collaborations 196

8.4. CHAPTER SUMMARY 200

CHAPTER 9: DISCUSSION 202

9.1. INTRODUCTION 202

9.2. SUMMARY OF RESEARCH FINDINGS 202

9.2.1. Pharmaceutical company climate action 203

9.2.2. Dominant discourses shaping and constraining climate action 206

9.2.3. Alternative discourses that can support net zero progress 216

9.3. RESEARCH CONTRIBUTIONS 223

9.3.1. Contributions to academic literature 223

9.3.2. Contributions to pharmaceutical company leadership to support climate action 226

9.3.3. Theoretical and methodological contributions 231

9.4. STRENGTHS AND LIMITATIONS OF RESEARCH APPROACH 232

9.5. CHAPTER SUMMARY 236

CHAPTER 10: CONCLUSIONS AND RECOMMENDATIONS 238

10.1. CONCLUSIONS 238

10.2. RECOMMENDATIONS 244

10.2.1. Key recommendations for pharmaceutical companies 251

10.2.2. Key recommendations for health care policymakers and regulators 253

10.2.3. Key recommendations for health care providers 255

10.3. FINAL THOUGHTS **257**

REFERENCES **259**

APPENDICES **274**

ETHICS DOCUMENTS **274**

Informed consent form **274**

Interview information sheet **276**

SAMPLE INTERVIEW AND DOCUMENTARY EXTRACTS **281**

APPENDIX FIGURE AND TABLE **286**

ACADEMIC OUTPUT DURING DPHIL **292**

Publications **292**

Conference presentations **293**

Teaching **294**

Abbreviations

API – Active Pharmaceutical Ingredient

ATACH – Alliance for Transformative Action on Climate and Health

BEIS – Department for Business, Energy and Industrial Strategy

CDP – Carbon Disclosure Project

CEO – Chief Executive Officer

COVID-19 – Coronavirus Disease 2019

CSR – Corporate Social Responsibility

CSRD – Corporate Sustainability Reporting Directive

DEFRA – Department for Environment, Food and Rural Affairs

EEIO – Environmentally Extended Input-Output

EMA – European Medicines Agency

EPA – Environmental Protection Agency

ESG – Environmental, Social, and Governance

EU – European Union

FDA – Food and Drug Administration

GHG – Greenhouse Gas

GRI – Global Reporting Initiative

HIV – Human Immunodeficiency Virus

IEA – International Energy Agency

IPCC – Intergovernmental Panel on Climate Change

LED – Light Emitting Diode

MHRA – Medicines and Healthcare products Regulatory Agency

NHS – National Health Service

NHSE – National Health Service England

NGO – Non-Governmental Organisation

NPI – Non-pharmaceutical Intervention

OECD – Organisation for Economic Co-operation and Development

SASB – Sustainability Accounting Standards Board

SBTi – Science Based Targets initiative

SME – Small and Medium-sized Enterprise

SMI – Sustainable Markets Initiative

TCFD – Task Force on Climate-related Financial Disclosures

TRIPS – Trade-Related Aspects of Intellectual Property Rights

UAE – United Arab Emirates

UK – United Kingdom

USA – United States of America

USD – United States Dollar ($)

WHO – World Health Organisation

Glossary of terms[1]

Active Pharmaceutical Ingredient (API): The biologically active component of a pharmaceutical product.

Anthropocene: A proposed geological epoch highlighting the significant global impact of human activity on Earth's systems.

Anthropogenic climate change: The mean rise in global temperatures attributable to human activities that release greenhouse gas emissions.

Argumentative Discourse Analysis: A methodological approach developed by Maarten Hajer to analyse the discursive production of meaning, the actors who construct these meanings, and the practices through which these meanings are produced, reproduced, or transformed.

Big Pharma: An economically and politically influential group of multinational pharmaceutical companies that engage in drug discovery to produce branded, patented pharmaceuticals.

Biomedical discourse: A discourse reflecting a health care framework prioritising immediate, individualised patient care, focusing on illness and treatment, typically through pharmaceuticals.

Branded pharmaceuticals: Medications marketed under proprietary brand names, typically protected by patents.

Capitalism: An economic system based on private ownership of the means of production, rooted in principles of growth and profit creation.

Carbon footprint: A measure of the total greenhouse gas emissions produced by an entity, expressed in carbon dioxide equivalents (CO_2e).

[1] References for terms are included in the text.

Carbon neutral: A state where anthropogenic carbon dioxide (CO_2) emissions are balanced globally by anthropogenic CO_2 removals over a specified period.

Carbon offsetting: Investments in projects (e.g., reforestation) that reduce or absorb emissions elsewhere, helping entities to compensate for residual emissions they are unable to eliminate.

Climate action: Any activity individuals or organisations engage in to substantively reduce greenhouse gas emissions.

Climate impact: The contribution of individuals or organisations to climate change through release of greenhouse gas emissions.

Climate mitigation: Efforts to reduce or prevent greenhouse gas emissions.

Climate positive: A state in which human activities result in net beneficial effects on the climate system.

Climate reporting: A range of climate-related information that organisations report publicly, including but not limited to quantified greenhouse gas emissions, climate targets, and climate strategy.

Climate strategy or net zero strategy: An organisation's plan to reduce greenhouse gas emissions and reach net zero.

Climate target: A temperature limit, concentration level, or emissions reduction goal aimed at avoiding anthropogenic interference with the climate system.

Cold chain: Temperature-controlled supply chain system for storing and transporting heat-sensitive pharmaceuticals like vaccines.

Corporate Social Responsibility (CSR): Business model where companies commit to socially and environmentally responsible practices beyond profit-making.

Corporate Sustainability Reporting Directive (CSRD): Regulatory framework mandating large European Union (EU) companies to report standardised environmental, social, and governance information.

Counter-storylines: Condensed statement summarising narratives that challenge dominant storylines by offering alternative framings or critiques.

Decarbonisation: Systematic reduction of carbon dioxide and other greenhouse gas emissions.

Deprescribing: Clinical process of discontinuing medications that may no longer be beneficial or could be harmful, especially in polypharmacy contexts.

Discourse: An ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena; produced and reproduced through an identifiable set of practices.

Discourse-coalitions: Groups of actors who share the use and meaning of particular storylines and participate in the practices through which these storylines are produced.

Discourse institutionalisation: The solidification of a discourse into organisational and institutional arrangements and practices, making it a dominant lens through which phenomena are conceptualised and acted upon.

Discourse structuration: When a particular discourse begins to shape how a social group (e.g., an organisation) conceptualises a phenomenon.

Discursive affinity: A discursive mechanism where arguments with distinct discursive origins converge in similar ways of conceptualising an issue, allowing for alignment across diverse perspectives.

Discursive conditionality: A discursive mechanism where actors discuss and make sense of a phenomenon in ways that systematically place preconditions on action.

Dramaturgical theory: A sociological theory developed by Erving Goffman that uses the metaphor of theatre to explain social interaction. Dramaturgical theory views individuals and organisations as 'actors' performing in social 'settings' and managing the impressions they create through selective presentation of self.

Economic discourse: A discourse rooted in capitalist principles, focusing on financial viability, risk, opportunity, growth, and profit.

Emissions disclosure: The public reporting and communication of quantified greenhouse gas emissions by organisations.

Emission factors: Coefficients for converting activity data into emissions; available from various databases of emission factors including UK Department for Environment, Food and Rural Affairs.

Environmental, social, and governance (ESG): Framework evaluating company performance and risk across non-financial environmental, social, and governance dimensions.

EU Taxonomy: Classification system defining environmentally sustainable economic activities under the EU Green Deal.

Generic pharmaceutical industry: Sector of the pharmaceutical industry producing off-patent medications chemically equivalent to branded drugs, often at lower cost.

Globalisation: The intensification of worldwide social, economic, and political interconnectedness.

Global Reporting Initiative (GRI): Voluntary international sustainability reporting framework.

Greenhouse gas emissions: Natural and anthropogenic gases (e.g., carbon dioxide, nitrous oxide, methane) present in the atmosphere that absorb and emit radiation, causing heat to be trapped within the surface troposphere.

Greenhushing: The deliberate underreporting or withholding of legitimate environmental achievements to avoid scrutiny, scepticism, or accusations of greenwashing.

Greenwashing: A form of organisational impression management where companies selectively disclose positive environmental actions while suppressing negative impacts.

Health system financial models: The various approaches and structures through which health systems are financed. These models determine how resources are allocated and services paid for. Common models include tax-funded systems, social health insurance, private insurance, and out-of-pocket payment systems.

Impression management: The process by which individuals or organisations strategically control the presentation of information to construct a desired impression.

Industrialism: The social and economic organisation of production through coordinated labour and machinery, associated with rapid fossil fuel use and environmental degradation, especially since the Industrial Revolution.

Industrial Revolution: The period (late 18th to 19th century) marked by mechanisation of production, increased fossil fuel use, and the beginning of large-scale greenhouse gas emissions.

Institutional context: The formal and informal rules, norms, values, and systems that influence how organisations are structured and function.

Kyoto Protocol: A 1997 international treaty setting binding greenhouse gas reduction targets for industrialised countries.

Low-carbon prescribing: Incorporating climate considerations into pharmaceutical prescribing and deliberately prescribing pharmaceuticals with lower climate impact.

Market positioning: The way in which a company constructs and communicates the value of its products or services relative to competitors.

Network governance discourse: A discourse that frames action, especially to manage complex issues, as inherently interdependent and requiring coordination across formal and informal networks of diverse actors operating across different sectors and levels of governance.

Net zero emissions: A state where anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.

Net zero progress: Quantified evidence of emissions reduction and progress towards net zero.

Non-pharmaceutical interventions (NPIs): Strategies to prevent or manage illness without pharmaceuticals.

Normative discourse: A discourse grounded in ethical, moral, or value-based expectations about how actors should behave.

Operational resilience: The capacity of a company to anticipate, withstand, and adapt to disruptions ensuring the continuity and stability of its business operations.

Paris Agreement: An international treaty adopted in 2015 aiming to limit global warming to well below 2°C, preferably to below 1.5°C.

Patient care pathway: Standardised, evidence-based sequences of clinical interventions for specific conditions, designed to improve consistency and outcomes.

Performance (Goffman): In dramaturgical theory, structured acts through which individuals or organisations create desired impressions.

Pharmaceutical markets: The economic and regulatory environments in which pharmaceutical companies develop, produce, market, and sell medicines.

Planetary health discourse: A discourse that highlights the interconnectedness of human health and the health of the planet.

Post-technocratic discourse: A discourse that challenges the primacy of technocratic approaches, arguing that reliance on quantification and data can distract from substantive action, and advocating for outcomes over data.

Practices: Embedded routines and mutually understood rules and norms.

Regulatory compliance: The process by which companies ensure adherence to laws, regulations, and guidelines that govern their operations.

Reputation management: The practices through which companies shape and sustain their public image to build trust, legitimacy, and credibility with stakeholders, such as investors, customers, regulators, and the public.

SBTi corporate net zero target: A target set by the Science Based Targets initiative requiring companies to (a) reduce Scope 1, 2, and 3 emissions to zero or a residual level consistent with net zero emissions in eligible 1.5°C scenarios or sector pathways, and (b) neutralise any residual emissions at the net zero target date, including any greenhouse gases emitted thereafter.

Scopes (Greenhouse Gas Protocol): A classification system for reporting emissions: Scope 1, direct emissions from owned or controlled sources; Scope 2, indirect emissions from purchased energy; Scope 3, all other indirect emissions across the value chain, such as purchased goods and services, transportation, and waste management.

Social prescribing: Referrals to non-clinical services, often addressing social determinants of health.

Societal institutions: The informal and formal rules, norms, values, and systems that influence how society is structured and functions.

Storylines: Condensed statements summarising complex narrative.

Subjective I: A concept developed by Alan Peshkin referring to the personal qualities, perspectives, and emotions that a researcher brings to the research process.

Sustainability Accounting Standards Board (SASB): Voluntary industry-specific ESG disclosure standards focused on financial materiality for investors.

Task Force on Climate-related Financial Disclosures (TCFD): Voluntary framework guiding companies to disclose climate-related financial risks and strategies.

Technocratic discourse: A discourse that frames an issue primarily as a technical problem, solvable through measurement, data, and standardised procedures.

Technological fixes: Solutions relying solely on technology rather than addressing structural causes.

Techno-optimist discourse: A discourse rooted in faith in innovation and technological solutions as the primary means to address a problem.

List of figures

Figure 1. Simplified pharmaceutical supply chain **43**

Figure 2. Percentage change over reporting period in company Scope 1, 2, and 3 emissions **67**

Figure 3. 2022 Greenhouse gas emissions for included pharmaceutical companies according to GHG Protocol categories **158**

Figure 4: Contributions to pharmaceutical company leadership to support climate action **227**

Appendix Figure 1. Percentage of pharmaceutical company emissions covered by a climate target and progress on reaching the climate target as of 2022 **286**

List of tables

Table 1. Greenhouse Gas (GHG) Protocol scopes and categories **30**

Table 2. Overview of the 20 pharmaceutical companies included in the content analysis study **64**

Table 3. Emissions reduction strategies reported by all 20 pharmaceutical companies to reduce Scope 1, 2, and 3 greenhouse gas emissions **69**

Table 4. Overview of selected pharmaceutical companies **87**

Table 5. Texts sampled for document analysis **90**

Table 6. Overview of interviewees **95**

Table 7. Pharmaceutical companies' reported greenhouse gas emissions in tonnes carbon dioxide equivalents (CO_2e) in 2022 **157**

Table 8. Reporting frameworks, emission categories, data sources, and emission factors for pharmaceutical companies' reported greenhouse gas emissions in 2022 **162**

Table 9. Examples of pharmaceutical company climate-related collaborations **193**

Table 10. Dominant discourses and discursive conditionality shaping and constraining pharmaceutical company climate action **207**

Table 11. Counter-storylines and alternative discourses that challenge dominant discourses constraining pharmaceutical company climate action **217**

Table 12. Linking storylines, counter-storylines, and underlying discourses to recommendations across actor groups **246**

Appendix Table 1. Reported emissions reduction strategies of GSK, Novo Nordisk, and Teva for 2022 **287**

List of boxes

Box 1. Overview of research methods **82**

Box 2. Worked example illustrating the analytical process from data to interpretation for the storyline ‘climate action conflicts with patient wellbeing’ **101**

Abstract

Background: Up to 55% of health system greenhouse gas emissions are estimated to come from pharmaceuticals, contributing to climate change. There is limited understanding of how pharmaceutical companies mitigate their climate impact. My research explored how multinational pharmaceutical companies approached climate action and what might support net zero progress.

Methods: Guided by Maarten Hajer's argumentative discourse analysis, I analysed data from purposively sampled (a) company documents from three selected multinational pharmaceutical companies, and (b) narrative interviews with twenty-one representatives from these companies, industry groups, and health systems. Argumentative discourse analysis studies the discursive production of meaning about phenomena and the practices through which discourses are produced, reproduced, or transformed. Key analytical concepts include (a) *storylines*, condensed statements underpinned by various *discourses*, the ensemble of ideas and concepts through which meaning is ascribed to phenomena; (b) *counter-storylines*, condensed statements that challenge storylines; (c) *discourse-coalitions*, actors sharing storylines; and (d) *discourse institutionalisation*, the solidification of discourse into institutional practices. I extended my analysis with concepts from impression management theory, which sensitised me to the performativity of pharmaceutical company climate action.

Findings: I identified four storylines and counter-storylines, underpinned by distinct discourses. (a) *Climate action conflicts with patient wellbeing,* underpinned by a biomedical discourse prioritising patient care typically via pharmaceuticals, through which pharmaceutical climate impact and inaction was legitimised. A counter-storyline, reflecting planetary health discourse, framed climate action as integral to patient wellbeing. (b) *Climate action is contingent on financial viability,* advanced by pharmaceutical actors drawing on economic discourse to frame

climate action through financial terms. Health system actors challenged this through a counter-storyline, using normative discourse to advocate for climate action regardless of financial viability. (c) *Climate action as emissions quantification and disclosure,* underpinned by technocratic discourse through which emissions data was framed as vital for compliance and to inform climate action. A counter-storyline, grounded in post-technocratic discourse, critiqued over-reliance on data, urging focus on emissions reduction. (d) *Climate action requires more collaboration,* drawing on techno-optimist and network governance discourses, climate action was framed as solvable through collective innovation and shared responsibility. Calls for collaboration often remained vague or served to displace responsibility.

Conclusion: Dominant discourses, institutionalised in practice, collectively framed pharmaceutical company climate action as conditional on ensuring patient wellbeing, financial viability, access to emissions data, or increased collaboration, thereby delaying and constraining net zero progress. Acceptance, reproduction, and institutionalisation of counter-storylines and alternative discourses by key actors offers potential to support net zero progress, by reframing climate action as interconnected with patient wellbeing, decoupling it from profit, shifting emphasis from quantifying emissions to reducing them, and facilitating productive collaboration.

Chapter 1: Introduction

1.1. Introduction

Humanity stands on the brink of a climate emergency [1]. Decades of consuming fossil fuels and releasing greenhouse gas emissions into the atmosphere have come to take its toll on our climate, our planet, and on us. Mitigating climate change requires action from actors across society[2]. My research is about how multinational pharmaceutical companies are approaching climate action and what can support pharmaceutical companies to reach a point where the way they operate does not contribute to further, and irreversible, climate destruction.

Why climate change? Anthropogenic climate change is just one of the many crimes that humanity commits against our planet [2]. We have exploited land, water, air, and biodiversity. However, whether correctly or not, climate change has become a flagship for humanity's environmental harm. Considerable attention is paid to it by actors across society, whether acceptance, denial, solutions, or failures. Climate change has been propelled from the realm of physics and science, to become a social, economic, political, ethical, and health issue [3]. This makes it possible to study from multiple perspectives but simultaneously elevates its complexity. With the mass of attention paid to it, it seems that if we cannot get climate change right, there is little hope in tackling the other environmental impacts we have.

Why pharmaceutical companies? They are part of health systems that, until very recently, have been neglected in conversations about climate responsibility. They produce products that, on the one hand, are crucial to human health, while on the other, are harmful to the planet. They, like any modern company, operate within societal institutions (i.e., the rules, norms, values, and

[2] Where society is a distinct system of social relations.

systems that influence how society is structured and functions [4]) and are subject to the social, economic, and political expectations thereof.

Through this research, therefore, I offer insights on pharmaceutical companies' net zero journey, how they are approaching climate action to reduce their climate impact and operate with the planet in mind.

1.2. My story

My career trajectory has been somewhat unconventional. However, looking back at my journey to date, it seems inevitable that I would end up writing a doctoral thesis on pharmaceutical companies and climate change.

I come from an environmentally conscious family; my mother is the type of person that goes into supermarkets to speak to the manager about how it is irresponsible to wrap bananas in plastic. I spent my childhood switching off lights, turning off taps, and recycling milk bottles. I trained as a medical doctor. During medical school, I spent an elective at the World Health Organisation (WHO) researching the impact of pharmaceutical residues in the environment. This topic was not my first choice; an elective looking at cardiovascular disease had failed to materialise. In hindsight, this experience laid critical groundwork for my passion for the interconnection between the environment and health care.

During the COVID-19 pandemic, I worked as a frontline doctor in South Africa, my home country. My 'eureka' moment came when I was administering anaesthetic to a multiple gunshot wound patient in the early hours of a morning in August 2020. By the end of the case, we had filled several bags of single-use medical waste. This, and other experiences, sparked my growing discomfort with the negative environmental impact of the way we deliver health care. There was a disconnect

between my environmentally conscious upbringing and my daily contribution to health care's environmental harm.

I began exploring the literature and speaking to people (e.g., sustainability experts, health care professionals, academics) and was surprised by the limited research and action on this topic at the time. The research that did exist hinted at the considerable negative environmental impact of health care. I was drawn to the climate impact of health care. As mentioned, climate change, while not the only environmental impact caused by humans, has in many ways become the overarching symbol for all anthropogenic harm to our planet. I was particularly drawn to the climate impact of pharmaceuticals, which as I discuss in Chapter 2, contributes considerably to health systems overall climate impact. I wanted to engage in research with a recognition of how interconnecting forces influence climate change and action. My time as a doctor cemented an understanding that ill health was a consequence of biological, pathological, genetic, psychological, social, economic, political, and cultural factors. So too, is climate change a product of interconnecting forces, and so too are efforts to mitigate it.

My experiences, upbringing, education, and clinical practice, therefore, contributed to my interest in the climate impact of pharmaceuticals and what was being done to mitigate this, and motivated my shift from doctor to researcher. And what better patient to try and treat than the planet.

1.3. The Anthropocene

At the time of writing, we sit at 1.1°C above pre-industrial temperature levels, creeping ever nearer to the 1.5°C Paris Agreement target, agreed upon through global consensus, to limit the effects of anthropogenic climate change [5]. Over the last few years, more than two-thirds of the

‘planetary vital signs’, indicators used to assess planetary health, have recorded unprecedented extremes: greenhouse gas emissions, fossil fuel consumption, global surface temperature, ocean heat, and sea level rise, amongst others [6]. The year 2024 alone saw drought in Southern Africa and Brazil; flooding across Eastern Europe, Nigeria, Kenya, Myanmar, and the United Arab Emirates (UAE); heatwaves across Southeast Asia; wildfires across Canada; tornadoes in the United States of America (USA). Changing weather patterns, temperatures, sea levels, air quality, water, and food security, all consequences of climate change, threaten both individual humans as well as wider societal institutions.

With the preponderance of scientific evidence of anthropogenic climate change, and the limited progress towards climate targets to date, many climate experts now refer to climate change, not as problem of science, but as a problem of society [3, 7, 8]. Although not formally recognised as a geological epoch, the ‘Anthropocene’ has become a powerful metaphor for our social era, acknowledging the profound shifts in Earth’s systems caused by human activities [9]. Climate change can be seen, fundamentally, as a consequence of how we think, live, produce, and consume. Climate change is intrinsically interwoven into our societal institutions, its aetiology, its effects, and our responses to it [10].

Below, I unpack climate terminology used throughout my thesis (see also Glossary of Terms). I then provide a brief overview of the societal aetiology, effects, and responses to climate change, setting the scene for my study of pharmaceutical companies’ climate action.

1.3.1. Unpacking climate terminology

While climate change is likely a familiar concept to most readers, an extensive terminology has emerged around it, encompassing the science, measurement, reporting, and targets that

underpin climate policies and action. I outline some of the key terminology here (see also Glossary of Terms).

Anthropogenic climate change describes the mean rise in global temperatures attributable to human activities, such as the burning of fossil fuels (coal, oil, and natural gas), deforestation, industrial agriculture, and land use changes. These activities release greenhouse gases like carbon dioxide, methane, and nitrous oxide into the atmosphere, intensifying the greenhouse effect (i.e., trapping of heat near the Earth's surface) and disrupting climate systems [11].

A carbon footprint quantifies an entity's (e.g., country, organisation, individual, or product) total greenhouse gas emissions. Despite the misleading name, it accounts for all greenhouse gases, converting them to carbon dioxide equivalents (CO_2e) which represent the amount of carbon dioxide required to produce the same global warming as other gases [12]. Though carbon footprint remains a commonly used term, organisational-level emissions are primarily measured and reported using frameworks such as the Greenhouse Gas (GHG) Protocol [13]. The GHG Protocol divides emissions into three Scopes (see Table 1): Scope 1 for direct emissions from owned sources (e.g., fuel combustion, company vehicles), Scope 2 for indirect emissions from purchased energy, and Scope 3 for other indirect emissions across supply chains (e.g., purchased goods and services, waste management, and transportation).

Table 1. Greenhouse Gas (GHG) Protocol scopes and categories [13]

GHG Protocol Scopes	Categories
Scope 1	Direct emissions from sources owned or controlled by the company
Scope 2	Indirect emissions from generation of purchased energy

Scope 3	Purchased goods and services Emissions from capital goods Emissions from fuel and energy Upstream transportation and distribution Waste generated in operations Business commuting Employee commuting Upstream leased assets Downstream transportation and distribution Processing of sold products Use of sold products End of life treatment of sold products Downstream leased assets Franchises Investments

Efforts to mitigate climate change drive decarbonisation, the systematic reduction of carbon dioxide and other greenhouse gas emissions [14]. A range of terminology around climate targets has emerged to guide decarbonisation efforts: temperature limits, concentration levels, and emissions reduction goals aimed at avoiding dangerous human interference with the climate system [14]. The ultimate target is to achieve a climate positive state, where human activities produce net beneficial impacts on the climate. Intermediate targets reflect levels of progress aligned with the Paris Agreement which aims to limit global warming to below 1.5°C above pre-industrial levels [5]. Carbon neutrality, describing a state where carbon dioxide emissions are balanced by removals, has fallen out of favour in recent years. Instead, net zero is preferred, indicating a balance between all anthropogenic greenhouse gas emissions (not only carbon dioxide) and removals. Achieving net zero involves reducing emissions as much as possible, while carbon offsets, investments in projects (e.g., reforestation) that reduce or absorb emissions elsewhere, help compensate for residual emissions that cannot be eliminated.

This definition of net zero applies globally; however, action to achieve it occurs at national, organisational, and individual levels. Recognising this, the Science Based Targets initiative (SBTi), a non-profit collaboration, provides a formal net zero definition for corporations to align with a 1.5°C pathway: "*Setting corporate net-zero targets aligned with meeting societal climate goals*

means: (a) reducing Scope 1, 2, and 3 emissions to zero or a residual level consistent with reaching net-zero emissions at the global or sector level in eligible 1.5°C scenarios or sector pathways, and (b) neutralizing any residual emissions at the net-zero target date – and any GHG emissions released into the atmosphere thereafter" [15][pg10].

I summarise the above, as well as terminology that I will use throughout my thesis to refer to related climate topics, in the Glossary of Terms. Notably, I use the term 'climate impact' to refer to the contribution of pharmaceutical companies to climate change through release of greenhouse gas emissions; 'climate reporting' to refer to a range of climate-related information that companies report publicly; 'climate action' to refer to the activity pharmaceutical companies engage in to substantively reduce greenhouse gas emissions; 'emissions reduction strategy' or 'initiative' to denote a single, particular type of activity; 'climate strategy' to refer to companies' plan to reduce greenhouse gas emissions; and 'net zero progress' to refer to quantified evidence of emissions reduction and progress towards net zero.

1.3.2. Unpacking anthropogenic climate change

Accelerated climatic changes have been tied to human activities, especially since the onset of industrialism, facilitated by capitalist economies, exacerbated by globalisation, and rooted in entrenched norms, beliefs, and values that privilege growth and human progress at the expense of our planet (see Glossary of Terms) [16]. Climate change is already having negative effects on humanity, affecting our economies, infrastructure, social stability, and health. These effects are not equally distributed; vulnerability to climate change can be seen as largely socially determined, reflecting current and historical disparities within society [3].

Industrialism, the social organisation of production through coordinated labour and machinery, is widely cited as a pivotal factor in accelerating anthropogenic climate change [17]. The

Industrial Revolution marked a significant increase in greenhouse gas emissions through extraction of raw materials, combustion of fossil fuels, and energy intensive production processes, compounded by activities such as deforestation, agricultural intensification, and livestock farming [1, 18, 19]. Globalisation, the intensification of worldwide social, economic, and political interconnectedness, has magnified the climate harm caused by industrial activities [20, 21]. Technological advances in transportation, communication, and digitalisation, as well as the expansion of the global division of labour and shifts of deindustrialisation and the emergence of newly industrialising countries, has enabled the establishment of global supply chains, heavily reliant on emission-intensive systems. The relocation of industrial activity to countries like India and China has diversified nation-state contributions of emissions that have previously been dominated by historical industrial nations such as the UK, the USA, and Western European countries [21].

While industrialism provided the mechanisms for emissions release, capitalism, the dominant economic system based on the private ownership of the means of production for profit, is often considered the underlying driver of climate destruction [22]. Capitalism is premised on continual economic growth to maintain profit that is primarily achieved through the extraction and consumption of natural resources, embedding the exploitation of the environment into our economic systems [16, 23]. Some scholars go further than attributing climate change to capitalism, arguing that entrenched societal beliefs in consumerism, individualism, and human superiority, the "*unjustified privileging of human beings at the expense of other forms of life*", form the cognitive base that justifies environmental exploitation through industrial and capitalist processes [24-26]. Assumptions around human superiority also fuel a faith in progress and technological innovation, contributing to 'techno-optimism', a reliance on 'technological fixes' to address climate issues, and allowing many in society to justify continued emissions under the assumption that technology will resolve the crisis [3, 27, 28].

The effects of climate change are being seen with alarming frequency. Losses in agricultural productivity, damage to critical infrastructure, health impacts, and the soaring costs of adaptation measures are placing immense strain on national economies. It is estimated that climate change could cost the global economy $7.9 trillion by 2050 [29]. Climate disruptions have cascading effects on social stability. Rising sea levels, dwindling arable land, and resource scarcity are already triggering migration, intensifying urban congestion, and potentially fuelling conflict [30]. Climate change, although caused by globally integrated systems, affects society unevenly. Paradoxically, those who contribute the least towards climate change (e.g., children, low-income communities, the 'Global South'), face the greatest economic, social, and health risks from climate change [31].

Health impacts are amongst the most immediate and tangible effects of climate change on humans. The climate crisis was designated a health crisis in a 2009 Lancet editorial: "*climate change is the biggest global health threat of the 21st century*" [32]. Between 1970 and 2019, extreme weather events related to climate change accounted for an estimated 650,000 deaths from droughts, 577,232 from storms, 58,700 from flooding, and 55,736 from extreme heat [33]. Climate change has been linked to cardiovascular, respiratory, and renal conditions, water- and vector-borne diseases, pregnancy complications, dermatological malignancies, malnutrition, and mental illness [30, 34-38]. The WHO estimates that between 2030 and 2050 there will be an additional 250,000 deaths per year globally from climate change [39].

Climate change requires action by a range of societal actors. There have been efforts to drive climate action at the global (e.g., landmark agreements such as the 1997 Kyoto Protocol and the 2015 Paris Agreement [40, 41]), national (e.g., nation-state climate targets, renewable energy investments, and carbon taxes), corporate (e.g., voluntary and regulated company greenhouse gas emissions disclosures), and civil society (e.g., individual climate activists such as Greta Thunberg and social movements such as Extinction Rebellion) levels. However, there have also

been efforts to constrain climate action. Politically, climate action has seen delays stemming from internal government divisions, partisan polarisation, competing priorities, and the influence of lobbyists [42, 43]. This has contributed to inconsistent climate policies such as the USA's withdrawal from the Paris Agreement under the Trump administration [44]. Corporations, particularly in the fossil fuel industry, have resisted climate action by lobbying against climate regulations, spreading misinformation and misleading climate narratives, and engaging in greenwashing, exaggerating their environmental credentials while continuing unsustainable practices [16, 45, 46].

To summarise, climate change can be seen as a crisis born from societal institutions – industrialism, capitalism, globalisation, and entrenched norms, values, and beliefs about humanity – which has accelerated the release of greenhouse gas emissions through fossil fuel use. Climate change has far-reaching and unequal effects, crucially, on human health. Climate change requires action from a range of societal actors, but to date, action has been sporadic, unsustained, and without the urgency necessary to mitigate this crisis. Sectors, such as health systems, and their suppliers, pharmaceutical companies, that have been largely neglected in the climate fight to date, can no longer sit by but have a part to play in the fight against climate change.

1.4. Research focus

In the face of the health crises emerging from climate change, the irony of the limited response by health systems, and their pharmaceutical suppliers, to their own climate impact cannot be overstated. Up to 55% of health system greenhouse gas emissions are estimated to come from pharmaceuticals [47]. Emissions are produced across pharmaceutical lifecycles, especially during research, development, production, and distribution of products by pharmaceutical companies. Pharmaceutical companies operate within, and are influenced by, the same societal

institutions that drive climate change and shape responses to it. Pharmaceutical companies sit at the nexus of health systems and the corporate sector; they play an important role in human health that is so intrinsically interwoven with climate change, while also engaging in industrialised, globalised drug manufacturing and delivery practices, participating in capitalist economies, and facing mounting pressure to mitigate their climate impact. As powerful economic and political players, pharmaceutical companies have the potential to shape and influence wider climate action.

Pharmaceutical companies, therefore, offered a compelling case for exploring climate action. My research sought to understand how multinational pharmaceutical companies are approaching climate action, what shapes, constrains, and enables companies' climate actions, and what may support net zero progress.

1.5. Thesis outline

My thesis comprises ten chapters that collectively tell the story of my research.

In **Chapter 2,** I provide an overview of the multinational pharmaceutical industry and its structure. I then review and critique existing literature at the intersection of the pharmaceutical industry and climate change. Literature in this area is limited, and what does exist largely focuses on (a) quantitative analyses of pharmaceuticals' climate impact, often conducted as part of national health system assessments, industry-level estimates, or studies of individual pharmaceutical products; and (b) proposed strategies for mitigating this impact at both the health system and industry levels, typically derived from surface-level descriptive analyses. I unpack the gaps in this literature, notably, that studies lack critical analysis and rarely situate

pharmaceutical companies' climate actions within the context of wider societal institutions. In response to these gaps, I outline my research aims and questions.

In **Chapter 3**, I present the findings of an initial content analysis of public reports from 20 multinational pharmaceutical companies, which formed the basis of a published article [48]. This study provided a descriptive baseline of pharmaceutical company climate action – their climate targets, greenhouse gas emissions, and emissions reduction strategies. I show that while most companies had set climate targets and reported reductions in Scope 1 and 2 (operational) emissions, reporting was inconsistent with varied application of reporting standards and often excluded Scope 3 (supply chain) emissions. Companies reported engaging in various emissions reduction strategies, most commonly, transitioning to renewable energy, improving energy efficiency, sourcing raw materials sustainably, and reducing waste and water use. I reflect on the limitations of this surface-level descriptive approach – particularly its reliance solely on self-reported company data and lack of critical engagement with wider institutional contexts, discourses, and practices – and explain how these limitations motivated the subsequent interpretive, adapted argumentative discourse analysis phase of my research which I present across Chapters 4 to 10.

In **Chapter 4,** I present my research approach, grounded in interpretivism and guided by Maarten Hajer's argumentative discourse analysis that involves the analysis of the discursive production of meaning and the practices through which meaning is produced, reproduced, or transformed. As Hajer asserts, the meanings that actors allocate to phenomena shapes what courses of action are legitimised, offering insight into how companies approached climate action. I describe my data sources: (a) company documents from three selected pharmaceutical companies, GSK, Novo Nordisk, and Teva Pharmaceuticals, and (b) narrative interviews with representatives from these companies as well as the wider industry and health systems. I explain my analytical framework which drew on discursive concepts including storylines (statements that summarise

complex narrative), discourse-coalitions (actors that share storylines), and discourse institutionalisation (solidification of dominant discourse within institutional practices). I extended my analysis with concepts from impression management theory, which sensitised me to the performativity of pharmaceutical company climate action. I also incorporated additional sensitising concepts (e.g., techno-optimism) to help explain my findings.

Through my data analysis I identified storylines and counter-storylines that reflected various discourses (i.e., ensemble of ideas, concepts, and categories through which meaning is ascribed to phenomena), that shaped, constrained, and enabled pharmaceutical company climate action. I unpack these storylines across four findings chapters.

In **Chapter 5,** I unpack the storyline that climate action conflicts with patient wellbeing. This storyline was shared by a discourse-coalition comprising a broad range of pharmaceutical company and health system actors in my study. My analysis suggested this storyline was underpinned by a biomedical discourse that prioritised individualised patient care, typically delivered through pharmaceutical interventions. This discourse showed evidence of institutionalisation through practices such as prioritising patient wellbeing in pharmaceutical procurement and prescribing decisions, justifying ongoing climate impact from pharmaceuticals. I identified a counter-storyline, shared by a subset of actors, that framed climate action as essential to ensuring long-term patient wellbeing. These actors drew on a planetary health discourse which recognises the interdependence of human and planetary wellbeing.

In **Chapter 6**, I examine the storyline that climate action is contingent on financial viability. This storyline was shared primarily by pharmaceutical actors who drew on an economic discourse to frame climate action through financial terms. This discourse had institutionalised and was reproduced across multiple domains of company practice, including regulatory compliance, reputation management, market positioning, and operational resilience, where climate action

was consistently weighed against financial cost and opportunity. A counter-storyline, shared mainly by health system actors, critiqued the financialisation of climate action. These actors drew on a normative discourse to argue that climate action should be pursued regardless of financial viability. Despite these divergent discursive backgrounds, actors across both coalitions converged around the need for financial incentives to support climate action, illustrating a form of discursive affinity, the alignment of arguments with different origins through shared conceptualisation of possible solutions.

In **Chapter 7**, I unpack the storyline of climate action as emissions quantification and disclosure. This storyline was underpinned by a technocratic discourse through which actors positioned the quantification and disclosure of greenhouse gas emissions as a way to ensure regulatory compliance and to inform climate action. This discourse had institutionalised in company practices through formalised emissions disclosure processes and was further reinforced by external actors through, for example, regulatory frameworks and health system procurement requirements for emissions data. A counter-storyline challenged the primacy of data, drawing on a post-technocratic discourse that questioned the limits of quantification. Actors sharing this counter-storyline advocated for a shift from quantifying and disclosing emissions to reducing them, suggesting that overreliance on data can obscure substantive climate action.

In **Chapter 8**, I analyse the storyline that climate action requires more collaboration. This storyline was widely shared across my data and drew on techno-optimist and network governance discourses. Through the techno-optimist discourse, climate action was framed by actors as a problem to be solved through collaboration and innovation amidst uncertainty around net zero solutions. However, within this framing, collaboration and innovation often remained vague and aspirational, with limited articulation of what it involved in practice. The network governance discourse positioned climate action as a shared responsibility of actors across pharmaceutical supply chains. However, this framing was frequently mobilised to displace

responsibility, with actors invoking the need for collaboration as a rationale for deferring action or shifting accountability onto others.

In **Chapter 9**, my discussion chapter, I summarise my findings, link them to my research questions, and situate them within broader theoretical and empirical literature. I unpack how the three pharmaceutical companies approached climate action and how this aligns with existing literature. I discuss the dominant discourses I identified that appeared to shape, and often constrain, pharmaceutical company climate action. These discourses (i.e., biomedical, economic, technocratic, techno-optimist, and network governance) frequently converged to frame climate action as contingent on specific preconditions, such as ensuring patient wellbeing, financial viability, access to emissions data, or increased collaboration. I introduce the term discursive conditionality to explain this pattern, referring to how the way actors discuss and make sense of climate action systematically places preconditions on it, thereby delaying and deferring action. I unpack the alternative discourses I identified (i.e., planetary health, normative, reorientated economic, post-technocratic) that challenged the discursive conditionality of dominant discourses by reframing climate action as interconnected with patient wellbeing rather than in conflict with it, as a moral obligation that must be decoupled from profit, as a financial opportunity rather than a risk, as emissions reduction rather than quantification, and as grounded in productive collaboration rather than vague appeals to collective effort. I discuss my contributions to wider academic literature, pharmaceutical company leadership to support climate action, as well as my theoretical and methodological contributions.

In **Chapter 10,** I conclude by reflecting on the implications of my findings and suggest recommendations for relevant actors, including pharmaceutical companies, health care policymakers and regulators, and health care providers.

1.6. Chapter summary

Climate change is a profound consequence of human activities. Industrialism, supported by capitalist economies and amplified by globalisation, has produced greenhouse gas emissions at an unprecedented scale. These ecologically harmful societal institutions are often justified and perpetuated by norms, beliefs, and values centred on human superiority, technology, and notions of progress. The effects of climate change, spanning economic costs, infrastructure damage, social disruption, and health impacts, are global in nature, but often socially determined, exacerbating and shifting existing inequalities. Responses to climate change are mediated by actors within society; political, corporate, and individual interests intertwine, influencing both the pace and direction of climate action. Climate change is inextricably intertwined with societal institutions. Consequently, pharmaceutical company climate actions – and inactions – must be understood in relation to these interconnected societal institutions.

Through my medical practice, I saw the environmental harm that health systems inflict. Through this research, I sought to build on my clinical background and experiences by exploring the climate action of an industry that has been largely neglected in the fight against climate destruction. The societal justification for this research is there: we need every person, every company, every sector, every country to play their part in reducing their contribution to climate change. I took a broader, sociological approach to explore this topic, with the aim to generate new insights on a crisis that is steeped in science, but at its root, a social problem.

Chapter 2: The pharmaceutical industry and climate change

2.1. Introduction

Climate change and its effects on society, including human health, demands urgent action by a range of actors, including governments, industry, and individuals [11]. Health systems contribute approximately 5% of global greenhouse gas emissions and also have a responsibility to mitigate their climate impact [49]. Up to 55% of these emissions are estimated to come from pharmaceuticals, requiring action by pharmaceutical companies [47].

In the first part of this chapter, I provide an overview of the multinational pharmaceutical industry, its activities and structure, comprising branded (Section 2.2.1) and generic (Section 2.2.2) companies. I introduce the concept of corporate social responsibility that underpins pharmaceutical companies' obligation to engage with their climate impact (Section 2.2.3). In the second part of the chapter, I present the available literature on the pharmaceutical industry's climate impact (Section 2.3.1) and proposed strategies to mitigate this impact (Section 2.3.2). I surface gaps in the literature (Section 2.4). There is limited research at the intersection of the pharmaceutical industry and climate change, and existing research is largely dominated by quantitative methods (e.g., emissions quantification) and surface-level descriptive analyses (e.g., summarising reported emissions reduction strategies) and lacks critical analysis. Existing literature largely neglects to consider pharmaceutical companies' climate action within the context of wider societal institutions. I outline my research aims and questions.

2.2. Overview of the pharmaceutical industry

The pharmaceutical industry plays a vital role in health care; researching, developing, manufacturing, and delivering pharmaceutical products (e.g., injections, tablets) considered crucial for improving patients' health and curing disease [50]. Pharmaceutical companies operate within wider pharmaceutical supply chains, comprising outsourced products and suppliers, packaging and distribution services, as well as downstream pharmaceutical consumers, including health systems and retail pharmacies (see Figure 1) [51]. Pharmaceutical companies engage in a range of activities including research and development (i.e., drug discovery, clinical trials), manufacturing, marketing, sales, and distribution of pharmaceuticals. Overarching pharmaceutical companies' activities is a range of policy and regulation that governs their provision of pharmaceuticals, as well as their corporate practices.

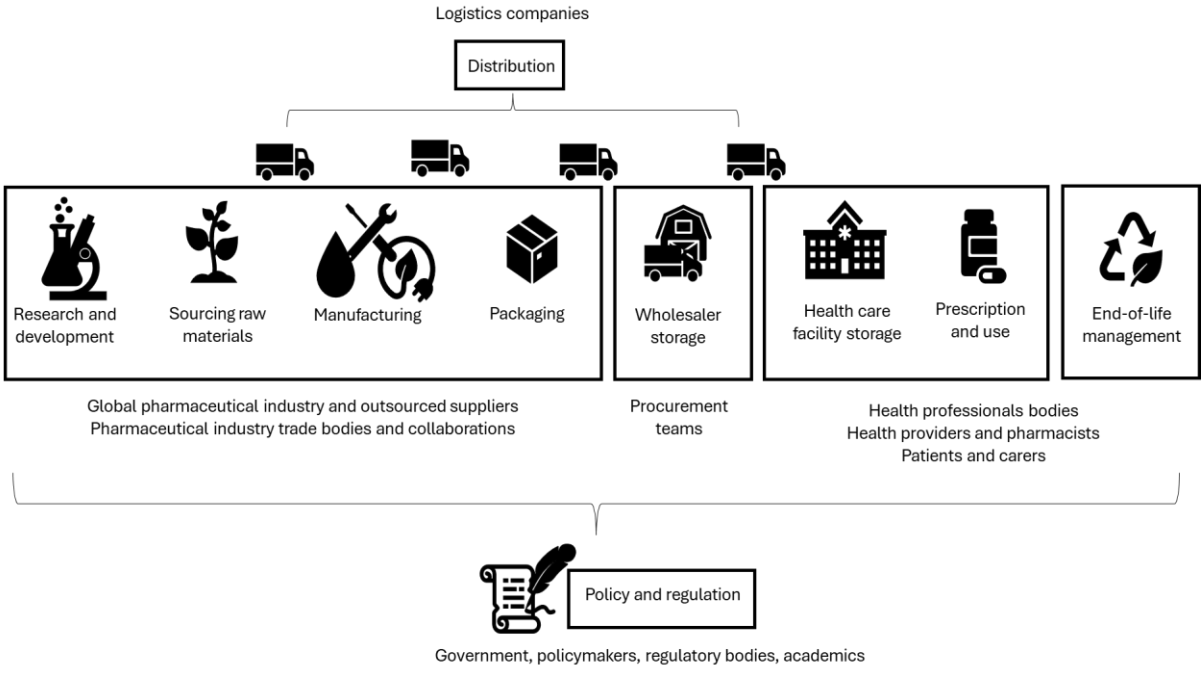

Figure 1. Simplified pharmaceutical supply chain, adapted from Merkuryeva [51]

The pharmaceutical industry primarily comprises two distinct segments: (a) 'Big Pharma', an economically and politically influential group of multinational pharmaceutical companies that engage in drug discovery to produce branded, patented pharmaceuticals, and (b) generic pharmaceutical companies, that produce drugs chemically equivalent to branded ones, typically at lower prices once patents expire [52]. I discuss these further, before turning to a brief discussion of the pharmaceutical industry and corporate social responsibility that sets the scene for unpacking the literature on the pharmaceutical industry and climate change.

2.2.1. The rise of Big Pharma

Big Pharma refers to a core group of large, multinational pharmaceutical companies that engage in research, development, and production of branded pharmaceuticals [53]. Through their historical and ongoing dominance in pharmaceutical markets, Big Pharma companies have gained considerable economic and political power. While they have driven medical advancements, they have also been embroiled in controversies that have led to increased regulation of drug design, development, and marketing, and demands for corporate social responsibility.

Many well-known Big Pharma companies (e.g., GSK, Johnson & Johnson, AstraZeneca) have their origins in early 19th century Europe and the USA, evolving from small-scale pharmacies (e.g., Merck), chemical and textile companies (e.g., Bayer, Sandoz), or emerging in response to the need for mass-produced analgesics and antiseptics during various wars (e.g., Pfizer, Eli Lilly) [54, 55]. These early pharmaceutical companies primarily focused on producing and marketing existing drugs over the counter and developing chemical-based (i.e., small molecule) drugs for pharmacists and doctors.

From these origins, the pharmaceutical industry's role and scale was transformed by multiple factors. Industrialisation and technological innovations facilitated large-scale drug production. During the World Wars, the need for mass production of pharmaceuticals led to government support and intervention in pharmaceutical companies that drove advances in drug manufacturing [56]. Increased public health funding (e.g., the founding of the National Health Service (NHS) in 1948) and the emergence of health insurance systems boosted pharmaceutical demand. Meanwhile, the discovery of breakthrough drugs such as insulin and penicillin heralded the immense potential for profitability of the pharmaceutical industry [54-57].

Pharmaceutical companies began to compete for the next 'blockbuster' drug, a drug that delivers annual sales of more than $1 billion [58]. Due to the high costs of drug discovery, companies tended to focus on specific therapeutic areas for which they had capabilities, experience, and expertise (e.g., GSK on respiratory conditions, Pfizer on oncology). Existing pharmaceutical companies gained a competitive advantage through their ability to screen vast numbers of potential drug targets, conduct multiple parallel experiments, and mass-produce drugs. Companies also began to expand internationally to reduce operational costs. The concentration of, often proprietary, research and development expertise and production capacity created significant barriers to entry for smaller companies. Ultimately, this led to the formation of a core group of multinational pharmaceutical companies, focused on various therapeutic areas, headquartered primarily in Europe and the USA, with operations globally, known collectively as 'Big Pharma' [53, 56].

Shifts and advancements in pharmaceutical drug discovery and development are ongoing. From its roots in herbal remedies, to the development of traditional chemical-based drugs, to the advent of biopharmaceuticals, genomics, and immunotherapy, the industry continues to see shifts in the processes of research, development, and pharmaceutical output [59]. On the horizon, personalised medicine (i.e., tailoring treatments to individual patients), artificial

intelligence, advanced screening and computational modelling, and gene editing are just some of the avenues the industry is exploring. Many of these novel approaches are researched within academia or by biotechnology spin-offs who, with a few exceptions, instead of replacing existing Big Pharma companies, are frequently absorbed into these larger companies through mergers and acquisitions, resulting in little disruption to the stable core of branded pharmaceutical companies that dominate pharmaceutical markets [56, 57].

Through their historical and ongoing dominance in pharmaceutical markets, Big Pharma are a major economic force. The world's fifty highest-revenue pharmaceutical companies are collectively worth approximately $4 trillion [60]. The pharmaceutical industry contributes billions of dollars to the global economy through its activities and supports millions of jobs across pharmaceutical supply chains [61]. Additionally, Big Pharma companies exert considerable political influence. It is estimated that they collectively spent over $6 billion lobbying American politicians over the last two decades [62].

Ethical concerns have been raised (e.g., by academic, members of the public, and governments) about Big Pharma companies and their practices. In addition to excessive lobbying and state-level corruption such as bribery and procurement fraud, the industry has faced critiques of price manipulation, publishing false data, unethical clinical trials, drug safety, disease mongering, and neglect of the 'developing' world [53]. The industry has been plagued by scandals, notably, the thalidomide scandal in the 1960's [63], numerous criminal and civil settlements usually for off-label promotion and failure to disclose safety data (e.g., Pfizer in 2009, AstraZeneca in 2010, GlaxoSmithKline in 2012) [56, 64], and the OxyContin scandal by Purdue Pharma that arguably fuelled the opioid epidemic in the USA [65].

In response to these, and other industry scandals, pharmaceutical regulation has evolved to govern the development, production, and marketing of drugs to ensure their safety, efficacy, and quality [66]. Pharmaceutical regulations are overseen by various major national regulatory

agencies including the FDA (Food and Drug Administration) in the USA, MHRA (Medicines and Healthcare products Regulatory Agency) in the UK, and EMA (European Medicines Agency) in Europe, while international bodies such as the World Health Organisation (WHO) play a role in setting drug safety guidelines and harmonising regulatory efforts. Key areas of pharmaceutical regulation focus on drug development and approval from preclinical research to post-market surveillance, ensuring good manufacturing practices, and controlling drug pricing, advertising and marketing.

2.2.2. The emergence of generic pharmaceuticals

Generic pharmaceuticals are chemically identical to branded drugs but offered at lower prices once patents expire [52]. The generic division of the pharmaceutical industry arose to produce lower-cost alternatives to branded drugs, spurred by changes in patent laws and a rising global demand for affordable medicines.

In the early history of the pharmaceutical industry, there were no distinct ‘generics’ companies. Established brands produced their own versions of common drugs, such as morphine, sold under various names by companies like Squibb, Smith, Kline & French, and Upjohn [67]. As competition for blockbuster drugs grew, the high costs of new drug development led to patent protections. The USA began patenting drugs in 1946 and other countries followed. The Trade-Related Aspects of Intellectual Property Rights (TRIPs) agreement established a global 20-year patent period [53, 56]. However, in response to demands for more affordable drugs, the USA 1984 Hatch-Waxman Act facilitated accelerated generic drug approval by reducing clinical trial requirements and safety control procedures for generic drugs and allowing pharmacies to sell equivalent generics [56]. This paved the way for the rapid expansion of the generic market, from approximately 20%

in 1984 to 90% of drugs sold today, aided by expiring patents on major drugs as well as the global demand for cheap medications [68, 69].

Historically concentrated in Europe and the USA, from the 1960's, the pharmaceutical industry saw generic drug production shift primarily to India and China, with India now the world's largest supplier of generics [70]. State intervention in India aimed at reducing reliance on costly imported drugs led to the establishment of state-owned pharmaceutical companies, the elimination of product patents, and the imposition of price controls [71]. India's 1970 Patents Act further enabled local production by allowing the reverse-engineering of patented pharmaceuticals, solidifying India's role as the 'pharmacy of the developing world' [72]. Although India aligned with international patent law under the TRIPs agreement in 1995, and updated its Patents Act in 2005, the nation had already honed its manufacturing capabilities, ensuring its continued dominance in generics production [72].

While generics sales dominate global pharmaceutical consumption, the saturated, fragmented, and competitive generic market means that individual generic companies typically generate less revenue than Big Pharma. For example, in 2021, the highest-revenue Big Pharma company, Pfizer, was valued at $289 billion, while Teva, the largest generic company, was valued at $32.8 billion [73]. Big Pharma's higher revenues mean that they frequently acquire generic subsidiaries (e.g., Pfizer with Viatris, Novartis with Sandoz). There is speculation that Big Pharma could eventually absorb much of the generic industry through these acquisitions; however, others predict that generic companies will – and some already have – expand into independent research and development to increase their revenue [71]. As the industry evolves, the distinction between branded Big Pharma and generic companies will likely blur.

2.2.3. The pharmaceutical industry and corporate responsibility

Alongside the evolution of the pharmaceutical industry, the concept of corporate social responsibility (CSR) has risen globally, not exempting pharmaceutical companies. CSR conceptualises the broader responsibilities of companies beyond profit-making. Corporate responsibilities have evolved alongside key societal shifts. For example, the rise in environmental movements in the late 20th century drew attention to companies' environmental impacts [74, 75]. In recent years, the emergence of environmental, social, and governance (ESG) reporting reflects a more metric-based, investor-focused approach to reporting and assessing company performance and risk across non-financial environment, social, and governance dimensions. Voluntary frameworks like the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), and Task Force for Climate-related Financial Disclosures (TCFD) have been developed to standardise ESG reporting across a range of environmental (e.g., waste production, water use) and social (e.g., human rights, diversity) issues [76-78].

As awareness of the urgency of climate change (e.g., through international climate agreements, political traction, activist action) has risen, ESG has increasingly included expectations for companies to report on climate-related issues [79]. Disclosing greenhouse gas emissions and the financial risks of climate change has been incorporated into voluntary frameworks, with regulations increasingly mandating corporate emissions disclosures. Examples of corporate climate-related regulation include the European Union (EU) Corporate Sustainability Reporting Directive (CSRD), the UK's Climate-related Financial Disclosure Regulations, and the EU Taxonomy, which defines criteria for economic activities aligned with net zero and wider environmental impacts [80-82].

Pharmaceutical companies, by virtue of their size and position within the corporate sector, are subject to these voluntary, and increasingly regulated, corporate expectations around climate change [83, 84]. These expectations have been shown to drive pharmaceutical companies to

engage with climate change [85, 86]; although, research also calls for stronger alignment between economic and regulatory incentives and climate action [87]. In the next section I unpack literature at the intersection of the pharmaceutical industry and climate change, before highlighting the gaps in this body of research that my thesis aims to contribute to.

2.3. The pharmaceutical industry and climate change

Pharmaceuticals are an important part of health care delivery, used to manage and treat illnesses. However, greenhouse gas emissions are released across pharmaceuticals lifecycle – research and development, raw material extraction, manufacturing, packaging, distribution, storage, procurement, prescription, use, and end of life management – contributing to climate change [51]. Action by the pharmaceutical industry is needed to mitigate this climate impact.

In this second part of this chapter, I unpack the limited literature at the intersection of the pharmaceutical industry and climate change. Existing research in this area can be broadly categorised into two strands: (a) quantitative analyses of pharmaceuticals' climate impact, often conducted as part of national health system assessments, industry-level estimates, or studies of individual pharmaceutical products; and (b) proposed strategies for mitigating this impact at both the health system and industry levels, typically derived from descriptive analyses.

2.3.1. The climate impact of pharmaceuticals

Quantitative analyses of the greenhouse gas emissions of pharmaceuticals have been performed at the national, industry, and product level. While this literature suggests that the climate impact of pharmaceuticals is considerable, these estimates are sparse, context-specific, and fraught

with methodological and data uncertainty, limiting comprehensive understanding of the climate impact of pharmaceutical companies and their products.

Pharmaceuticals are estimated to contribute up to 55% of national health system emissions [47]. Differences in how pharmaceuticals are categorised and labelled in national health system emissions estimates makes it difficult to understand their overall impact on emissions and to compare their contributions across different health systems. For example, "*pharmaceutical and chemical sectors*" are estimated to contribute 10% of health system emissions in OECD (Organisation for Economic Cooperation and Development) countries [88] and nearly 20% of the USA's health system emissions [89]. "*All pharmaceuticals*" contributed 19% of Australia's health system emissions [90] and 27% of the medicines services category in Japan [91]. 25% of NHS England's[3] (NHSE) emissions come from "*medicines and chemicals*" and "*anaesthetic gases and metred-dose inhalers*" [92], "*prescribed and non-prescribed drugs*" represented 25% of Canada's health system emissions [93], while "*non-hospital purchased pharmaceuticals*" and "*medical institutions pharmaceuticals*" totalled 55% of China's health system emissions [94]. These estimates were largely performed using top-down, environmentally extended input-output modelling (EEIO) methodology that converts pharmaceutical expenditure into a proxy emissions value. Despite these limitations in methodology (i.e., variations in categorisation and labelling, and spend-based conversions in the absence of primary data), it is evident that pharmaceuticals are a major source of greenhouse gas emissions in national health systems.

The few estimates of the pharmaceutical industry's greenhouse gas emissions focus primarily on Scope 1 and 2 emissions (i.e., direct and indirect energy emissions – see Table 1). For example, one analysis of pharmaceutical industry greenhouse gas emissions aggregated the Scope 1 and

[3] On 14 March 2025, NHS England was abolished by serving British Prime Minister Keir Starmer, with services shifted to the direct oversight of the Department of Health and Social Care. My research, conducted before this announcement, refers directly to NHS England, and I report it, and actions related to it, as such in my thesis, acknowledging that this announcement will likely alter future oversight of the NHS's net zero plans and climate action.

2 emissions from annual reports (i.e., companies' publicly published financial and non-financial performance) of 15 major pharmaceutical companies [95]. This analysis suggested that the industry's emissions per revenue were 55% higher than that of the automotive industry [95]. Another industry-wide analysis concluded that emissions reductions can be achieved while maintaining growth in company profit [96]. These analyses, however, were critiqued for neglecting to consider the Scope 3 emissions of pharmaceutical companies [97]. A white paper report by My Green Lab (a non-profit organisation that works with industry and academia to improve laboratory sustainability) estimated that the industry contributed approximately 5% of global greenhouse gas emissions in 2022, with industry emissions rising over the years and primarily coming from Scope 3 [98].

Region-specific studies of pharmaceutical industry emissions provide further insight. For example, between 2000 and 2016, the Chinese pharmaceutical industry's energy-related (Scope 1 and 2) emissions were found to have risen by 140% from 23.03 to 55.34 metric tonnes of carbon dioxide equivalents [99]. Potential emissions reductions from the Chinese industry were found to exceed the UK's total emissions [100]. In India, limited climate transparency was highlighted as, in 2013, only two out of nine examined pharmaceutical companies publicly disclosed their emissions [85]. The dearth of data on the pharmaceutical industry's climate impact and the need for increased transparency of pharmaceutical company emissions has been called out [101-103], especially of generic companies [104].

There have been efforts to determine the carbon footprint of individual pharmaceutical products and their components across their lifecycle (i.e., from raw material extraction to disposal). Much of this work has focused on anaesthetic gases and metred-dose inhalers. The use of anaesthetic gases results in the release of carbon dioxide, nitrous oxide, and other greenhouse gas particles into the atmosphere [105]. Nitrous dioxide and desflurane have been repeatedly demonstrated as the most polluting anaesthetic gases [105-108]. Metred-dose inhalers, used to treat

respiratory conditions like asthma, have been found to contain propellants that, in some estimates, are more than 3,800 times more polluting than carbon dioxide [109, 110].

Carbon footprint estimates of other pharmaceutical products remain sparse, limited by confidential manufacturing practices and proprietary information held by pharmaceutical companies. At the time of writing, carbon footprint calculations of penicillin [111], enrofloxacin [112], morphine [113], ibuprofen [114], intravenous anaesthetic drugs [115], heparin [116], pregabalin [117], and Viagra [118] have been performed, although these estimates are context-dependent and often performed in collaboration with pharmaceutical companies [119-121]. A call for standardised carbon footprint methodologies for pharmaceutical products remains prominent amongst researchers, aiming to reduce inconsistency and enhance transparency [122].

Estimates of the carbon footprint of individual components of pharmaceuticals' lifecycle have also been performed. For example, research on pharmaceutical packaging found that polymer vials have lower emissions than glass and PVC (polyvinyl chloride) blister packs have lower emissions than aluminium, while the heavier the packaging weight, the higher the emissions from transportation [123, 124]. Finally, studies on the production of active pharmaceutical ingredients (i.e., the biologically active component of pharmaceuticals) have identified emissions hotspots in resource consumption, solvent use, and energy use [125-127].

2.3.2. Reducing the climate impact of pharmaceuticals

Against the backdrop of the climate impact of pharmaceuticals, there is a limited body of research on proposed strategies to mitigate pharmaceutical emissions at the health system and industry levels. Existing research is largely descriptive (i.e., summarising reported pharmaceutical company emissions reduction strategies).

Health systems globally are committing to net zero, but achieving these targets requires alignment from suppliers, including the pharmaceutical industry [128]. Sustainable health system procurement practices, including reducing demand for products, embedding sustainability criteria into procurement policies, fostering supplier engagement, and encouraging product substitution with low-carbon alternatives, have been suggested by researchers as a way for health systems to drive supplier climate action [129-132]. NHSE has led in addressing supplier emissions, becoming the first health system body to leverage procurement to prompt supplier climate action through their NHS Supplier Roadmap which came into force in 2022 [133]. This policy requires suppliers, including pharmaceutical companies, to report company and product-level greenhouse gas emissions, establish climate targets, and implement decarbonisation plans. The impact of this procurement policy in driving pharmaceutical emissions reductions has yet to be assessed.

Strategies for health care providers to reduce pharmaceutical greenhouse gas emissions have been proposed by researchers. For example, health care providers have been called to action to mitigate pharmaceutical emissions by reducing unnecessary pharmaceutical use, practicing careful, evidence-based prescribing, and engaging in practices such as regular reviews of medicines, deprescribing, and reducing polypharmacy [130, 134-138]. Non-pharmaceutical interventions, such as social prescribing, which connects patients to community resources and green spaces, are also being explored to improve health outcomes while reducing pharmaceutical reliance [139-141].

When pharmaceuticals are necessary, there is growing support (e.g., from the British Medical Association, Royal Pharmaceutical Society) for integrating climate considerations into prescribing decisions, alongside cost, efficacy, and side effects, and prescribing low-carbon alternatives when clinically equivalent options are available (i.e., low-carbon prescribing) [142-145]. Access to information on a pharmaceutical's carbon footprint enables such choices. For

example, there is much research that discusses techniques for reducing the carbon footprint of anaesthetic gases by, for example, avoiding emission-intensive anaesthetic gases like desflurane and nitrous oxide, using low-flow anaesthesia, using anaesthetic gas capturing systems, and by reasoned use of different anaesthetic techniques such as intravenous or regional anaesthesia [107, 146-150]. Desflurane has also been banned, except in exceptional circumstances, in some health systems, such as in Scotland [151]. Similarly, strategies for reducing the climate impact of metred-dose inhalers have been demonstrated, such as switching to dry powder inhalers, using reusable inhalers, altering the method of cleaning the nebulisation chamber, or combining more than one medicinal substance into a single inhaler [152-156]. In the absence of carbon footprint data for most other pharmaceuticals, efforts to determine and access this data to inform emissions reduction strategies are rising [142, 157].

Literature on climate action at the pharmaceutical industry level is scarce and primarily descriptive. As of 2023, 90% of the 91 pharmaceutical companies analysed in the My Green Lab report still had no climate targets [98], while an analysis of the ten largest pharmaceutical companies in Australia concluded that companies had varying levels of target setting, emissions disclosures, and quantification of emissions reductions [103]. Suggestions for pharmaceutical company emissions reduction have been proposed, largely focusing on improving energy efficiency, optimising manufacturing, and enhancing distribution [87, 158]. For example, advanced equipment, light sensors, renewable energy investments, and the use of artificial intelligence and data analytics to streamline processes have been proposed to reduce emissions [159].

Emissions reduction strategies focusing on individual components of pharmaceuticals' lifecycle have also been explored. For example, green chemistry principles to reduce the impact of pharmaceutical manufacturing has gained academic traction, advocating for sustainable sourcing, solvent recycling, enzymatic and water-based processes, and optimised continuous-

batch manufacturing [160-162]. Additionally, the potential for emissions reductions from innovations in lightweight, recyclable packaging and environmentally conscious distribution practices, have been explored [123, 158]. Finally, a body of research has emerged around 'greening' industry-led clinical trials, advocating for increased transparency of the carbon footprint of trials, and reducing emissions through practices such as decentralisation of trials, tele-consultation for trial participants, and other novel techniques such as digital twins (i.e., digital versions of trial patients in place of a control group) [163, 164].

2.4. Gaps, aims, and research questions

Current literature on pharmaceutical greenhouse gas emissions, at the national, industry, and product level, indicates the considerable contribution of pharmaceuticals to climate change. However, critical gaps in research exist. To date, literature at the intersection of the pharmaceutical industry and climate change is sparse. Current literature is primarily dominated by quantitative methods (e.g., attempting to calculate the greenhouse gas emissions of pharmaceutical companies and their products) and surface-level descriptive analyses (e.g., categorising pharmaceutical companies' climate targets or summarising reported emissions reduction strategies). Proposed emissions reduction strategies are often based on limited primary data analysis, with few studies demonstrating confirmed emissions reductions from proposed strategies. Studies lack critical analysis and rarely situate pharmaceutical companies' climate actions within the context of wider societal institutions.

The limited peer-reviewed literature that quantifies pharmaceutical company greenhouse gas emissions relies on pharmaceutical companies' reported emissions data, raising questions of credibility, accuracy, and freedom from bias. This lack of access to credible emissions data, as well as differing methodologies and reporting processes, limits comprehension of the full scope

of the climate impact of pharmaceutical companies and their products. It also complicates the ability to compare pharmaceutical emissions across nations, companies, and products. Additionally, these estimates are region-specific, questioning the relevance of emissions data in different settings.

Through corporate social responsibility expectations and policies like the NHS Supplier Roadmap, pharmaceutical companies are increasingly (albeit sporadically) being asked to set net zero targets, report emissions, and develop decarbonisation plans. However, there is limited information on what companies are doing to respond to such pressures and reach these targets, with existing research primarily comprising surface-level descriptions of pharmaceutical companies' reported climate action. Furthermore, suggestions for health system strategies to reduce pharmaceutical emissions (e.g., low-carbon prescribing) are largely anecdotal and untested.

No research, to my knowledge, has engaged in a critical analysis of pharmaceutical company climate action within the context of wider societal institutions. This is a critical gap considering how intrinsically interconnected climate change – its aetiology, effects, and solutions – is with societal institutions (see Chapter 1). The pharmaceutical industry too, is deeply interconnected with societal institutions; it has been shaped by industrialisation, globalisation, capitalism, technological advances, political intervention, health system evolution, increasing consumption of drugs, and demand for affordable pharmaceutical options.

Therefore, through my research, I sought to contribute to the limited body of research on pharmaceutical company climate action. I focused on the company-level because much of the potential to decarbonise pharmaceuticals sits at the point of design, manufacture, and distribution of pharmaceuticals, while health system efforts are often reliant on upstream company actions such as data transparency and ensuring availability of low-carbon pharmaceuticals for health system use.

My research aims were to understand how multinational pharmaceutical companies are approaching climate action, and what could support net zero progress. Specifically, I asked:

a) How are multinational pharmaceutical companies approaching climate action?
b) What shapes, constrains, or enables pharmaceutical companies' climate action?
c) What alternative approaches to pharmaceutical company climate action are emerging, and how might they support net zero progress?

2.5. Chapter summary

The pharmaceutical industry, comprising branded and generic companies, are part of a network of suppliers, regulatory bodies, and health systems; they wield considerable economic and political power, but have also faced controversies around drug affordability, marketing, and ethical trials. The industry continues to be shaped by trends such as gene therapy, artificial intelligence, biotechnology, and crucially, shifts towards sustainability.

The pharmaceutical industry contributes to climate change. Pharmaceuticals account for a considerable portion of health system emissions; estimates of company-level emissions suggest a substantial contribution to global emissions, and product-level emissions estimates have identified some emission-intensive products such as anaesthetic gases and metered-dose inhalers. Despite these initial research efforts, there is limited data to comprehensively understand pharmaceutical emissions, at the health system, company, and product level. Emissions data is often produced through varied and inconsistently applied methodologies that rely on proxy data.

Efforts to reduce pharmaceutical emissions appear to be in their infancy, and it remains to be seen how emissions reduction strategies proposed in the literature will drive industry

decarbonisation. Additionally, pharmaceutical company climate action has been decontextualised. To my knowledge, there have been no critical analyses of pharmaceutical company climate action and studies rarely situate pharmaceutical companies' climate actions within the context of wider societal institutions. This is a notable gap considering how intrinsically interconnected climate change and the pharmaceutical industry are with societal institutions.

Through my research, I aimed to contribute to the limited literature on pharmaceutical companies' climate action. I did so by blending my clinical background with a sociological lens, recognising the interconnection between companies', societal institutions, and climate change. In the next chapter, I present early research I conducted to explore my topic: a content analysis of publicly available pharmaceutical company documents. This study, which formed the basis of a published article [48], provided the descriptive foundation that motivated, informed, and laid the groundwork for my subsequent adapted argumentative discourse analysis of pharmaceutical company climate action reported in Chapters 4-10, which constitutes the core of my thesis.

Chapter 3: Pharmaceutical company climate action: Content analysis of public reports from 20 pharmaceutical companies

3.1. Introduction

In this chapter[4], I provide a descriptive baseline of multinational pharmaceutical company climate action – their reported climate targets, greenhouse gas emissions, and strategies to reduce emissions. I present the methods I used to conduct this research – content analysis of the 20 highest revenue pharmaceutical companies' publicly available 2020/2021 reports, focusing on information on their reported climate action. I then unpack the key findings of this content analysis: nineteen companies had committed to reducing greenhouse gas emissions, ten to carbon neutrality and eight to net zero emissions between 2025 and 2050; companies showed reductions in Scope 1 and Scope 2 emissions (see Table 1), with variable results in Scope 3 emissions; and commonly reported strategies to reduce emissions included optimising manufacturing and distribution, and responsible sourcing of energy, water, and raw materials.

These descriptive findings provided a baseline understanding of multinational pharmaceutical company climate action. However, this research also surfaced the limitations of surface-level descriptive analysis, reliant solely on what companies were reporting, and with little engagement

[4] This chapter is adapted from Booth et.al., Pharmaceutical company targets and strategies to address climate change: a content analysis of public reports, International Journal of Environmental Research and Public Health, 2023. I was the primary author for this work, responsible for its conceptualisation, design, data collection, and analysis. Co-authors assisted with data checks (AJ), and review and edits of the article manuscript (SDF, CCW, SES). The original article is reproduced in this chapter with permission from co-authors.

with what was happening behind-the-scenes of company reporting as well as the wider institutional context in which companies operated – a gap I also noted in my literature review. This research, therefore, led to and informed my subsequent research (see Chapters 4-10) employing an adapted argumentative discourse analysis, combining analysis of company documents and narrative interviews with relevant actors to delve deeper into how companies were approaching climate action, what was shaping, constraining, and enabling action, and what might support companies to reach net zero.

3.2. Methods

I used a content analysis approach to guide data collection and analysis for this initial research on multinational pharmaceutical company climate action. Content analysis is a *"a research method that provides a systematic and objective means to make valid inferences from verbal, visual, or written data in order to describe and quantify specific phenomena"*[165][pg314]. The steps involved in content analysis, namely, sampling, data collection, and analysis, are described below [166].

3.2.1. Sampling

I employed purposive sampling to select multinational pharmaceutical companies, aiming to capture the majority of industry revenue and reflecting variation in size, geographical location, and product focus (see Chapter 2). To achieve this, I identified the top 20 pharmaceutical companies by 2020 revenue [167], a sample representing a substantial proportion of global pharmaceutical revenue and, by extension, industry activity [168].

3.2.2. Data collection

Companies produce publicly available annual reports that include both financial and non-financial information. The primary data source for this study comprised publicly available, self-reported company documents published in 2020 or 2021. Between November and December 2021, I accessed the global websites of the selected pharmaceutical companies and downloaded documents and webpages that reported on climate action. These materials were supplemented with publicly available information on greenhouse gas emissions from company reports submitted to the non-profit, environmental disclosure platform, Carbon Disclosure Project (CDP) [169].

I read the documents and manually extracted data using a structured data extraction form. Extracted variables included basic company information, stated climate targets and their alignment with recognised standards, reported greenhouse gas emissions (most recent 12-month values, baseline values, and years of reporting), frameworks and standards used for emissions reporting, and any initiatives or strategies described to reduce emissions. To ensure completeness, I also used the search function within each document (e.g., Adobe Acrobat) to locate the terms “environmental sustainability”, “greenhouse gas emissions”, “carbon footprint”, “carbon neutral”, “net zero”, “energy”, “scope 1”, “scope 2”, and “scope 3.” This cross-checking process confirmed the thoroughness of manual extraction and helped identify instances where relevant information appeared in narrative text rather than in environmental data tables.

Given the focus of this study on climate action, other environmental reporting (e.g., water use, waste production), or targets to improve other environment indicators, were excluded.

3.2.3. Data analysis and synthesis

I analysed and interpreted the extracted data using content analysis, an approach that has been successfully applied in previous studies assessing corporate environmental disclosures [170]. The analysis aimed to provide a descriptive summary of pharmaceutical company climate action, including reported targets, greenhouse gas emissions, and the strategies described to reduce these emissions. I also calculated simple descriptive statistics to indicate the proportion of companies engaging in climate-related reporting and determined the percentage change (increase or decrease) in reported emissions relative to each company's stated baseline year.

I recorded publicly stated targets to reduce greenhouse gas emissions along with their target dates and categorised these as 'net zero' (statements including "net zero", "climate positive", or "reduction in greenhouse gas emissions to zero"), 'carbon neutral' (statements including "carbon neutral", "carbon zero", or "zero carbon emissions"), or other reductions (e.g., percentage-based emissions reduction targets).

Reported values for Scope 1, 2, and 3 greenhouse gas emissions were recorded for each company's most recent reporting year and corresponding baseline year. Where companies provided both location-based and market-based Scope 2 emissions, the location-based value was used, as it reflects *"the average emission intensity of grids on which energy consumption occurs"* [171][pg4], rather than market mechanisms such as renewable energy certificates that companies may use to claim emissions reductions. I calculated the percentage change in reported emissions for each company relative to their baseline year. I also determined the proportion of companies reporting Scope 1, 2, and 3 emissions, as well as the proportion that documented an improvement in these metrics. I recorded the reporting standards and tools used by companies and assessed the completeness with which these were applied.

Finally, I extracted information on strategies that companies reported implementing to reduce their emissions. These were grouped according to common themes and the Scope targeted by the strategy.

3.3. Findings

3.3.1. Overview of included pharmaceutical companies

Nine of the companies included in the study were headquartered in the USA, eight in Europe, two in Japan, and one in Israel (see Table 2). Across the 20 companies, annual revenues ranged from USD 11.0 billion to USD 47.5 billion, and employee numbers from approximately 11,000 to more than 130,000. Eighteen companies primarily produced branded medicines, while two (Viatris and Teva) specialised in generics. One company (Boehringer Ingelheim) was privately owned, and the remaining nineteen were publicly listed, including one (Novo Nordisk) controlled by a foundation focused on sustainability, life sciences, and health.

Table 2. Overview of the 20 pharmaceutical companies included in the content analysis study

Company Name	Headquarters	2020 Annual Revenue (Billion USD)	Number of Employees
Roche	Switzerland	47.5	>90,000
Novartis	Switzerland	47.2	>100,000
AbbVie	USA	44.3	>47,000
Johnson & Johnson (J&J)	USA	43.1	>130,000
Bristol Myers Squibb (BMS)	USA	41.9	>30,000
Merck & Co.	USA	41.4	>74,000
Sanofi	France	35.8	>100,000
Pfizer	USA	35.6	>78,000
GlaxoSmithKline (GSK)	UK	30.6	>99,000
Takeda	Japan	27.9	>50,000
AstraZeneca	UK	25.5	>76,000

Amgen	USA	24.1	>22,000
Gilead	USA	23.8	>11,000
Eli Lilly	USA	22.6	>35,000
Novo Nordisk (NN)	Denmark	19.4	>45,000
Bayer	Germany	18.9	>99,500
Boehringer Ingelheim (BI)	Germany	16.5	>47,000
Astellas	Japan	11.5	>15,000
Viatris	USA	11.5	>45,000
Teva	Israel	11.0	>40,000
Total	20	580.4	>1,200,000

3.3.2. Location of climate data

In total, I identified 86 documents containing information on the companies' climate action. These documents included: 14 annual reports (a report published on a yearly basis to communicate companies' financial statements, governance, and other aspects to shareholders); 15 Corporate Social Responsibility (CSR), Environmental, Social, Governance (ESG) or sustainability reports; 2 integrated reports (including financial and non-financial information); 7 policy documents; 28 position statements; 6 data summary reports; and 7 infographics. Additional information was also obtained directly from company webpages where relevant. For instance, Boehringer Ingelheim included details on emissions reporting and climate targets within the sustainability section of their website rather than in a standalone report.

3.3.3. Reported climate targets

Nineteen companies reported current targets to reduce their greenhouse gas emissions through commitments to one or more of carbon neutrality, net zero, or percentage-based emissions reduction (see published article for full details on respective company targets [48]).

Ten companies had pledged carbon neutrality and eight had committed to achieving net zero emissions between 2025 and 2050. Targets often varied across emission scopes; for example, a company might aim for net zero in Scopes 1 and 2 but only carbon neutrality in Scope 3. Companies articulated these goals using differing terminology, including phrases such as *"carbon neutral across Scopes 1 and 2",* "*net zero impact on climate",* and "*carbon zero without using offsets"*.

Sixteen companies pledged to reduce greenhouse gas emissions by a specified percentage within varying target years. In some cases, these percentage reductions represented the level of emissions cuts required to achieve carbon neutrality or net zero targets, while in others they served as standalone commitments. Five companies committed to 100% reductions in Scope 1 and 2 emissions, and one of these (Novo Nordisk) also pledged a 100% reduction in selected Scope 3 categories, specifically transport and distribution. One company (Gilead Sciences) set an absolute percentage reduction target for Scope 3 emissions but did not provide any Scope 3 emission data.

3.3.4. Progress on targets: Scope 1, 2, and 3 emissions and reported change from baseline

All 20 companies reported on Scope 1 and 2 emissions and fourteen on Scope 3 emissions, with varying reductions from the baseline year of reporting (see Figure 2).

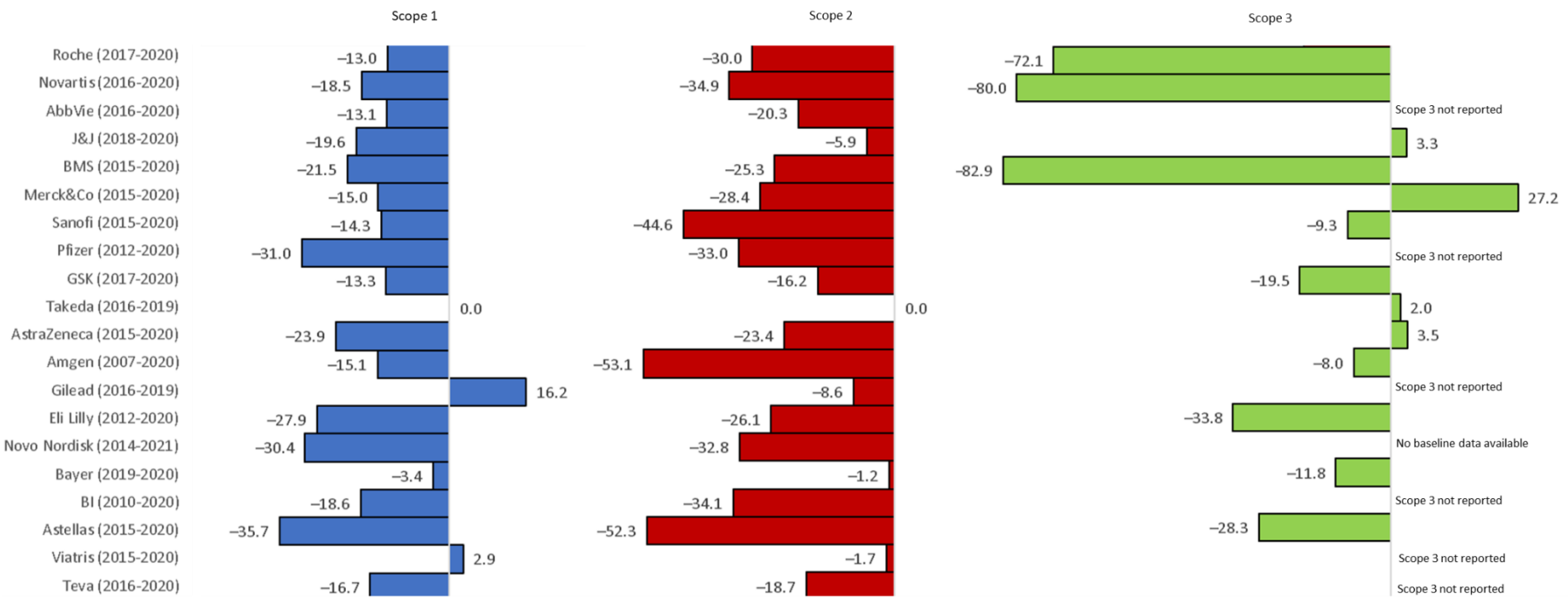

Figure 2. Percentage change over reporting period (in brackets) in company Scope 1, 2, and 3 emissions (*Roche, Novartis, and BMS only reported business travel/ flights in Scope 3 emissions)

Reductions in Scope 1 emissions, calculated over a median period of five years from each company's baseline reporting year, were observed in 17 of the 20 companies. Six of these companies achieved reductions exceeding 20% relative to their respective baselines. Nineteen companies reported decreases in location-based Scope 2 emissions, with eight achieving reductions of 30% or more. Fourteen companies reported data for one or more Scope 3 emission categories, and nine of these documented reductions relative to their baseline year.

All 20 companies stated that they measured and reported their emissions in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard [172]. However, there were inconsistencies in how the protocol was applied to Scope 3 emissions. Eleven companies reported across all 15 Greenhouse Gas Protocol categories for Scope 3, three limited their reporting to business travel or flights, and six did not report any Scope 3 emissions.

3.3.5. Emissions reduction strategies

All 20 companies described a range of emissions reduction strategies that they had either implemented or planned to implement (Table 3). Most companies (18-20) reported initiatives aimed at reducing emissions from energy use, primarily targeting Scopes 1 and 2. A broader variety of initiatives were reported for Scope 3 emissions, with companies most consistently engaging in activities focused on optimising waste and water management.

Table 3. Emissions reduction strategies reported by all 20 pharmaceutical companies to reduce Scope 1, 2, and 3 greenhouse gas emissions

Greenhouse gas emission scopes and categories		Emissions Reduction Strategy*	Company	Number (Proportion)
Scopes 1 and 2	**Energy**	Increase renewable energy purchased/ install onsite renewable energy	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	20 (100%)
		Reduce operational energy use e.g., use of energy efficient equipment, timers on equipment	Roche; Novartis; AbbVie; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	19 (95%)
		Optimise energy use in building design e.g., optimise heating, ventilation and air conditions, install LED (Light Emitting Diode) lights	Novartis; AbbVie; J&J; BMS; Merck & Co; Pfizer; Sanofi; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	18 (90%)
		Optimise own manufacturing process through green chemistry principles e.g., increased efficiency of process, reduced water and energy use	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Teva	19 (95%)

	Company-owned vehicles	Convert to energy efficient vehicle fleet e.g., hybrid or electric	Novartis; AbbVie; BMS; Merck & Co; Sanofi; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Astellas	13 (65%)
Scope 3	**Purchased goods/ services**	Implement sustainability criteria in vendor selection processes and encouraging suppliers to disclose environmental performance (e.g., through platforms such as EcoVadis)	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	20 (100%)
		Assist suppliers to convert to renewable energy in their manufacturing processes	Roche; Novartis; J&J; Merck & Co; Sanofi; Pfizer; GSK; AZ; Amgen; Novo Nordisk; Bayer; Viatris; Takeda	13 (65%)
		Source raw materials responsibly (e.g., reduce hazardous substances and precious metals in production processes, use recycled materials in packaging, and ensure protection of biodiversity in sourcing)	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	20 (100%)
		Reduce water consumption or engage in water recycling or reuse projects	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI;	20 (100%)

			Astellas; Viatris; Teva	
	Capital goods	Bought buildings are assessed for environmental sustainability and energy efficiency	Roche; AbbVie; BMS; Sanofi; Pfizer; AZ; Amgen; Gilead; Merck & Co	9 (45%)
	Transportation and distribution	Converting from air to sea/ land distribution	Novartis; BMS; Merck & Co; Sanofi; Takeda; AZ; Eli Lilly; Novo Nordisk; Bayer	9 (45%)
		Implement technology to determine lowest carbon route of transport and distribution	J&J; Eli Lilly	2 (10%)
	Waste production	Efforts to reduce waste generated from manufacturing process	Roche; AbbVie; Novartis; J&J; BMS; Merck & Co; Sanofi; GSK; Pfizer; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	20 (100%)
		Improvement of recycling rates and reuse of waste	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	20 (100%)
		Reduce waste to landfill	Roche; AbbVie; J&J; BMS; Merck & Co; Sanofi; GSK; Takeda; AZ; Amgen; Gilead; Astellas; Eli	16 (80%)

			Lilly; Novo Nordisk; BI; Viatris	
		Implement E-labelling to reduce packaging waste	BMS; Takeda; AZ; Astellas	4 (20%)
		Efforts to reduce food waste	Novartis; J&J; BMS; Sanofi; Gilead	5 (25%)
		Implement auditing of waste and recycling vendors	Roche; AbbVie; Pfizer; Astellas	4 (20%)
	Business travel	Reduce business travel	Roche; Pfizer; BMS; Sanofi; GSK; Takeda; AZ; Novo Nordisk; Bayer; BI	10 (50%)
		Encourage train instead of air travel	Sanofi; Merck & Co	2 (15%)
	Employee commuting	Encourage remote working	Novartis; BMS; Merck & Co; Sanofi; GSK; Viatris;	6 (30%)
		Provide alternative low-carbon ways to get to work (e.g., electric buses to transport staff, charging points at work)	Novartis; Sanofi; Takeda; Bayer	4 (20%)
	Leased assets	Assess leased facilities for energy efficiency	Merck & Co	1 (5%)
	Processing and use of sold products	Use low-carbon propellant in inhalers	GSK; AZ	2 (10%)
		Encourage recycling of insulin syringes	Novo Nordisk	1 (5%)
	End-of-life management	Introduce take-back programmes for products/ promote responsible consumer disposal	Roche; J&J; Sanofi; Pfizer; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk	9 (45%)

		Monitoring system or wastewater treatment systems for pharmaceuticals in the environment	Roche; Novartis; AbbVie; J&J; BMS; Merck & Co; Sanofi; Pfizer; GSK; Takeda; AZ; Amgen; Gilead; Eli Lilly; Novo Nordisk; Bayer; BI; Astellas; Viatris; Teva	20 (100%)
All:	**Carbon offsets**	Support tree planting, anti-deforestation initiatives, water and waste management projects etc.,	Novartis; J&J; BMS; Merck & Co; Pfizer; GSK; Takeda; AZ; Amgen; Eli Lilly; Bayer; BI; Teva	13 (65%)
***Some initiatives will likely reduce emissions across more than one scope, for example, optimising the manufacturing process through green chemistry principles will aid in reducing Scope 1 and 2 energy emissions by improving the energy efficiency of the process, as well as Scope 3 emissions from raw material acquisition; however, for the sake of simplicity, they are only included in the table once.**				

3.4. Chapter summary

This content analysis of public reports from 20 multinational pharmaceutical companies offered descriptive insights into how pharmaceutical companies were approaching climate action – their climate targets, reported emissions, and emissions reduction strategies. I found that 95% (19/20) of the studied companies had published targets to reduce their greenhouse gas emissions. Half (10/20) of the companies had committed to carbon neutrality and 40% (8/10) to achieving net zero emissions, although few of these targets included Scope 3 emissions. All companies reported Scope 1 and 2 emissions in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard. However, reporting practices were inconsistent, with notable data gaps. Only 55% (11/20) of companies comprehensively reported Scope 3 emissions. Despite this incomplete reporting, Scope 3 emissions constituted the largest share of emissions in this study. Companies reported variable reductions in Scope 1 (85%; 17/20), Scope 2 (95%; 19/20), and Scope 3 (64%; 9/14) emissions. Reported emissions reduction strategies

commonly included transitioning to renewable energy, improving energy efficiency, sourcing raw materials sustainably, and reducing waste and water use. Companies also highlighted supply chain interventions such as engaging suppliers, procuring products with lower carbon footprints, and embedding sustainability into procurement policies.

To my knowledge, this was the first study at the time to assess pharmaceutical companies' climate action. However, it had several limitations. Firstly, the study relied solely on publicly available, self-reported company documents, and I recognised the potential for such reporting to emphasise positive climate action and convey an impression of progress towards net zero, while concealing the challenges, tensions, and uncertainties surrounding climate action. Secondly, while content analysis enabled me to generate a useful description of pharmaceutical company climate action, this approach provided only a surface-level view. It lacked the depth and critical insight required to situate these actions within the wider institutional contexts that – as I outlined in Chapter 1 – are deeply interwoven with both climate change and the pharmaceutical industry.

These limitations motivated, shaped, and informed the design of the adapted argumentative discourse analysis component of my research, which formed the central focus of my thesis. The following chapter outlines this research: an adapted argumentative discourse analysis, extended with concepts from impression management theory, of a selection of three multinational pharmaceutical companies. Drawing on both company documents and narrative interviews, this analysis built on the descriptive baseline presented here to examine how actors made sense of, understood, and communicated climate action, and how this shaped, constrained, or enabled climate action by pharmaceutical companies.

Chapter 4: Methodology and methods

4.1. Introduction

In this chapter, I present the methods I used to conduct my adapted argumentative discourse analysis of pharmaceutical company climate action. I state my interpretivist stance, which shaped my understanding of the pharmaceutical industry and climate change and informed my research design. I detail my methodological approach informed by Maarten Hajer's argumentative discourse analysis [173] and analytical concepts from impression management theory [174] which facilitated my study of the discourse and performance around pharmaceutical company climate action (Section 4.2). Adapting Hajer's framework, I elaborate on my sampling, data collection, and analysis (Section 4.3). I conducted initial desk research (see Chapter 3) and helicopter interviews (Section 4.3.1) which guided selection of three pharmaceutical companies, GSK, Novo Nordisk, and Teva Pharmaceuticals, for more detailed study (Section 4.3.2). I collected data from purposively sampled company documents (Section 4.3.3) and narrative interviews (Section 4.3.4) with representatives from each of the selected companies, as well as from the wider industry and health systems, including industry collaborations, pharmaceutical regulatory bodies, international health organisations, policymakers, and health care providers. I analysed my data using concepts from Hajer's argumentative discourse analysis (i.e., storylines, discourse-coalitions, discourse structuration and institutionalisation), impression management theory to explore the performative dimensions of companies' climate action, as well as additional sensitising concepts which helped me explain my findings (Section 4.3.5). In detailing my research methods, I emphasise the non-linearity of my research, which involved a process of iterative sense-making, moving between my data, reading, writing, following storylines, returning to my methodology, and re-examining data. I discuss my reflexivity, exploring my subjective

influence on my research (Section 4.3.6). I present my ethical considerations (Section 4.4) and include a note on geography (Section 4.5), unpacking how, and why, my research findings are sometimes specific to a certain location and at other times geographically abstract.

4.2. Research approach

I employed interpretivism as the lens through which I made sense of pharmaceutical companies' climate action, and which informed my research approach. Interpretivism is an epistemological position that assumes that 'reality' is relative and that people have different understandings, interpretations, and subjective meanings about the social world that shapes their actions [175]. My alignment with interpretivism stems from my perspective that the social world is constructed and subjective and influences pharmaceutical companies and their climate action. As discussed in Chapter 1, climate change is driven by social actions, with effects that are often socially determined. Climate action by pharmaceutical companies involves diverse actors across sectors and geographies, each with varied understandings, interpretations, interests, and beliefs about pharmaceutical companies and climate change – there is no one 'reality'.

This interpretivist lens was central to how I approached my research questions. Interpretivism is rooted in sense-making, the process by which individuals and groups construct and negotiate meaning about phenomena within their social contexts [176]. In asking how pharmaceutical companies approached climate action, what shaped, constrained, or enabled that action, and what could support net zero, I did not seek to just explore emissions reduction strategies, describe barriers and facilitators of action, or map out future trends or technological solutions. Rather, I sought to understand how climate action was understood, framed, communicated, and enacted by companies, how actors' understandings, interpretations, and meanings influenced

action, and what alternative ways of understanding and framing climate action might support net zero progress.

My interpretivist lens guided my research approach. I employed a research approach to collect, analyse, and communicate my findings, informed by argumentative discourse analysis [173] which I adapted and extended with concepts from impression management theory [174]. I first unpack argumentative discourse analysis and then impression management below.

4.2.1. Argumentative discourse analysis

Argumentative discourse analysis is a methodological approach developed by Maarten Hajer to analyse the discursive production of meaning, the actors who construct these meanings, and the practices through which these meanings are produced, reproduced, or transformed [173]. Hajer contends that the meanings that actors allocate to problems shape what courses of action are legitimised. I adapted Maarten Hajer's argumentative discourse analysis to explore the problem of climate action by pharmaceutical companies and how the meaning actors allocated to climate action shaped, constrained, or enabled it.

In argumentative discourse analysis, discourse refers to a set of concepts that structure the contribution of actors to a discussion, as defined by Hajer: "*an ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices*" [173][pg67]. Here, practices are defined as "*embedded routines and mutually understood rules and norms that provide coherence to social life*" [173][pg70].

To analyse the discursive production of meaning and the practices that shape issues, such as climate action, Hajer proposed a set of analytical concepts, including storylines, discourse-coalitions, discourse structuration, and discourse institutionalisation [173]. Storylines are

condensed statements that summarise complex narratives. Hajer suggests that storylines reflect the way actors conceptualise and give meaning to an issue, often drawing on elements of multiple discourses. This enables individuals from different discursive backgrounds to engage in shared conversations, despite underlying differences in assumptions or values. Hajer terms this phenomenon, discursive affinity, the idea that arguments with distinct discursive origins can converge in similar ways of conceptualising an issue, allowing for alignment across diverse perspectives.

Hajer's concept of discourse-coalitions refers to the groups of actors who share the use and meaning of particular storylines and participate in the practices through which these storylines are produced [173]. This concept enables an analysis of how actors align themselves with storylines and contribute to the reproduction or transformation of discourses, and thereby influence practices, such as those surrounding climate action. Importantly, Hajer emphasises that the same actors may articulate seemingly contradictory statements or participate in multiple discourse-coalitions, reflecting the fluid and contested nature of meaning-making. The politics of an issue, from this perspective, is understood as a process through which actors from diverse backgrounds form and shift coalitions around specific storylines in an ongoing struggle over problem definitions and legitimate responses [177].

While storylines and discourse-coalitions often draw on elements from multiple discourses, Hajer argues that certain discourses can come to hold a dominant position within a particular context [173]. He offers two concepts to assess the dominance of a particular discourse: discourse structuration and discourse institutionalisation. Discourse structuration occurs when a discourse begins to shape the way a social unit (e.g., a company) conceptualises and discusses an issue. Discourse institutionalisation takes place when this discourse solidifies into institutional arrangements and practices, such as formal procedures, standards, or regulatory

frameworks. When a discourse is widely adopted by actors and becomes reflected in institutional practices, it can be seen as having achieved dominance within that context.

I employed argumentative discourse analysis to examine the discursive production of meaning surrounding pharmaceutical companies' climate action, specifically, which discourses dominated, which actors reproduced these discourses, and how these shaped, constrained, or enabled pharmaceutical company climate action. To capture the performative dimensions of what actors said, both verbally and in text, I incorporated concepts from impression management into my analysis. These concepts allowed me to consider how actors strategically manipulated problem definitions, constructed and maintained particular impressions, and influenced organisational practices. I elaborate on this in the following section.

4.2.2. Impression management

I adapted my argumentative discourse analysis, incorporating concepts from impression management theory [178-180], which has its roots in dramaturgical theory, initially proposed by Erving Goffman [174]. In particular, I focused on organisational impression management, where organisations (i.e., companies) selectively disclose information (e.g., on climate action) to construct a desired impression [178]. Concepts related to impression management were helpful in sensitising me to the performative nature of pharmaceutical companies' reported climate action.

In his development of dramaturgical theory, Goffman metaphorically used theatre to suggest that individuals and organisations, in their interactions, use language, acts, and contrived settings to enact a 'performance' [174]. This performance involves accentuating and suppressing certain information and implies that meanings given to a certain problem or situation are constructed and must be continuously reproduced and 'enacted' in a particular 'setting'. Goffman

distinguished two regions of this setting: the backstage, where actors openly discuss and construct their performance, define the situation, and decide what information to present, and the frontstage, where the carefully constructed, often idealised, performance is enacted in the presence of others. The performance serves as a point of tension between an intended impression and its acceptability to an audience; it is where trust and credibility is constantly updated.

Building on Goffman's dramaturgy, is a body of academic literature on impression management, expanding beyond its sociological roots to encompass psychology, communication, media, and politics [180-182], and beyond its focus on the individual, to analysis of organisations and institutions. Early work in organisational impression management proposed that it is a rational process driven by organisations seeking to bridge the gap between a current and desired situation, especially evident in public or externally validated situations, such as company climate action [178]. The application of impression management theory has also expanded to analysis of artifacts. This application is prevalent in accounting research, particularly the analysis of texts in corporate reporting [179], where organisations are suggested to manipulate and misrepresent corporate disclosures to mislead investors, forestall negative impact, retain control over information, and establish organisational trust and legitimacy [183].

Goffman initially proposed tactics for maintaining impressions, including 'accounts' (explanations for negative events), 'excuses' (denying responsibility for negative outcomes), 'opinion conformity' (speaking or behaving in ways consistent with audience expectations), and 'strategic ambiguity' (deliberate vagueness in provided information) [174]. This typology has since expanded [180, 181]. A review of impression management literature identified more than 30 behaviours labelled as 'impression management' [184]. Corporate practices around reputation management, for example, can be understood as a specific, strategic form of organisational

impression management, aimed at shaping external perceptions to build trust, legitimacy, and credibility with stakeholders [185].

In the context of climate change, greenwashing can be considered a type of organisational impression management tactic focused on environmental reporting [46]. Greenwashing involves the conscious accentuation and suppression of information in climate reporting to construct an impression and bridge the gap between actual and desired 'reality' [186]. Drawing on Goffman's concepts of regions, greenwashing implies variable access to information, suggesting that companies control the information that they present on the frontstage (e.g., in company reports). Furthermore, greenwashing is not a passive phenomenon. Greenwashing depends on external accusation; it is "*constituted in the eye of the beholder*" and constructed by a range of actors [187]. This echoes Goffman's view on performance; it may not always be successful, and the impression that actors aim to maintain might fail. This has contributed to a more recent concept in impression management literature – greenhushing – where companies deliberately avoid publicly reporting legitimate environmental initiatives and achievements to evade scrutiny and criticism [188].

To summarise, my research approach was rooted in interpretive sense-making and informed by analytical concepts from argumentative discourse analysis and impression management (summarised in Box 1 below). In the next section, I detail my methods.

4.3. Methods

I conducted my sampling, data collection, and data analysis informed by Hajer's argumentative discourse analysis, which I adapted, and within which I incorporated analytical concepts of impression management. Hajer proposed ten 'steps' for engaging with argumentative discourse

analysis: 1) desk research, 2) helicopter interviews, 3) document analysis, 4) interviews, 5) analysis of sites of argumentation, 6) analysis of positioning effects, 7) identification of key incidents, 8) analysis of practices in particular cases of argumentation, 9) interpretation, and 10) a second visit to key actors [173]. For my research, I adapted these steps (see Box 1) and report my research methods against them, incorporating examples from my findings to elevate my data collection and analysis out of the abstract.

I report desk research and helicopter interviews together as I engaged with these in parallel to inform my research focus and approach (see Chapter 3). I include an explanation of my selection of three pharmaceutical companies for detailed analysis of their climate action. Aligned with Hajer's framework, I collected data from purposively sampled company documents, webpages, and press releases and narrative interviews with representatives from the three pharmaceutical companies included in my study and actors from the wider industry and health systems. I present my data analysis and interpretation informed by steps five to nine of Hajer's framework, extended with concepts from impression management. I conclude with reflexivity.

Box 1. Overview of research methods, adapted from Hajer's argumentative discourse analysis and incorporating analytical concepts from impression management [173, 174]

1. **Desk research and helicopter interviews:** I conducted general scoping of documents relevant to my research area and had informal conversations with individuals to map existing perspectives in the research area and establish networks of participants. This work formed the basis of my content analysis of company documents, presented in Chapter 3.
2. **Selection of pharmaceutical companies:** Informed by desk research and helicopter interviews, I selected three pharmaceutical companies for more detailed study of their climate action.
3. **Document sampling and collection:** I collected data from company documents, webpages, and press releases that focused on companies' climate action.

4. **Interview sampling and narrative approach:** I conducted narrative interviews with twenty-one representatives from the included pharmaceutical companies as well as actors from wider industry and health systems.
5. **Data analysis and interpretation:** I analysed data, drawing on concepts from Hajer's argumentative discourse analysis, extended with concepts from impression management. Through interpretive moments (e.g., familiarisation, writing, theorising), I identified key storylines that served as analytical entry points to generating an account of the discourses at play, the actors who shared them, and the practices through which they were produced. I outline the analytical concepts I used below:
    a. Identification of key 'storylines', condensed statements summarising complex narratives and underpinned by elements of various discourses. I also identified 'counter-storylines' which challenged storylines by offering alternative framings or critiques.
    b. Analysis of positioning effects arounds storylines and formation of 'discourse-coalitions', groups of actors that shared the usage and meaning of a particular storyline within a particular context.
    c. Analysis of practices (i.e., embedded rules or norms) in which discourses were produced and exploration of how, and which, discourses dominated the way actors conceptualised climate action, 'discourse structuration' and solidified into institutional practice, 'discourse institutionalisation'.
    d. Consideration of how, and why, climate-related information was accentuated or suppressed by included companies through 'impression management' tactics (e.g., omission, concealment, exemplification etc.).
6. **Reflexivity:** I reflect on my subjective beliefs, opinions, and lived experience and how this influenced the research process.

4.3.1. Desk research and helicopter interviews

I began by conducting desk research and helicopter interviews. Desk research involves a general survey of documents in a given topic to develop an initial reading of the research space, while helicopter interviews are informal conversations with a small number (e.g., 3-4) of key actors chosen for the different perspectives they may have to offer [173]. I searched online databases

for literature related to the pharmaceutical industry's climate impact and read available published and grey literature on this topic, to familiarise myself with the broad research area (see Chapter 2). My content analysis of pharmaceutical company documents (see Chapter 3) formed part of this wider desk research, to attain an initial understanding of the research space. Concurrently, I engaged in helicopter interviews, having informal conversations, usually online, with key actors at the intersection of health, pharmaceuticals, and climate change (e.g., climate experts, health system policymakers, and industry sustainability leads), who I identified through a google search, reached out to via email, or was referred to by individuals familiar with the research space. These actors were able to provide me with a range of perspectives on historical and current climate action in the health care and pharmaceutical sectors, and where the research gaps were.

The desk research and helicopter interviews served several purposes. Firstly, they allowed me to familiarise myself with concepts integral to understanding and exploring climate change, for example, climate terminology, methods for greenhouse gas emission quantification, and types of emissions reduction strategies. Secondly, I was able to gather insights and perspectives on the research area and where the gaps were, which honed my research focus. Thirdly, I was able to acquaint myself with the structure of the pharmaceutical industry and companies within it, for example, the division between and nature of branded and generic pharmaceutical companies, and the geographical location of companies. Through my content analysis study, I also gained a broad overview of the current engagement of pharmaceutical companies with climate change, for example, which companies had climate targets, which reported on climate issues, and where they reported climate information (e.g., in publicly available company documents). This informed my sampling strategy of companies and documents which I describe in the next sections. Finally, I was able to map the actors influencing pharmaceutical companies' climate action, including industry bodies and peers, suppliers, investors, corporate and medicines regulatory bodies, health system policymakers, pharmaceutical procurement teams, health care providers,

academics, patients, advocacy groups, and through the helicopter interviews, establish networks of actors to engage in my research interviews (see Section 4.3.4). In sum, the desk research and helicopter interviews allowed me to attain a general understanding of the research area and hone my research focus. This step informed my sampling and served as an initial base of contacts for interviews.

4.3.2. Selection of pharmaceutical companies

Building on my background understanding of the research area and the pharmaceutical industry, gained through desk research, including my content analysis of company documents, and helicopter interviews, I selected four pharmaceutical companies for detailed study: GSK, Novo Nordisk, Teva Pharmaceuticals, and Dr Reddy's Laboratories. I purposively selected these multinational companies for their commitments to net zero and active engagement with climate change, aiming for a mixture of branded and generic companies.

The selection of GSK and Novo Nordisk was driven by these being pharmaceutical companies publicly committed to net zero targets (see Appendix Figure 1) across their entire supply chains at the time of selection (December 2022). I included Teva and Dr Reddy's to provide insights from multinational generic pharmaceutical companies. As outlined in Chapter 2, there are key differences between branded and generic pharmaceutical companies (e.g., historical origin, geographical location, profit margins) and I sought to include a mixture of perspectives on climate action from both types of companies. At the time of selection, no generic companies had net zero targets across their entire supply chain; however, Teva and Dr Reddy's had set near-term climate targets aligned with the Science Based Targets initiative (see Chapter 1 and Glossary of Terms). Despite multiple attempts to gain access to representatives from Dr Reddy's, I received no

engagement, thus my final selection of pharmaceutical companies comprised GSK, Novo Nordisk, and Teva Pharmaceuticals.

My selection of these companies had a strategic element. I anticipated potential challenges in accessing companies with less favourable climate action who might be unwilling to undergo scrutiny. Approaching companies who had set net zero (or similar) targets to learn from their climate action was expected to facilitate accessibility. Therefore, my selection of companies with commitments to net zero (or similar) was a pragmatic approach that balanced research limitations, such as time constraints and access considerations, against the depth and breadth of data needed to explore pharmaceutical companies' climate action.

The three selected companies offered a multinational perspective. They are headquartered in specific locations, but have offices, manufacturing sites, suppliers, and customers across multiple nations. With histories spanning 100 years or more, these companies reflect the stable historical origins of the pharmaceutical industry (see Chapter 2), have a robust history of scientific research, industrialised product development across various therapeutic areas (e.g., GSK on respiratory conditions, Novo Nordisk on diabetic products, and Teva on generics), and a level of maturity and stability within the global economy. As multi-billion-dollar, publicly listed entities, with boards of directors and shareholder accountability[5], they embody characteristics typical of companies within the broader pharmaceutical industry. Within the jurisdictions in which the three companies operate, they are subject to varying regulation related to financial and non-financial activities (e.g., ESG reporting). An overview of the three companies can be seen in Table 4.

[5] This differs slightly with Novo Nordisk, which has a Foundation ownership structure under which a holding company, Novo Holdings A/S, holds approximately a quarter and three-quarters of Novo Nordisk's shares and voting shares respectively.

Table 4. Overview of selected pharmaceutical companies, data drawn from company webpages accessed in December 2023

Overview	GSK	Novo Nordisk	Teva
Company mission	Unite science, technology, and talent to get ahead of disease together	To drive change to defeat diabetes and other serious chronic diseases	To be a global leader in generics and biopharmaceuticals, improving the lives of patients around the world
Product focus	Vaccines (>20) Speciality medicines (cancer, respiratory disease, HIV) General medicines (inhalers, antibiotics, dermatology) Generic medicines	Diabetes Obesity Cardiovascular disease Rare diseases Hormone therapies Haemostasis management	Generic medicines Innovative therapeutic areas (movement disorders, neurodegeneration, migraines, neuropsychiatry, oncology, and respiratory)
Founding year*	1715	1923	1901
Headquarters	London, UK	Copenhagen, Denmark	Tel Aviv, Israel
Operational countries**	112	170	60
No. of manufacturing sites	37	16	53
No. of employees	70,000	59,000	37,000
No. of suppliers	24,000	60,000	48,000
2022 Revenue	$36 billion	$25 billion	$14.9 billion
Ownership structure	Publicly listed	Publicly listed Foundation ownership	Publicly listed

*Of oldest legacy company
**Countries in which companies have manufacturing and research and development sites, as well as to which they supply products

Next, I detail my data collection, which included (a) company documents, which provided initial reference points for making sense of companies' climate action, and (b) narrative interviews with representatives from the included companies, and wider industry and health systems, which allowed me to explore interviewees understanding of and meaning they ascribed to companies'

climate action, and to clarify, corroborate, and refine my preliminary interpretation from documents [189]. Sample extracts of company documents and interviews can be found in the Appendix.

4.3.3. Document sampling and collection

Documents are textual representations through which discourses are produced, reproduced, and shared by actors [190]. Documents offer insights into how actors frame and communicate issues, and suggest avenues for exploration in other data sources (e.g., interviews) [191]. Examining documents allowed me to analyse companies' reported climate action and identify areas to further delve into during interviews. Additionally, documents were chosen as a data source due to their ease of accessibility, low research cost, unobtrusiveness, and their ability to present a stable (albeit potentially 'performative') representation of the climate action companies aimed to convey. I discuss my sampling approach and data collection from documents below.

4.3.3.1. Document sampling

My sampling frame included (a) all published company documents available in online company archives, (b) webpage texts, and (c) company press releases, reflecting activities of the year January to December 2022. I downloaded all these texts and manually searched them for mention of climate change. From these texts, I purposively sampled all company documents, webpage texts, and press releases that detailed companies' engagement with climate change (e.g., their reported greenhouse gas emissions, climate targets, emissions reduction strategies, and net zero strategy).

My sampling of a range of company documents, webpage texts, and press releases allowed me to develop a perspective of climate action across various document genres and reflected differences in the location of company reporting on climate change. For example, Novo Nordisk presented the bulk of their climate action on their webpage while Teva reported components of theirs in press releases. The focus on the most recent year, at the time of document sampling, was deliberate, considering that company climate commitments were recent[6], and to explore how companies were engaging with climate change within their current institutional context (i.e., the formal and informal rules, norms, values, and systems that influence how organisations are structured and function [4]). I sampled those documents that presented a detailed account of companies' climate action. Not all documents published for the year 2022 presented companies' climate action (e.g., financial reports focused on companies' financial statements) and these were excluded from my sample. Documents that repeated information or made brief cross-reference to companies' climate action that was detailed in other documents were also excluded. For example, Novo Nordisk had a Remuneration Report that included information on executive remuneration for meeting climate targets; this information was already present in their Annual Report. I asked the selected companies for any additional internal documents that detailed their climate action but was denied access to any.

Table 5 summarises the texts that I sampled for my research. I focused on sections of text within documents that were relevant to climate change, indicated in Table 5 by the number of pages in each document that included data on climate change.

[6] GSK committed to net zero in 2021 and adjusted it in 2022 to align with the Science Based Targets initiative, Novo Nordisk to net zero in 2021, and Teva set science-based targets in 2022.

Table 5. Texts sampled for document analysis

Text	Focus	Pages on climate
GSK		
Ahead Together: Annual Report 2022 [192]	Presents information related to financial and non-financial activities. It includes information on climate governance, climate-related financial disclosures, climate risk assessments, climate targets and some strategies, and climate performance rankings alongside reporting on financial disclosures.	21/320
Environmental, social, and governance (ESG) Performance Report 2022 [193]	Presents information on ESG focus, strategies, and performance, including climate change. Reports their climate targets, greenhouse gas emissions, and some emissions reduction strategies.	11/55
Basis of Reporting 2022: Environmental Data [194]	Provides the methodology for measuring their greenhouse gas emissions.	11/16
ESG Environmental Data 2022 [195]	Table of reported greenhouse gas emissions.	2/2
Our Pathway to Net Zero Impact on Climate 2023 [196]	Provides additional detail on the pathway they are following to reach net zero, including climate targets, value chain footprint, priority actions to reduce emissions, and graph projecting emissions reduction to net zero.	7/7
Sharing our Journey to Net Zero and Nature Positive for a Healthier Future 2022 [197]	Details further examples of emissions reduction strategies to reach net zero.	6/7
Putting Health at the Centre of Action on Climate and Nature 2022 [198]	Details the interconnections between climate, nature, and health, and key action areas.	11/11
Novo Nordisk		
Annual Report 2022 [199]	Presents information related to financial and non-financial activities. It includes information on climate governance, climate-related financial disclosures, greenhouse gas emissions, climate risk assessments, climate targets and some strategies, and climate performance rankings alongside reporting on financial disclosures.	9/110

ESG Portal [200]	A range of webpage tabs that provide information on climate targets, emissions reductions to date, and emissions reduction strategies to reach net zero.	Multiple webpage tabs
Teva Pharmaceuticals		
ESG Progress Report 2022 [201]	Presents information on ESG focus, strategies, and performance, including climate change. Reports their climate targets, their greenhouse gas emissions, and some climate strategies and case studies.	13/68
ESG Progress Report Disclosures 2022 [202]	Presents ESG disclosures according to Global Reporting Initiative, Sustainability Accounting Standards Board, and Task Force for Climate-Related Financial Disclosures. Provides methodology for greenhouse gas emission calculations.	13/68
News and Media [203]	A range of featured stories on climate engagement, detailing climate targets and emissions reduction strategies.	Multiple press releases

4.3.3.2. Data collection

I collected all company documents reflecting activities of the year January to December 2022 that met my sampling criteria described above (refer to Table 5). I downloaded and saved documents (over the period 24 March to 9 May 2023) that were published in PDF format and copy-pasted texts from company webpages and press releases into a Microsoft Word document.

4.3.4. Interview sampling and narrative approach

Documents offer a formal account of 'meaning'; however, they often present only a partial, sometimes aspirational (or 'performative'), account [204]. I, therefore, sought to uncover what was happening 'behind-the-scenes' of these documents, the nuances, tensions, decision-making processes, and efforts that led to the published end-product. I adopted a narrative interview approach, through which I aimed to explore perspectives on companies' climate action, understand how company climate action was unfolding, who was involved, what actions were

being taken, and how, and the associated tensions, challenges, and opportunities [205, 206]. I discuss my sampling and narrative approach to interviews below.

4.3.4.1. Interview sampling

I employed a combination of purposive maximum variation sampling and snowball sampling to identify input to my research from (a) diverse representatives from across the three pharmaceutical companies included in my study, and (b) actors from the wider industry and health systems, who appreciated – and potentially shaped – pharmaceutical companies' climate action.

Focusing first on representatives[7] from the three pharmaceutical companies, I purposively sought interviewees occupying a diversity of roles related to the companies' climate action, spanning strategic executive leadership and operational implementation, to gain insights into their respective companies' climate action. My sampling approach was iterative. I began by identifying relevant actors from desk research, helicopter interviews, company websites, and documents (e.g., some company documents included contact details of the sustainability lead), who I emailed interview invitations, and one follow-up email in cases of no response. I was able to obtain interviews with current and previous employees from all three pharmaceutical companies (excluding Dr Reddy's Laboratories). For current employees, these interviewees were allocated to me by the companies, and I had little, if any, choice in selecting interviewees beyond the request that they be involved in the company's climate action. This group then comprised of two interviewees who occupied current executive and senior positions within their respective

[7] I acknowledge that my interviewees, often occupying executive positions within organisations, might have undergone 'media training', potentially influencing the information they provided. I made efforts to create an environment where interviewees felt comfortable being open during interviews. However, I remained aware that they were likely presenting a specific impression of climate action (see impression management) and their company's interaction with it. Liu, X. Interviewing Elites: Methodological Issues Confronting a Novice. International Journal of Qualitative Methods. 17:1-9. 2018.

companies' sustainability teams, and two interviewees who were previously employed by the pharmaceutical companies in a sustainability executive and project manager position respectively. Despite my attempts to interview multiple individuals within each company, the companies were unwilling to grant me more than one interview in most cases.

Turning to the wider industry and health systems, I sought interviews with a diverse group of actors across geographies, who appreciated or potentially shaped pharmaceutical companies' climate action, to provide perspectives on company climate action and the wider institutional context in which the companies were operating. As with company interviewees, I identified relevant actors from desk research, helicopter interviews, and websites, and emailed interview invitations, and one follow-up email in case of no initial response. After each interview, I sought interviewee recommendations from participants, utilising snowball sampling [207]. I made additional sampling decisions of the snowball suggestions, aiming to capture perspectives from a range of relevant actors spanning geographies due to the industry's global nature.

This multifaceted approach facilitated the gathering of diverse perspectives, from actors within the wider industry and health systems, regarding companies' climate action. I conducted interviews with sustainability leads within industry trade associations and collaborations to capture broader industry views on climate action. To provide external expertise, I obtained interviews with climate consultancies, offering insights from experts engaged in companies' climate strategies. Perspectives from non-governmental organisations focused on environmental and health issues were sought to understand third-sector engagement with pharmaceutical companies' climate action. Furthermore, an individual from an international health organisation, involved in climate and health initiatives, was interviewed to gather insights from a global health perspective. I also conducted interviews with a diverse array of professionals working within health systems, including doctors, pharmacists, policymakers, executive strategists, and

sustainability experts. Additionally, perspectives from a standards body and pharmaceutical regulatory agency were included in the study.

I approached representatives from other organisations that did not respond and were ultimately not represented in the final interview set (e.g., Sustainable Healthcare Coalition, International Federation of Pharmaceutical Manufacturers and Associations). Despite attempts at gaining interviews with patients, I was unsuccessful. The patient groups I reached out to told me that they had no knowledge of this research space and did not feel they could offer any insights.

From the above sampling approach, I interviewed twenty-one individuals (outlined in Table 6), two from GSK, one from Novo Nordisk, and one from Teva, with the remainder from the wider industry and health systems. Interviewees came from a range of geographies including the UK, USA, Denmark, Netherlands, France, Spain, South Africa, and India.

This was a niche community, and interviewees were easily identifiable from their job titles. For some, current and historical roles overlapped. For example, one interviewee had previously worked for an industry trade association and now worked for a pharmaceutical regulatory agency. To ensure anonymity, I assigned each interviewee a general description and identification label (see also Section 4.4). These descriptions are used in Table 6 below, and in findings chapters where illustrative quotes are included. Across my findings chapters, I categorise actors as either from ‘pharmaceutical companies’ (including industry representatives) or ‘health systems’ to reflect the distinct institutional contexts shaping their perspectives.

Table 6. Overview of interviewees

Identification label	Date	Method	Length	Descriptor
Pharmaceutical company representatives				
PC1	11/05/23	Online	50:29	Sustainability Executive, Pharmaceutical Company
PC2	11/05/23	Online	48:12	Senior Environmental Strategist, Pharmaceutical Company
PC3	12/05/23	In-person	116:24	Senior Sustainability Director, Pharmaceutical Company
PC4	22/05/23	Online	54:49	Sustainability Project Manager, Pharmaceutical Company
Industry representatives				
IN1	13/04/23	Online	41:02	Sustainability Working Group Member, Industry Trade Association
IN2	08/06/23	Online	51:20	Senior Lead, Pharmaceutical Collaboration
IN3	18/07/23	Online	54:25	Sustainability Director, Industry Collaboration
IN4	28/04/23	Online	53:59	Director Pharmaceutical Portfolio, Climate Consultancy
IN5	28/04/23	Online	53:59	Client Manager Pharmaceutical Portfolio, Climate Consultancy
IN6	12/11/23	In-person	56:31	Executive, Climate Consultancy
Health system representatives				
HS1	10/05/23	Online	51:11	Sustainability Expert, Health System
HS2	09/06/23	Online	53:53	Sustainability Director, Health System
HS3	15/06/23	Online	62:29	Environmental Officer, Intergovernmental Health Organisation
HS4	16/06/23	Online	53:58	Sustainability Director, Non-profit Health Organisation
HS5	21/07/23	Online	53:25	Pharmaceutical Lecturer and Academic, Health System
HS6	25/08/23	Online	55:04	Senior Sustainability Lead, Health Insurance Company
HS7	25/08/23	Online	55:04	Environmental Lead, Health Insurance Company
HS8	25/09/23	Online	54:29	Chief Pharmacist, Health System
HS9	02/10/23	Online	53:05	Executive Strategist, Health System
Other representatives				
O1	07/06/23	Online	52:54	Senior Director, Standards Body
O2	25/08/23	Online	60:05	Scientific Director, Regulatory Agency

4.3.4.2. Interview approach

I employed a narrative approach to interviewing. Narrative interviews provide actors with the opportunity to tell a story, share experiences, contemplate explanations, and make sense of phenomena, unconstrained by the typical question-answer schema [208]. Through narrating, actors reconstruct actions and contexts, connecting events in time and meaning, with a focus on sense-making [189].

I began interviews by introducing myself, discussing my research, providing time for questions, and seeking formal consent before recording. All interviewees agreed that I could record interviews and use quotes, with some on the condition I referred these back to them to obtain permission. I asked interviewees to tell me about their role and experience with pharmaceutical company climate action, which sensitised me to their perspective (e.g., that of someone who 'implements' pharmaceutical company climate action or who makes climate requests from companies in procurement tenders). Employing a narrative approach [205], I then asked interviewees how pharmaceutical companies are approaching climate action. Responses to this initial question uncovered a range of narratives; some interviewees spoke about scientific and technological approaches to reaching net zero, some about challenges of the geopolitical landscape, others about tensions involved in enacting climate action within a corporate space. I asked follow-up questions of interviewees to clarify or elaborate on aspects of what they had said, remaining cognisant of my research focus to keep boundaries on the interview. With some interviewees, I focused on insights they were uniquely positioned to provide. For example, I explored regulation on climate change with the pharmaceutical regulator. Most interviewees, especially those not affiliated with a company, gave a largely general perspective, commenting on the whole industry as opposed to individual companies, although specific companies were sometimes mentioned as examples. Therefore, my findings consist of a combination of general

commentary on the industry, interspersed with specific examples, primarily from the included companies (see also Section 4.5).

Interviews were conducted over seven months, between 13 April and 12 November 2023, and lasted between 41 and 116 minutes. Two interviews were attended by two participants from the same organisation concurrently (see Table 6). Most interviews occurred online using Microsoft Teams, with two conducted in person. During interviews, I actively listened, took notes, and reflected on interviewees statements in a rolling Word document (e.g., I noted patterns emerging across interviews such as frequent mentions of tension between climate action and patient wellbeing). Interviews were recorded using a hand-held audio recorder and the Microsoft Teams recording function. Recordings were transcribed by an independent transcriber. Subsequently, I engaged with transcribed interview texts and my notes on each interview.

4.3.5. Data analysis and interpretation

As described above, I collected a range of data in the form of PDFs of company documents, copy-pasted text from webpages and press releases, notes from interviews, and transcribed interviews. I analysed this data employing analytical concepts from Hajer's argumentative discourse analysis and impression management theory (refer to Section 4.2 and Box 1). Here, I describe the ways in which I analysed and made sense of my data, noting that analysis began in parallel with data collection, and key interpretive moments through which I generated an account of my findings.

I began by analysing company documents, initially focusing on each individual company, and then analysing documents across the three companies. I read each document multiple times to familiarise myself with the data, noting the content of the documents, how content was presented, the location of climate information within documents, and initial thoughts on patterns

in a Microsoft Word document. I "*asked questions of my data*" [209][pg4] guided by my research focus; for example, what was the companies' reported climate action to reach net zero, how did they frame climate action in documents, did they note any external factors that influenced their climate action. I searched for initial patterns across the documents, noting repetition of statements that reflected particular storylines. For example, there were frequent statements in documents about the importance of access to safe, quality medicines for patients, which reflected storylines around patient wellbeing (see Chapter 5). Documents, in particular, provided information on disclosed greenhouse gas emissions which I recorded and from which I developed summary tables and a graph (see Chapter 7). For example, I collated the three companies reported greenhouse gas emissions into one table (Table 7) and input the values into a bar graph to aid visualisation of emissions hotspots (Figure 3).

In analysing documents, there were instances where I purposively referred to external documents to make sense of wider contextual information [176]. For example, I referred to the Science Based Targets Initiative Net Zero Standard and Greenhouse Gas Protocol Corporate Accounting and Reporting Standards to understand company emissions quantification and disclosure (see Chapter 7). I also referred to historical company documents, for example, to determine when they had first reported Scope 3 emissions. Where I have referenced additional texts in the findings, I have made this clear.

In analysing interviews, I similarly read and re-read the transcribed interviews and notes to familiarise myself with their content. I went line-by-line through interviews, inserting comments on what interviewees were saying. I made analytical notes, tested my initial hunches from the document analysis (e.g., interviewees echoed storylines around patient wellbeing) and noted additional patterns across the interview data (e.g., interviews surfaced commentary related to patient care pathways that was absent in documents – see Chapter 7).

I then analysed documents and interviews in parallel, working from the initial patterns I had developed across my data, focusing on sites of argumentation, instances where there was tension, contradiction, conflict, or debate between actors around an issue, and employing discursive and impression management concepts to deepen my analysis [173]. I identified storylines and counter-storylines, which I used as analytical entry points to unpack the various discourses at play, the actors who shared these storylines (discourse-coalitions) and mobilised these discourses, and how these discourses shaped companies' climate action. For example, I identified a storyline that climate action conflicts with patient wellbeing (see Chapter 5). This storyline was shared by a discourse-coalition comprising a wide range of pharmaceutical company and health system actors I interviewed. It was underpinned by a biomedical discourse, in which patient wellbeing was equated with the provision of pharmaceutical products, and through which pharmaceutical climate impact was justified. Alongside this, I identified a counter-storyline positioning climate action as integral to patient wellbeing. This was advanced by a subset of actors within the same coalition, drawing on a planetary health discourse that emphasised the interdependence of human and planetary wellbeing.

I drew on Hajer's concepts of discourse structuration and discourse institutionalisation (see Section 4.2.1) to analyse the dominance of particular discourses and how they shaped pharmaceutical company practices related to climate action. For example, in my data, I observed the institutionalisation of a technocratic discourse that prioritised quantification and the disclosure of emissions data. This discourse was embedded in formal company practices, such as company emissions reporting, and was reinforced through external practices, most notably, health system procurement requirements mandating the provision of emissions data by companies (see Chapter 7).

To enhance transparency and demonstrate the credibility of my analysis, Box 2 presents a worked example showing how I moved from raw data to my findings. The example is drawn from the

storyline ‘climate action conflicts with patient wellbeing’ (see Chapter 5). It illustrates how I analysed data from documents and interviews through successive layers of interpretation: making analytical notes on raw data, identifying storylines, recognising underlying discourses, mapping discourse-coalitions, observing institutionalisation through practices, and deriving interpretive insights. This process was repeated iteratively across my dataset for each storyline presented in the findings’ chapters.

Box 2. Worked example illustrating the analytical process from data to interpretation for the storyline 'climate action conflicts with patient wellbeing'

Examples of raw data excerpts
"Of course, serving the patients should always come first." (PC1)
"Everyone, everywhere should have access to quality medicines." (Teva ESG Report)
"Medicines isn't a hyperspace where we can actually just say, we are not buying it from you … We are not going to remove the supply of medicines to patients who particularly need them." (HS2)
"They are providing the world's medicines…don't need to report or reduce our climate impact." (PC4)
"Supply chain constraints have forced us to increase our use of airfreight to ensure timely delivery of our medicines to patients globally." (Novo Nordisk ESG Report 2021)
"Inherent challenges in reducing emissions at a time when demand for our life-changing medicines is growing rapidly." (Novo Nordisk ESG Report 2021)
"It's a sort of life-and-death situation versus it's just the planet." (IN4)
"When one medicine is a lot better for a patient than the other, but the other is a lot better for the environment, that will be a real ethical dilemma." (HS5)
"I have to say in the health care industry there has certainly traditionally been a view that we are saving lives and so, you know, the planet comes second." (IN6)

Analytical notes
Recurrent emphasis on duty to patients.
Narrow framing of patient wellbeing; duty to patients equated with pharmaceutical provision
Climate impact justified through patient access to pharmaceuticals.
Climate action framed as secondary concern or in conflict with patient wellbeing.
Binary opposition between 'health' and 'climate'.
No direct evidence offered that climate action harms patients.

Storyline identified
Climate action conflicts with patient wellbeing.

Aspects of the underlying discourse
Biomedical discourse:
- Frames patient wellbeing as illness-focused, individual, immediate, and short-term.
- Equates patient wellbeing with pharmaceutical provision; neglects wider socio-economic-environmental determinants of health or non-pharmaceutical treatments.
- Constructs a dichotomy between climate action and patient wellbeing, justifies climate impact from pharmaceutical provision, and frames climate action as a potential risk to patients.

Discourse-coalition (actors articulating the storyline)
Pharmaceutical company actors – sustainability leads, executives, company reports.
Health system actors – procurers, prescribers, regulators, policymakers.

Practices/ evidence of discourse institutionalisation
Company mission statements prioritising patient access to pharmaceuticals.
Regulatory frameworks centred on patient pharmaceutical safety.
Corporate reports justifying emissions to ensure patient access to pharmaceuticals.
Procurement policies prioritising patient wellbeing (i.e., pharmaceutical provision) over climate action.
Prescribing practices privileging short-term individual care over long-term patient and planetary health.

Interpretive insight
The storyline and underlying biomedical discourse equate patient wellbeing with pharmaceutical provision, providing justification for limited climate action to reduce pharmaceutical emissions. Through institutionalised practices, this discourse renders climate action conditional on ensuring pharmaceutical provision, thereby legitimising climate impact and delay of climate action.

My data analysis was further sensitised by analytical concepts from impression management to explore how and why actors strategically constructed and maintained particular meanings and impressions of pharmaceutical company climate action. Across my findings, I identified performative strategies by pharmaceutical companies, such as the accentuation and suppression of information, as well as the use of strategic ambiguity to manage how climate action was perceived by different audiences. For example, pharmaceutical interviewees described extensive internal deliberations surrounding the publication of emissions data, shaped by factors such as corporate trends, market expectations, and regulation (see Chapter 7). In contrast, health system actors perceived these disclosures as lacking transparency and driven by a desire to maximise profit while minimising financial and reputational risk (see Chapter 6). In this example, companies' selective disclosure of emissions data contributed to the formation of distinct discourses and coalitions.

As my analysis progressed, I incorporated additional sensitising concepts to help interpret my findings, particularly the discourses at play and the broader assumptions, values, and principles they reflected. This approach reflects Wilkinson's idea of 'writing theory back in', which challenges the practice of applying predefined theoretical categories from the outset and advocates for generating rich, grounded descriptions before introducing theoretical concepts that illuminate the data [210]. For example, in analysing the storyline that climate action requires more collaboration (see Chapter 8), I found the concept of techno-optimism useful for theorising how collaboration was discursively framed as a mechanism to accelerate innovation and technological solutions towards net zero. I incorporated other sensitising concepts (e.g., biomedical, technocratic, network governance – see Glossary of Terms) throughout my findings and discussion chapters.

A key interpretive moment in my data analysis was making decisions on which data to focus on, storylines to explore, and what to 'save for later' [211]. From documents and interviews, I copy-

pasted text sections that supported various storylines. This focused my analysis on these sections of text and facilitated comparison of multiple accounts and perspectives, enriching the analysis of who said what, why, and how. For instance, there were mentions of patient wellbeing across various documents and interviews. Grouping and focusing on texts mentioning patient wellbeing aided identification of storylines and counter-storylines, the actors that shared them, and the discourses underpinning them.

In another interpretive exercise, I navigated the process of selecting textual extracts for inclusion in my findings. Extracts, or quotes, provide readers with direct access to primary data, inviting agreement, critique, and debate on the validity of findings [212]. Quotes serve to justify research claims and enhance the depth of findings. Having initiated my analysis with texts and later engaged with my own writing, revisiting the original text to choose extracts allowed me to validate my findings, delve deeper into the content and language, and make deliberate decisions about the value and necessity of included extracts. When using direct quotes from company documents, I kept the original spelling and grammar (e.g., American English) to reinforce authenticity.

Finally, integral to my data analysis were discussions with colleagues and supervisors, or peer-debriefing, a recognised technique for enhancing rigour and credibility of qualitative research [213]. I frequently shared and discussed my research findings with my supervisors, who provided thoughts and insights on my interpretations, their basis in evidence from my data, and their relevance to my research questions. These were integral interpretive moments as my supervisors encouraged me to ‘go deeper’ into my data and findings. As one of my supervisors expressed, these interactions allowed them to ‘hold a mirror’ up to my analysis as I attempted to explain it to others. Presenting my research findings at conferences and department meetings offered similar collaborative opportunities for feedback from colleagues.

In sum, my data analysis consisted of an iterative process of reading, re-reading, asking questions of my data related to my research focus, making analytical notes, looking for patterns, surfacing sites of tension, inserting discursive, impression management, and other sensitising concepts to deepen my analysis, shifting to analysis around storylines, discourse, and coalitions, making decisions on what data to focus on, peer-debriefing, and moving between these steps of reading, writing, and analysing. From this, I generated an account of my findings across four findings chapters.

Each of my finding's chapters are structured around a storyline which served as an analytical entry point for unpacking the discourse-coalitions that articulated these storylines, the discourses they drew upon, and the practices through which these discourses were produced and reproduced, highlighting instances of performativity in companies' approaches to climate action. Across my finding's chapters, I also present counter-storylines, which represent findings that actively challenged dominant storylines and discourses. Although I present storylines and counter-storylines as distinct, this was a heuristic analytical approach I used to make sense of complex discursive patterns, and which allowed me to surface the key debates and arguments around an issue.

4.3.6. Reflexivity

As a researcher and a medical doctor, I came to this study with a set of beliefs, opinions, and lived experiences, and recognise that my research data and findings were shaped through interactions with texts, interviewees, and myself. Reflecting on this, I found it helpful to use Alan Peshkin's concept of 'subjective I's' to engage in a 'subjectivity audit' [214]. Peshkin recognised that subjectivity has value in understanding how personal qualities interact with research data, but that discovering this subjectivity when writing findings is too late. He advocated for actively and

consciously exploring subjectivity at the outset of the research process, through both rationalising and sensing when emotions are engaged, a process he termed a 'subjectivity audit' of a researcher's 'I's'. In subsequent sections I reflect on two particularly pertinent 'I's' that I identified: 'Doctor I' and 'Doomist I'.

I am a doctor: 'Doctor I'. In medical school, I was taught about thalidomide, the opioid scandal, the lawsuit levelled against the South African government by pharmaceutical companies over a law that would allow South Africa to manufacture cheap generic HIV (Human Immunodeficiency Virus) drugs [215]. I encountered senior consultants who spoke with distaste about 'Big Pharma' and their profits, or about colleagues who had 'sold their soul to the dark side'[8]. I worked as a frontline doctor during COVID-19 and witnessed the harm of political and corporate agendas around vaccine cost and supply. I began to view the pharmaceutical industry and those who provided health on the ground as 'them and us' – them making all the money and us doing all the work to save lives. Cognisant of the mistrust I harboured as a doctor, I made a conscious effort to remain attentive to my preconceptions towards the industry as I analysed my data. Notably, in recognising my 'Doctor I', I also identified positionalities in health system actors I interviewed and considered these in their comments. While I acknowledge the potential for my scepticism to have influenced my findings, I remained actively attentive to it.

I am concerned about the future: 'Doomist I'. While there is literature on the influence of the researcher on research, there is less about the impact of research on the researcher, and the potential feedback loop this might have. Climate research is existentially challenging, forcing one to contemplate humanity's demise regularly. The nonchalant approach of key players, such as politicians and industry leaders, towards the climate crisis, often prioritising self-interest over population survival, is especially troubling. Growing up in a 'Global South' country, I witnessed

[8] 'Sold their soul to the dark side' is a common phrase within the medical community, referring, often with cynicism and judgement, to colleagues who had left clinical medicine to work for Big Pharma – the dark side – often for financial motivations.

the disproportionate effects of climate change on a population that contributed minimally to it. Throughout my research, I experienced 'peaks and troughs', alternating between optimism and deep cynicism about our ability to address the climate crisis[9]. Despite intending to lean towards optimism in my findings, I found it impossible to avoid commentary on wider economic and geopolitical systems, sacrificing some of my optimism in the face of these formidable obstacles to progress.

One of the most challenging aspects of my research was attempting to maintain neutrality in my 'Researcher I' while my 'Doomist I' was filled with anger, frustration, and fear. As noted by Helen Simons, "*it is when our emotions and feelings are aroused that we know our subjectivity is engaged"* [216][pg5], and not acknowledging the influence of emotions poses a threat to validity. Clouded by these emotions, there were moments when I found myself inserting personal opinions into my writing, calling out global players, and demanding action. Reflecting on the role of research in activism, I considered the risk – or perhaps the necessity – for researchers to incorporate personal voices into climate research, detaching it from 'objectivity' and turning it into a call to action [217]. Despite my attempts to largely avoid this, I still grapple with my 'Activist I', recognising how it has influenced my research and how my research has shaped this 'I'.

While I had identified my 'Doctor I' and 'Doomist I' early in my research process, actively reflecting on their influence as my research progressed was essential. I approached this in several ways. Firstly, whenever strong feelings arose during my research, I considered how they might be reflected in my writings and whether they influenced my representation of interviewees' views. Secondly, I recorded personal observations and reactions to my data, aware of how external events were impacting my lifeworld at the time. Thirdly, I discussed my research findings, observations, and reactions with my supervisors and colleagues. Finally, I made a conscious

[9] Anthony Giddens speaks about four psychological adaption measures to daily existential threat: 1) Pragmatic acceptance; 2) Sustained optimism; 3) Cynical pessimism; 4) Radical engagement. I fluctuate between sustained optimism and cynical pessimism, with the occasional thought of radical engagement!

effort to distinguish between error and bias in my work, aiming to eliminate the former and account for the latter.

4.4. Ethical considerations

I secured ethics approval from the Central University Research Ethics Committee (R84575/RE001). Given the low risk of this research (i.e., utilising publicly available documents and not collecting personal data from interviews, except interviewees' emails), the primary concern was ensuring anonymity and preventing inadvertent harm to reputation for interviewees. My research draws on two distinct datasets: (a) publicly available company documents and (b) interview data. When reporting document data, I have retained the company names because the data were drawn entirely from documents already in the public domain, published by the companies themselves, and therefore easily accessible and verifiable online. Retaining company names aligns with established practice in this field [95, 103] and preserves the contextual and analytical integrity of argumentative discourse analysis. Additionally, as Guenther [218][pg4] observes, concealing organisational names *"often doesn't preserve external confidentiality unless all potentially identifying details are obscured, which in turn can undermine the importance of meanings in names and the significance of findings."* This approach also follows precedent in critical studies of power and discourse, which emphasise that anonymising institutions can inadvertently protect powerful actors and that naming them can serve the public interest [218, 219].

Individual interviewee participants, however, are fully anonymised and labelled using identifiers (e.g., PC1, HS1, O1 – see Table 6) to ensure confidentiality. I mitigated the risk of identification by assigning interviewees vague descriptors (see Table 6) and have ensured that no quotations could lead to linkage between participants and specific companies. While this approach may

somewhat reduce readers' sense of participants' positionality, it prioritises participant protection and remains consistent with the ethical approval granted. Ethics documentation can be viewed in the Appendix.

4.5. A note on geography

The three pharmaceutical companies in my research are headquartered in the UK, Denmark, and Israel with operations, suppliers, customers, and shareholders in multiple countries around the world. It is, therefore, disingenuous, and perhaps impossible, to study the pharmaceutical industry, and indeed, climate change, without taking a global perspective. It was often challenging to distil general commentary by interviewees to specific locations, such that my research findings run the risk of geographical abstractness. It is likely that interviewees provided perspectives from geographical locations they were the most familiar with, which given the USA-Eurocentric dominance of research interviewees, does present the limitation of a potentially skewed perspective. In some cases, interviewees emphasised the ubiquitous geographical nature of their commentary (e.g., challenges with regulation are not unique to any geographical location) and in other cases, they mentioned specific geographical examples (e.g., Singaporean energy infrastructure). For the latter, I situate my data within specific geographic locations, while for the former, my findings are kept intentionally geographically abstract. I note the limitations with locating findings and the skewed geographical perspective in Chapter 9 but mention it here to prelude the findings presented across the next four chapters.

4.6. Chapter summary

In this chapter, I have presented my research approach and methods for the adapted argumentative discourse analysis component of my thesis. I positioned myself with an interpretivist stance which informed my understanding of the pharmaceutical industry and climate change and my research approach. I discussed how I conducted my research according to an adapted version of Hajer's argumentative discourse analysis extended with analytical concepts from impression management theory. I conducted desk research and helicopter interviews which provided background understanding of the research area and informed my selection of three pharmaceutical companies for detailed study. I elaborated on my data collection from purposively sampled company documents and narrative interviews. I explained how I drew on analytical concepts from argumentative discourse analysis (e.g., storylines, discourse-coalitions, discourse institutionalisation) and impression management (e.g., performance, selective disclosure) to analyse my data through interpretive moments including familiarisation of data, writing, selecting data to focus on, incorporating sensitising concepts, and peer-debriefing. I included reflections on reflexivity, examining how my subjective perspective influenced and was influenced by the research. Next, I present my findings across four chapters, each structured around a storyline I identified in my data analysis.

Chapter 5: Climate action conflicts with patient wellbeing

5.1. Introduction

In this chapter, I unpack a storyline I identified through my data analysis: climate action conflicts with patient wellbeing. As outlined in Chapter 4, Hajer defines a storyline as a condensed statement summarising complex narrative [173]. I use this storyline as an entry point for exploring the complex narrative and underlying discourses related to climate action and patient wellbeing (i.e., physical and mental health of a patient), and how this shaped pharmaceutical company climate action. My findings showed that a discourse-coalition of a wide range of pharmaceutical company (e.g., sustainability leads, industry collaboration members) and health system (e.g., prescribers, policymakers) actors I interviewed shared this storyline, as well as a wider group of pharmaceutical company actors who contributed to the articulation of this storyline in company documents. Actors in this discourse-coalition drew primarily on a biomedical discourse that prioritised immediate, individualised, illness-focused patient care, typically delivered through pharmaceutical interventions [220] (Section 5.2). Through this discourse, actors framed patient wellbeing in terms of pharmaceutical provision, thereby justifying pharmaceuticals' climate impact and legitimising climate inaction to uphold patient wellbeing. Analysis of my data suggested this discourse contributed to pharmaceutical company and health system practices (i.e., embedded routines, rule, and norms [173]) that prioritised patient wellbeing, equated with pharmaceutical provision, over climate action to reduce pharmaceutical emissions, reflecting what Hajer terms discourse institutionalisation, or solidification of discourse in institutional practice [173] (Section 5.3).

I identified a counter-storyline in my data: climate action is integral to patient wellbeing (Section 5.4). This counter-storyline suggested the presence of another discourse-coalition, comprising pharmaceutical company actors who contributed to the articulation of this counter-storyline in company documents, as well as a subset of pharmaceutical and health system interviewees who also shared the dominant storyline, suggesting the boundaries between discourse-coalitions were not fixed. My findings showed that actors in this discourse-coalition drew on a planetary health discourse that foregrounded the interconnection between patient and planetary wellbeing and challenged the biomedical framing of patient wellbeing [221]. There was evidence of discourse structuration in my findings, which Hajer defines as when a discourse begins to shape how a particular social unit (e.g., a company) conceptualises an issue [173]. From my analysis, this planetary health discourse appeared to be beginning to shape how pharmaceutical company and health system actors conceptualised the relationship between climate action and patient wellbeing.

5.2. Institutionalised biomedical discourse on patient wellbeing

In this section, I show how a biomedical discourse was reproduced across company documents and in interviews. This biomedical discourse was centred on immediate, individualised, illness-focused patient care, typically delivered through pharmaceutical interventions. Through this discourse, the provision of pharmaceuticals to ensure patient wellbeing was framed as a responsibility and priority of pharmaceutical companies and health systems. Biomedical discourse appeared to be institutionalised within pharmaceutical companies and wider health system practices, evident, for example, in pharmaceutical companies' public commitments to

patients, health systems actors' procurement practices, and regulatory frameworks governing pharmaceuticals.

The mission statements of all three pharmaceutical companies in my study exemplified their reported prioritisation of patient wellbeing. GSK's mission is to *"unite science, technology, and talent to get ahead of disease together"*; Novo Nordisk's is to *"drive change to defeat diabetes and other serious chronic diseases"*; and Teva's is *"to be a global leader in generics and biopharmaceuticals, improving the lives of patients around the world"*. These statements reflected a biomedical discourse, framing patient wellbeing primarily in terms of treating illness through pharmaceutical intervention. Across the publicly available documents I sampled, each company invoked patient wellbeing – as attained through pharmaceutical provision – as a priority. For example, Novo Nordisk stated that "*meeting patient demand is a top priority"* [199][pg5], and Teva that *"everyone, everywhere should have access to quality medicines"* [201][pg7].

Pharmaceutical interviewees consistently articulated a responsibility to ensure patient wellbeing through pharmaceutical provision, reflecting the influence of biomedical discourse. One sustainability executive in a pharmaceutical company, for example, positioned patient wellbeing as the company's primary responsibility, "*Of course, serving the patients should always come first"* (PC1). Similarly, one senior leader within a pharmaceutical collaboration invoked a broader obligation, positioning the pharmaceutical industry as responsible for societal health: *"The whole business of pharma is to make society better – it's to cure people, it's to help people. And so, there is a certain responsibility, kind of, baked into the philosophy within pharma"* (IN2).

Health system interviewees also emphasised their commitment to patient wellbeing. One sustainability director involved in NHS pharmaceutical procurement stressed the importance of maintaining patient access to pharmaceuticals: *"We still need to make sure medicines are available and there is appropriate access to patients who need them"* (HS2). Similarly, one health insurance interviewee, referencing pharmaceutical reimbursement, emphasised their duty to

uphold quality care for patients: *"We won't compromise the quality and the outcome of the health care that we fund and deliver"* (HS7). These accounts showed how biomedical discourse had institutionalised into health care delivery practices prioritising pharmaceutical interventions.

My analysis showed that patient wellbeing was also prioritised within pharmaceutical regulation. While pharmaceuticals offer therapeutic benefits, they also carry risks, such as adverse drug interactions and side effects [222]. These risks have historically justified the need for regulatory oversight (e.g., through agencies such as the UK's Medicines and Healthcare products Regulatory Agency and the USA's Food and Drug Administration – see Chapter 2) of pharmaceutical design, production, packaging, distribution, and use to ensure patient safety and wellbeing. As one scientific director from a regulatory agency stated, "*The [regulatory] agency has a public remit, and that is patient and public safety – that absolutely comes first and foremost"* (O2). This statement suggested that patient wellbeing was positioned as the primary priority in pharmaceutical regulation.

In sum, my analysis showed that pharmaceutical company and health system actors shared discourse on patient wellbeing, grounding it in a biomedical model of health, and framing pharmaceutical interventions as central to achieving patient wellbeing. This institutionalised biomedical discourse formed the basis of the storyline articulated across company documents and interviews: climate action conflicts with patient wellbeing.

5.3. Climate action conflicts with patient wellbeing

Across my data, the three pharmaceutical companies, along with wider health system actors, reproduced biomedical discourse that underpinned the storyline that climate action conflicts with patient wellbeing, and which I discuss in this section. I identified a discourse-coalition

comprising all pharmaceutical (e.g., sustainability leads, industry collaborative members) and health system (e.g., regulators, policymakers, prescribers, sustainability experts) actors that I interviewed, as well as a wider group of actors who shaped the articulation of this storyline in company documents and by interviewees. In my findings, this discourse-coalition constructed a perceived conflict between climate action and patient wellbeing, framing patient wellbeing as dependent on pharmaceutical provision regardless of their climate impact, and portraying climate action to reduce pharmaceutical emissions as potentially harmful to patient outcomes. My analysis suggested there was institutionalisation of this biomedical discourse, evident in pharmaceutical company and health system practices that consistently prioritised patient wellbeing through pharmaceutical provision over climate action.

Analysis of my data illustrated how biomedical discourse on patient wellbeing functioned to deflect attention from pharmaceutical companies' and health systems climate impact. For example, one climate consultant observed that the *"life-and-death"* stakes associated with health care have allowed pharmaceutical companies to escape the level of climate scrutiny applied to other industries, *"it's a sort of life-and-death situation versus it's just the planet. I think they [pharmaceutical companies] have got away with a lot, so they've avoided the pressure"* (IN4). This sentiment was echoed by one previous pharmaceutical company employee, who stated, *"They've got this major sort of trump card [i.e., a card-game metaphor referring to a card ranking above others] where they are providing the world's medicines and therefore that is their priority, and ultimately that is going to carry them a long way in terms of, we don't need to report or reduce our climate impact"* (PC4). These statements showed how biomedical discourse on patient wellbeing had insulated pharmaceutical companies from scrutiny of their climate impact by framing the industry as fulfilling a higher social purpose through the protection of patient wellbeing.

Across documents, the three pharmaceutical companies in my study explicitly linked their climate impact to ensuring pharmaceutical provision for patients. In doing so, all three companies drew on biomedical discourse to justify emissions from pharmaceutical products and publicise tensions between emissions reduction and ensuring pharmaceutical provision. For example, GSK stated in their ESG Performance Report: *"the use of our medicines and vaccines by patients makes up more than 50% of our total climate impact"* [193][pg17]. Novo Nordisk similarly referenced the resource intensity of insulin production and the rise in emissions from increased air freight during supply chain disruptions: "*Supply chain constraints have forced us to increase our use of airfreight to ensure timely delivery of our medicines to patients globally"* [200]. In their Annual Report, Novo Nordisk further acknowledged the "*inherent challenges in reducing emissions at a time when demand for our life-changing medicines is growing rapidly, resulting in increased manufacturing and more product shipments"* [199][pg13]. GSK's framing of emissions as a consequence of pharmaceutical use, and Novo Nordisk's emphasis on the difficulty of reducing emissions while meeting patient needs, illustrated how patient wellbeing was leveraged by companies to legitimise their climate impact.

Pharmaceutical interviewees also framed climate action as contingent upon ensuring patient wellbeing through continued pharmaceutical provision. For example, one pharmaceutical sustainability director described the ethical complexities of designing low-carbon metred-dose inhalers, noting that while these inhalers contain potent greenhouse gas propellants, they are essential for patient wellbeing. Additionally, one climate consultant who had worked with the pharmaceutical industry described the challenges of implementing low-carbon packaging solutions while maintaining patient wellbeing:

> *"When it's positioned as a choice of health or the environment, it's always going to be a struggle. I will tell you some real examples – packaging. You can't use recycled packaging, even though a plastic container is made from multiple layers of plastic, and you can have*

recycled plastic in the layers with a coating, the risks of something happening to that final layer is too great; you can never do that. Those kinds of things you are always going to have-- this, this is one industry where its primary purpose is so much higher than all other considerations. It's always going to be a challenge I think.'

(IN4 – Director Pharmaceutical Portfolio, Climate Consultancy, May 2023)

In this extract, the interviewee positioned the pharmaceutical industry's "*primary purpose"* to ensure patient wellbeing as a higher priority than climate action. This articulation reinforced a dichotomy between *"health or the environment"* and showed how patient wellbeing was prioritised over climate action.

Beyond pharmaceutical companies, the institutionalisation of biomedical discourse was apparent in health system interviewees' discussions on prioritising patient wellbeing over climate action in procurement and prescribing practices. Pharmaceutical procurers I interviewed acknowledged that climate action would be deprioritised if it compromised patient access to pharmaceuticals. For example, while policy initiatives such as the NHS Supplier Roadmap [133] encourage the procurement of low-carbon pharmaceuticals from companies demonstrating climate action, interviewees expressed reluctance to deprioritise higher-carbon medicines if doing so could limit patient access to pharmaceuticals. One health system sustainability director noted, *"Medicines isn't a hyperspace where we can actually just say, we are not buying it from you. We are not going to remove the supply of medicines to patients who particularly need them"* (HS2). Additionally, one pharmacist raised concerns that prioritising low-carbon pharmaceutical procurement could inadvertently exacerbate patient inequalities, given this interviewees perception that these pharmaceuticals might be more expensive. My analysis of these accounts from interviewees reinforced how biomedical discourse appeared to be institutionalised in procurement practices.

Similarly, pharmaceutical prescribers I interviewed emphasised that patient wellbeing would take precedence over climate action in prescribing practices. While these interviewees expressed interest in integrating the climate impact of pharmaceuticals into prescribing decisions, they also highlighted tensions when faced with the choice between a less effective but lower-carbon drug. One prescriber remarked: *"When one medicine is a lot better for a patient than the other, but the other is a lot better for the environment, that will be a real ethical dilemma… How do we discuss it with patients? What are our primary objectives in treatment?"* (HS5). Another pharmacist suggested that unless the climate impact of a drug could be directly linked to serious population health harms, individual patient wellbeing would continue to be prioritised: "*Unless we can say the environmental impact is so severe that it's harming the population's health, I don't see a situation where we'd prescribe a slightly less effective drug purely because it's lower carbon"* (HS8). Across my data, prescribers frequently assumed that low-carbon prescribing might harm patients without citing supporting evidence, suggesting that this perceived trade-off was discursively constructed. Prescriber accounts revealed how biomedical discourse shaped prescribing practices that prioritised short-term individual outcomes over long-term population and planetary health, even in the absence of evidence that low-carbon prescribing compromised individual patient wellbeing.

As discussed in Chapter 4, my research did not include patients' perspectives. However, several health system interviewees speculated that patients would also deprioritise climate action in favour of access to pharmaceuticals. One prescriber noted: *"I think then you will need to have patients that are really planetary health orientated but maybe, most people will choose what's best for themselves"* (HS5). One health insurance interviewee referenced consumer research to support this view: "*When it comes to people's health care, sustainability is not a priority because health care is so important… they rank sustainability of the service very low. They care more about the access, the quality, and other things"* (HS7). These reflections suggested that biomedical

discourse may also be internalised by patients themselves, contributing to patient practices that prioritise their own wellbeing.

In sum, biomedical discourse underpinning the storyline that climate action conflicts with patient wellbeing appeared to shape and constrain pharmaceutical companies' climate action. The repeated use and adoption of this storyline across different institutional contexts contributed to the formation of a discourse-coalition comprising various pharmaceutical company and health system actors whose communication and practices reflected alignment with a biomedical discourse. While reducing emissions and ensuring pharmaceutical provision is not without challenge, my analysis suggested that alignment with this biomedical discourse allowed companies and health system actors to deflect scrutiny over climate impact, to offer justification for emission-intensive practices, and to deprioritise climate action. Biomedical discourse appeared to be institutionalised, reflected in practices, such as in procurement and prescribing, that routinely deprioritised climate action in favour of ensuring pharmaceutical provision.

5.4. Climate action is integral to patient wellbeing

I identified a counter-storyline, articulated in company documents and particularly by health system interviewees, that climate action is integral to patient wellbeing. As Hajer suggests (see Chapter 4), the same actors may articulate seemingly contradictory statements or participate in multiple discourse-coalitions, reflecting the fluid and contested nature of meaning-making [173]. This counter-storyline signalled the presence of another discourse-coalition comprising a subset of actors from the dominant discourse-coalition, particularly those in health system roles (e.g., sustainability experts, policymakers, prescribers), but also some pharmaceutical actors, particularly those who contributed to the articulation of this storyline in company documents. My data analysis suggested that actors in this discourse-coalition drew on a planetary health

discourse, which conceptualised climate action and patient wellbeing as interdependent, and challenged the biomedical framing that positioned the two as in conflict. In my findings, actors within this discourse-coalition proposed strategies to align climate action and patient wellbeing, which I also unpack in this section. My analysis suggested that discourse structuration was apparent in how this discourse appeared to be beginning to influence the way companies and health system actors conceptualised climate action and patient wellbeing; however, it was not yet widely institutionalised in practice.

In their publicly facing documents, all three pharmaceutical companies in my study noted that climate change is inextricably linked to patient wellbeing. For instance, GSK stated that *"the world's climate and nature crises pose an urgent threat to human health"* [193][pg16]. Novo Nordisk highlighted the *"significant threat to human health from climate change",* noting *"the relationship between climate change and type 2 diabetes",* and drawing links between "*patterns of human behaviour that exacerbate global warming and rising disease rates [of diabetes]"* [223, 224]. Teva summarised this interconnection by stating that "*the health of the planet… is inherently linked to the health of those who inhabit it"* [201][pg16]. My analysis suggested that while companies foregrounded patient wellbeing in their documents, they were beginning to articulate this wellbeing through the lens of planetary health, positioning climate change and patient wellbeing as interconnected.

Additionally, across their documents all three companies framed climate action as an opportunity to enhance patient wellbeing. For example, GSK asserted that climate action offered the potential for a *"healthy planet"* to support "*healthy people",* and an opportunity to create *"a healthy, nature-positive, net-zero and equitable world"* by putting *"health at the centre of action on climate"* [198][pgs1-11]. Teva similarly framed their climate action as a way to *"improve the health of the planet, which is inherently linked to the health of those who inhabit it"* [201][pg16], while Novo Nordisk referenced the co-benefits of their climate action, *"taking actions to reduce carbon*

emissions is also an unprecedented opportunity to bring the world on a healthier, more sustainable course" [223]. These statements further reflected a planetary health discourse in which climate action and patient wellbeing were presented as interconnected rather than conflicting.

My analysis suggested that the documentary framing of climate action and patient wellbeing as interconnected legitimised company climate action by aligning its communication with companies' patient-centred missions. However, this framing contrasted with interview data, in which company interviewees more frequently reproduced biomedical discourse that positioned climate action as conflicting with patient wellbeing. Additionally, this framing co-existed within the same documents that omitted or downplayed the tensions involved in ensuring both climate action and patient wellbeing. For example, Teva's ESG Progress Report highlighted efforts to deliver low-cost, quality medicines alongside emissions reduction strategies, without reference to the challenges of reconciling the two [201]. This disparity indicated a gap between internal discourse, external communications, and company practices, raising questions about the extent to which the emerging planetary health discourse evident in public documents had been integrated into company decision-making and practices around climate change.

Some pharmaceutical and health system interviewees also drew attention to the links between climate change and patient wellbeing. One pharmaceutical company climate consultant observed that, while the view that patient wellbeing must take precedence over climate action had long dominated the health care sector, actors within the sector were beginning to recognise that climate change is fundamentally linked to patient wellbeing:

> *"I have to say in the health care industry there has certainly traditionally been a view that we are saving lives and so, you know, the planet comes second. But of course, this isn't about, as you know, it's not about the planet. It's about saving lives; climate change is about lives and health and actual human beings. But it's taken a bit of time for that to come*

through. The immediacy of producing a drug that saves lives today still takes precedence over preventing deaths in the future."

(IN6 – Executive, Climate Consultancy, November 2023)

This extract challenged the framing of climate action and patient wellbeing as being in conflict with each other. Rather, this interviewee positioned climate action as central to saving lives, while also acknowledging the persistent dominance of biomedical discourse that prioritised immediate patient care over climate action.

Other interviewees also referenced the emerging discursive shift towards a planetary health discourse, reinforcing the interconnections between climate action and patient wellbeing. One pharmaceutical interviewee remarked that *"the seeds of the link between climate and nature and health are just starting to be talked about"* (PC3). One representative from an international health organisation noted that *"sustainability is an important piece of it [i.e., health care], and it relates directly to the health of the patient and the planet"* (HS3). Similarly, one regulatory agency official observed that *"a healthy population is dependent on having a healthy planet"* (O2), and one insurance company interviewee stated, *"we cannot look after people's health if we are not looking after the health of the planet"* (HS6). Finally, one lead from a pharmaceutical collaboration commented that *"climate action is very much, kind of, part of that, increasingly recognising the links between the environment and health"* (IN2). These accounts supported the storyline that climate action is integral to patient wellbeing and pointed to the formation of an alternative discourse-coalition. This coalition included some of the same actors, primarily health system representatives (e.g., regulators, members of health organisations), from the dominant discourse-coalition discussed in the previous section, but who appeared to engage in more critical reflection on the interconnection between climate action and patient wellbeing.

Several health system interviewees proposed the need to reframe the fundamental purpose of health care in light of climate change, suggesting this reframing could help align climate action

with patient wellbeing in practice. One sustainability expert within a health system described climate change as "*an opportunity to review what our fundamental purpose is, which is to improve health"* arguing that health systems had lost sight of their *"wider point",* having become overly focused on treating illness rather than promoting long-term health and wellbeing (HS1). This interviewee's reframing of health care's purpose challenged biomedical discourse to suggest health care delivery that is proactive and preventive and prioritises wellness over the treatment of illness.

Health system interviewees proposed disease prevention and health promotion as strategies capable of delivering both climate and patient co-benefits. One health system policymaker advocated for greater attention to the *"wider determinants of health"*, including environmental quality, nutrition, and *"social infrastructure"*, arguing that improving these could enhance patient wellbeing while reducing reliance on emission-releasing pharmaceutical interventions (HS2). Another health system interviewee supported this view through the example of diabetes management, noting that investment in preventive care and lifestyle support could reduce dependence on insulin injections and their associated climate impact: *"maybe the mechanisms should be to support people to stay in good health rather than to be provided X amount of insulin injections*" (HS1). One pharmaceutical interviewee also acknowledged that the best way to reduce climate impact is to keep the population healthy, focusing on *"health and prevention"* (PC2). These perspectives illustrated that pharmaceutical emissions are driven by choices that prioritise pharmaceutical intervention over alternative interventions, rather than representing an unavoidable cost of patient wellbeing.

Minimising unnecessary pharmaceutical use and broadening treatment options to include non-pharmaceutical interventions were suggested by health system interviewees as other approaches to aligning climate action and patient wellbeing. Several interviewees referenced initiatives such as green and social prescribing [225], that encourage outdoor activity and

community engagement as alternative treatments for certain conditions. For example, one insurance company environmental lead reflected critically on pharmaceuticals being the default treatment for depression: *"For example, in a very simple form of antidepressants, if they're given out as a first-hand treatment but haven't tried, for example, talking therapies, then there may be the missed opportunity to minimise the environmental impact in the first place"* (HS7). The same interviewee also suggested personalised medicine [226], in which treatments are tailored more precisely to individual patients, as a strategy for improving treatment efficacy while potentially reducing pharmaceutical emissions. These accounts challenged the reliance on pharmaceutical treatment in biomedical health care models and encouraged more nuanced patient care that considered both climate impact and patient wellbeing.

Analysis of my document and interview data highlighted the potential for the pharmaceutical industry to support broader health care delivery beyond the provision of pharmaceuticals, aligning climate action with patient wellbeing. As one sustainability expert reflected: *"We'd all like to think that the interest of these companies can be shifted to align with the interests of the healthy climate and healthy planet"* (HS1). One example of such alignment was Novo Nordisk's mission to *"defeat diabetes and other serious chronic diseases"* and its participation in the Cities Changing Diabetes programme [224]. This initiative brings together partners across more than 40 cities to *"advance disease prevention through education and on-the-ground interventions."* According to Novo Nordisk, the programme promotes actions that generate both climate and health co-benefits, suggesting an intentional effort to reorientate company activities towards prevention and sustainability. This example indicated that at least one pharmaceutical company was attempting to connect climate action with patient wellbeing through preventive strategies.

Overall, the counter-storyline positioning climate action as integral to patient wellbeing signalled the presence of another discourse-coalition, primarily comprising health system actors, but also some pharmaceutical actors, particularly those who contributed to the articulation of this

counter-storyline in company documents. While both pharmaceutical company and health system actors in this coalition drew on a planetary health discourse to reframe patient wellbeing in terms of climate stability, it was primarily health system actors that contested biomedical health care models centred on pharmaceutical provision.

5.5. Chapter summary

In this chapter, I have unpacked a storyline that climate action conflicts with patient wellbeing. My analysis suggested that this storyline was shared by a discourse-coalition comprising pharmaceutical company and health system actors I interviewed, as well as a broader group of actors in similar roles (e.g., sustainability experts, climate consultants), who likely influenced the articulation of this storyline in interviewee accounts, company documents, and organisational practices. Actors in this discourse-coalition drew primarily on a biomedical discourse. Through this biomedical discourse, patient wellbeing was framed in terms of immediate, individualised, illness-focused patient care, typically through pharmaceutical intervention, and pharmaceutical provision to ensure patient wellbeing was framed as a priority of companies and health systems. My analysis showed institutionalisation of this discourse, reflected in practices such as accepting emissions from pharmaceutical provision and prioritising pharmaceutical availability in procurement and prescribing decisions. The discursive construction of a conflict between climate action and patient wellbeing, as articulated by this discourse-coalition, reflected a narrow framing of both climate action and patient wellbeing, that did not explicitly engage with empirical evidence to validate the perceived conflict between the two. My analysis suggested that this biomedical framing of patient wellbeing was often mobilised to justify the continuation of emissions-intensive practices and to legitimise limited climate action.

I identified a counter-storyline that positioned climate action as integral to patient wellbeing. This counter-storyline, more frequently articulated by health system actors and reflected in a subset of company documents, indicated the presence of a smaller, emerging discourse-coalition. Actors in this discourse-coalition drew primarily on a planetary health discourse to frame patient and planetary wellbeing as intrinsically interconnected. The presence of this planetary health discourse indicated a shift in how these actors conceptualised climate action, although this discursive shift had not yet been widely institutionalised in practice. Health system actors within this discourse-coalition suggested health care practices such as prevention-focused care, reduced pharmaceutical dependence, and the integration of non-pharmaceutical interventions into patient treatment, all of which could align with climate action.

Analysing dominant and alternative discourses around climate action and patient wellbeing provided insight into how discourse shaped, constrained, and enabled pharmaceutical companies' climate action, which I discuss further in Chapter 9. My analysis suggested that discourse-coalitions mobilising these discourses were not mutually exclusive; in some cases, the same actors simultaneously recognised the negative health impacts of climate change and voiced perceived conflicts between climate action and patient wellbeing. However, there appeared to be a disconnect between acknowledging the link between climate change and health and implementing climate action in practice, reflecting the continued dominance of the storyline that climate action conflicts with patient wellbeing and the underlying biomedical discourse.

Additionally, my data analysis suggested that implementing climate action in practice faced broader constraints, such as financial considerations, that may have been strategically obscured by appeals to patient wellbeing. For example, financial incentives that favour pharmaceutical interventions in health care may explain why none of the pharmaceutical interviewees suggested a shift towards non-pharmaceutical interventions. As I discuss in my next chapter, my findings

showed that financial considerations played a significant role in shaping pharmaceutical companies' climate action.

Chapter 6: Climate action is contingent on financial viability

6.1. Introduction

In this chapter, I unpack a second storyline I identified: climate action is contingent on financial viability. This storyline was shared by a discourse-coalition comprising primarily pharmaceutical company actors (e.g., executives, sustainability directors, industry collaborative members, climate consultants) who consistently framed climate action through language of financial risk, opportunity, and cost-benefit considerations. These recurring patterns of language suggested that actors were mobilising an economic discourse which reflected and reproduced broader capitalist frameworks centred on financial viability and growth (see Chapter 1) [227]. My analysis indicated that this economic discourse had institutionalised [173], shaping the nature of climate action pharmaceutical companies undertook (Section 6.2). Economic discourse underpinning this storyline also permeated wider domains of company practice (i.e., sites where discourse is produced, reproduced, and transformed [173]), with climate action framed across my data as a matter of regulatory compliance, reputation management, market positioning, and operational resilience (Section 6.3). These financial framings of climate action across wider domains of company practice reinforced economic discourse as a dominant lens through which climate action was understood and enacted by pharmaceutical companies, shaping what kinds of actions were taken, and how they were justified and prioritised within companies' wider operations.

Alongside this storyline, I identified a counter-storyline: pharmaceutical companies' climate action is contingent on maximising profit (Section 6.4). Rather than simply representing an alternative conceptualisation of climate action, this storyline actively opposed and challenged the storyline articulated by actors in the previous discourse-coalition. Analysis of my data suggested this storyline was shared by a discourse-coalition comprising exclusively health system actors (e.g., procurers, prescribers, health organisation members) and was underpinned by a normative discourse [228]. Actors in this discourse-coalition voiced normative expectations that pharmaceutical companies should implement climate action regardless of financial viability and critiqued company climate actions as superficial and performative, aimed at ensuring minimal disruption to profit. While my analysis suggested this discourse had not institutionalised, evident in its limited influence on company practices that continued to be shaped by economic discourse, the presence of this alternative discourse revealed a discursive tension between financial practicalities and normative expectations for pharmaceutical company climate action.

Despite this underlying tension between discourse-coalitions, my findings showed actors within both discourse-coalitions converged around the need to enhance the financial viability of climate action. This convergence indicated discursive affinity [173], where actors from across discourse-coalitions drew on different values and discursive framings but coalesced around shared solutions. Across my data, both pharmaceutical company and health system actors drew on economic discourse to offer suggestions for regulatory reform and financial mechanisms to support climate action (Section 6.5).

6.2. Climate action is contingent on financial viability

In this section, I unpack the storyline that climate action is contingent on financial viability. From my data analysis, a discourse-coalition comprising primarily pharmaceutical company actors mobilised an economic discourse to frame climate action in relation to financial costs, benefits, and viability of implementation. My analysis suggested that this economic discourse had institutionalised, apparent in pharmaceutical companies' prioritisation of climate actions that were considered financially viable.

Across documents and interviews, financial viability was a key consideration shaping which types of climate action pharmaceutical companies, in my study and beyond, implemented. My findings showed that actions which offered cost savings, such as energy efficiency improvements, were prioritised by companies. One pharmaceutical sustainability strategist emphasised the financial savings from energy efficiency: *"Reducing your energy use is a cost reduction... if you use less energy, you're gonna pay less for energy"* (PC2). Another pharmaceutical interviewee described how energy initiatives had become formalised within their company's climate strategy because they offered financial returns: *"We've always had an energy reduction programme... the rules about payback for a project were always slightly relaxed for energy saving projects because these things do pay back"* (PC3). The use of terms such as 'cost reduction' and 'payback' in these accounts suggested these actors drew on economic discourse to frame climate action, and that this discourse had institutionalised in company practices, shaping the types of climate action implemented. Economic discourse was also reproduced in the company documents I sampled, reflected in companies' external communication of climate action. For example, Teva reported that "*approximately 100 projects were executed in 2022, resulting in $3.6 million in savings through energy consumption reductions, exceeding the Task Force's target"* [201][pg17].

My findings indicated that pharmaceutical companies were more hesitant to implement climate actions that offered limited or uncertain financial returns. One regulatory expert referenced the discontinuation of GSK's inhaler recovery scheme (i.e., a take-back programme for used inhalers in the UK), attributing its termination to limited cost-effectiveness and the absence of broader industry participation: *"It just wasn't becoming cost effective for them… they seemed to be doing the donkey work for their competitors"* (O2). This example highlighted how decisions by pharmaceutical companies to continue certain climate actions were shaped by considerations of cost-effectiveness, as well as the distribution of financial burden across competitors.

Additionally, the cost of implementing some initiatives was cited across interviews as prohibitive, particularly for small-medium-sized companies, reinforcing the framing of climate action in terms of financial viability. One industry collaborative member described small-medium-sized companies as lacking the *"time, energy, or money"* (IN1) to pursue climate action, suggesting that high upfront costs of climate action were a major consideration in companies' decisions to implement climate action. These accounts illustrated how economic discourse dominated companies' decision-making around climate actions but also surfaced the financial practicalities of implementing climate action.

The accounts presented in this section illustrated how financial viability was embedded in pharmaceutical company decision-making and practices around climate action, shaping not only which actions were prioritised, but also, given uneven financial capacities, which actors were positioned to implement actions. My analysis showed that the implementation of climate action was consistently mediated through cost-benefit calculations, illustrating the institutionalisation of economic discourse and supporting the storyline that climate action is contingent on financial viability. While financial viability influenced what climate action was undertaken, my analysis revealed that economic discourse related to climate action permeated

other domains of company practice, shaping how companies justified and engaged with climate action in the first place.

6.3. Institutionalised economic discourse shaping climate action across domains of company practice

Hajer conceptualises domains of practice as the sites where discourse is produced, reproduced, and potentially transformed [173]. Economic discourse related to climate action was consistently reproduced, in documents and interviews, across four interrelated domains of pharmaceutical company practice which I examine in the sections below: (a) regulatory compliance, (b) reputation management, (c) market positioning, and (d) operational resilience. The consistent references to climate action across these domains suggested that climate action had become integrated into how companies conceptualised and managed their wider operations. My analysis suggested that this integration was largely driven by the financial implications of climate action, or inaction, within these domains, reflecting economic discourse.

6.3.1. Regulatory compliance

Regulatory compliance, referring to the adherence to laws, regulations, and guidelines relevant to a company's operations, was a key domain of company practice in which economic discourse on climate action was reproduced across my data. Interviewees, primarily from pharmaceutical companies, framed compliance with corporate climate-related regulations in terms of risk management and costs of compliance.

All pharmaceutical interviewees in my study emphasised the importance of compliance with expanding global regulatory frameworks mandating corporate climate disclosures. As discussed

in Chapter 2, current corporate climate-related regulations mandate emissions disclosure (e.g., EU Corporate Sustainability Reporting Directive – CSRD [80]), linking of financial transactions to climate impact (e.g., EU Taxonomy [229]), and climate-related financial risk disclosure (e.g., Task Force on Climate-related Financial Disclosures [78]). One pharmaceutical sustainability director emphasised the importance of compliance with these regulations, "*Rule number one is comply with the regulation. You have to"* (PC3). Pharmaceutical interviewees noted that climate-related regulation was more advanced in Europe (*"regulation in Europe is having a massive impact"*) than in the USA and other countries ("*there is a bit of confusion in America*") (IN3). However, the multinational nature of pharmaceutical companies necessitated the need to *"get ready"* (IN3) for diverse national and regional regulations. These accounts pointed to the diverse landscape of global regulation, but also how climate reporting was spoken about by interviewees through terms of regulatory compliance and risk management, reflecting economic discourse.

Compliance with climate-related regulations was also perceived by pharmaceutical interviewees as a potential source of strategic financial advantage. For example, one pharmaceutical interviewee described their company's efforts to pre-empt climate-related regulatory developments through horizon scanning, engaging consultancies or internal teams to track regulatory trends: *"we do it ourselves or we get different agencies to scan the horizon for regulations coming through"* (PC3). This foresight enabled their company to implement proactive measures such as internal carbon pricing, upgrade emissions reporting platforms, and perform product carbon footprinting, avoiding potential financial risks from non-compliance. These practices suggested further evidence of institutionalisation of economic discourse on climate action.

My findings suggested that the financialisation of climate-related regulation (e.g., linking emissions to financial transactions) was transforming companies' internal climate governance structures (i.e., the individuals and teams overseeing and implementing company climate

strategy). Referencing the EU Taxonomy, one pharmaceutical interviewee commented, *"Every single financial transaction [is tied] to a climate benefit... finance teams [have to be] involved."* (PC4). This account suggested that climate action was no longer siloed within sustainability departments but was being embedded across company operations, reflecting institutionalisation of economic discourse as it shaped company climate governance practices.

Regulatory compliance was also spoken about in terms of financial costs of compliance. Pharmaceutical interviewees expressed the financial and operational burdens of compliance, especially for small-medium-sized and generics companies. Global regulatory fragmentation contributed to this financial burden as pharmaceutical companies navigated shifting regional, national, and local climate-related regulatory requirements. Referencing this fragmented and shifting landscape, one representative from a generic's trade body described the financial risks of investing in compliance measures that may become obsolete, stating that companies risked being *"stuck in a tunnel of spending a lot of money"* (IN1). Differing regional and national regulations were also cited by pharmaceutical interviewees as a disadvantage to those companies who operated in locations with more stringent regulations, given the financial costs of compliance. For example, stringent EU regulations (i.e., CSRD) were seen to disadvantage domestic manufacturers relative to overseas competitors in less-regulated markets, as one pharmaceutical interviewee warned, *"if EU manufacturing is restricted and there isn't a regulation that impacts the importing of products from India, then right away, a competitor can just wipe us out of production"* (PC3). These accounts further highlighted how regulatory compliance was a domain of company practice in which climate action was spoken about in terms of financial viability.

Across my data, there were divergent perspectives on regulatory arbitrage by pharmaceutical companies, the relocation of operations to jurisdictions with weaker regulation to reduce compliance costs [230]. One interviewee from a non-profit organisation suggested that

pharmaceutical companies exploited global regulatory asymmetries on climate change to reduce costs, *"capital moves from one country to another... in the interests of companies that have so much profit"* (HS4). However, one pharmaceutical sustainability director contested this, arguing that the cost of relocation typically outweighed regulatory savings: *"The barrier to moving is pretty high... an environmental regulation has to be pretty huge for us to move"* (PC3). These conflicting perspectives illustrated the tensions in optimising financial outcomes amidst varying regional climate regulations and reinforced the framing of climate action through economic discourse.

Across my data, I found that compliance with corporate climate-related regulation was a domain of practice in which climate action was framed by actors, particularly pharmaceutical interviewees who were involved in meeting climate-related regulation, through economic discourse of risk management, compliance costs, and capital relocation. The institutionalisation of this discourse was reflected in company practices such as regulatory horizon scanning. For well-resourced companies, proactive regulatory compliance was framed by interviewees as a strategic financial advantage. However, my findings indicated that the fragmented global regulatory landscape posed challenges to compliance, particularly for companies with limited resources or those operating in jurisdictions with more stringent requirements. These challenges reinforced the framing of regulation, in documents and by pharmaceutical interviewees, in financial terms but also illustrated how, in practice, climate-related regulatory compliance, like climate action more broadly, appeared contingent on financial viability.

6.3.2. Reputation management

I found that reputation management was another key domain of company practice where economic discourse on climate action was reproduced. Reputation management, which can be

seen as a form of organisational impression management, refers to the practices through which companies shape and sustain their public image to build trust, legitimacy, and credibility with stakeholders such as investors, customers, regulators, and the public [185]. Pharmaceutical interviewees in my study framed climate action as a reputational strategy, capable of enhancing corporate image and generating financial returns. However, the reputational value of climate action appeared contingent on a shifting and contested global landscape of stakeholder expectations. My analysis showed that companies strategically sought to maximise reputational benefits from aligning with external expectations for climate action, while concurrently managing and minimising potential reputational or financial risks associated with misalignment.

All interviewees from the three pharmaceutical companies framed climate action as a reputational strategy that could confer financial benefits. The interviewees described climate action as a way to "*use it as a selling point"* (IN1), *"obtain public relations and marketing benefits"* (O2), maintain "*public image"* (PC4), and present a "*good corporate image*" (PC3). Climate action was also framed by pharmaceutical interviewees as valuable for internal reputation, specifically in the context of employer branding and talent retention. One pharmaceutical executive noted, *"employees are really, really important stakeholders and why companies do the right thing"* (PC2), while one pharmaceutical sustainability director highlighted that new talent, especially from younger generations, increasingly prioritised climate-conscious employers. Economic discourse is reflected in these accounts, as interviewees constructed climate action as a reputational asset with potential financial benefits.

However, my findings showed that the reputational value of climate action was contested and context-dependent. One pharmaceutical executive described the reputational risks of climate action in politically polarised markets, particularly the USA: *"If your big sales markets are in the States, which all pharma companies are, you have to be very careful"* (PC3). Similarly, GSK's Annual Report acknowledged the politicisation of climate action in the USA, where climate action

may be reputationally penalised rather than rewarded [192]. These examples from my sampled documents and interviews reflected the precarious nature of reputational gains from climate action, shaped by shifting social, economic, and political landscapes.

In summary, within the domain of reputation management, climate action was framed by pharmaceutical interviewees as a strategic means to generate reputational, and by extension, financial value. However, the reputational value of climate action remained contingent, shaped by shifting social, economic, and political contexts.

6.3.3. Market positioning

Across my data, market positioning was a third domain of pharmaceutical company practice in which economic discourse on climate action was reproduced. Market positioning, while overlapping with reputation management, refers specifically to how companies construct and communicate their value proposition of products relative to competitors to secure access to specific markets [231]. In my findings, pharmaceutical interviewees, as well as some health system interviewees (e.g., those involved in NHS procurement), framed climate action as a way to strengthen companies' market position, particularly in relation to access to health system customers and investors. This framing reinforced the institutionalisation of economic discourse, as climate action appeared increasingly embedded as a competitive market strategy within company decision-making and practices.

Climate action was framed by both pharmaceutical and health system interviewees as a strategy for securing market access to health system customers, particularly health systems (e.g., NHS) that were embedding climate-related criteria into procurement processes. Across my data, NHS England (NHSE) was described as a powerful *"market influencer"* (IN2), and the NHS Supplier Roadmap, that embedded climate criteria into procurement policy, was frequently cited by

interviewees as an example of how climate action was being formalised as a condition for market participation. Referencing the NHS Supplier Roadmap, pharmaceutical interviewees framed climate action as commercially necessary to retain access to one of the world's largest health system markets. Interviewees reported shifts in company climate strategies in response to the Roadmap, which was reflected in increased demand for climate consultancy services. As one consultant observed, *"we are getting queries from companies that are looking for help in complying with [NHSE's] requirements"* (IN5). Similar procurement requirements in countries such as France, Germany, and Australia, along with international initiatives like the World Health Organisation (WHO) Alliance for Transformative Action on Climate and Health (ATACH), which aims to coordinate international health system procurement demands, were also referenced by interviewees. My analysis of these accounts illustrated how health system actors also mobilised economic discourse to shape pharmaceutical company behaviour by embedding climate action within conditions of market access (see also Section 5.5).

Interviewees cited the potential for some pharmaceutical companies, especially small-medium-sized and generic companies, to face market exclusion if they did not have the financial resources to comply with these procurement requirements, reinforcing the contingency of climate action on financial viability. For example, interviewees from industry collaborations highlighted the financial costs of performing product-level carbon footprinting (see Chapter 7), which NHSE expects suppliers to produce by 2028 [133]. One industry collaboration interviewee estimated that $30 million was needed to assess a member's full portfolio, while one generics association member cited "*£100,000 to do a life cycle assessment"* (IN1). These accounts illustrated how procurement climate requirements could contribute to market inequities by privileging financially stronger companies, further entrenching climate action within an economic discourse of cost and opportunity.

Intellectual property considerations complicated equitable market positioning of pharmaceutical companies in relation to climate action. As one non-profit interviewee observed, companies who embedded environmental sustainability into patented products could gain exclusive market advantages: *"When overlaid with the way the world works at IP [intellectual property] and everything else, it could perpetuate the inequity, but it could mean a lot of money, a lot of profits as well"* (HS4). One health system strategist described how one company had *"patented the hell out of that space"* (HS9) after developing a low-carbon pharmaceutical, effectively restricting competitors from accessing climate-conscious markets with similar products. These accounts positioned climate action as a potential avenue for competitive market advantage, while also cautioning that current intellectual property regimes may reinforce market inequities and constrain the broader scaling of climate action within the pharmaceutical industry.

Interviewees cited climate action as a strategy for companies to secure capital in investment markets increasingly orientated towards climate action. Both pharmaceutical company and health system actors described the pharmaceutical industry as "*absolutely driven by the financial investment community"* (O1), with one climate consultant noting that investors had become more attuned to climate risk, *"the investment market suddenly realised that if this tiny little virus [COVID-19] can wipe trillions off their balance sheets, what will climate change do?"* (IN6). Across company documents and interviews, the three pharmaceutical companies in my study reported engaging with climate-aligned investment strategies, such as green bonds and sustainability-linked financing, illustrating how climate action was leveraged by companies to attract investment. For example, Teva issued a "*$5 billion SLB [sustainability-linked bond] – the largest of its kind when it was issued and the first from a generic medicines company"* [201][pg12]. One pharmaceutical company project manager described how their Chief Executive Officer (CEO) strategically foregrounded climate action in investor communications to attract capital. These accounts suggested further institutionalisation of economic discourse on climate action within company investment strategy and communications.

Document and interview data showed that investor interest in climate action varied, and climate action did not always confer investment advantages in certain markets. Pharmaceutical interviewees highlighted tensions between long-term climate action and short-term investor expectations. One interviewee reported that their company's CEO faced *"a lot of flack for not having driven profits as well as are being projected"*, adding that investors were "*not thinking about ESG [environmental, social, and governance]"* (PC4). GSK's annual report pointed to the varying investor interest in climate change across different markets: *"Investor sentiment, particularly in the US, has seen similar shifts as the ESG agenda becomes increasingly polarised and politicised"* [192][pg15]. These accounts suggested that within fragmented global investment markets, climate action became a balance of investment opportunity and risk.

In sum, my findings showed that market positioning, by the three pharmaceutical companies in my study and the pharmaceutical industry more widely, was a key domain of company practice through which economic discourse on climate action was reproduced. In both documents and interviews, climate action was discursively constructed by actors in this discourse-coalition, particularly pharmaceutical actors and health system actors directly involved in pharmaceutical procurement, in terms of competitive strategy, market access, intellectual property advantage, and investor appeal. My analysis also uncovered financial constraints to climate action as a market positioning strategy, such as the costs of meeting climate-related procurement criteria and navigating fragmented investor expectations, which further reinforced the overarching storyline that climate action is contingent on financial viability.

6.3.4. Operational resilience

Operational resilience, as a domain of company practice, refers to the capacity of a company to anticipate, withstand, and adapt to disruptions, such as those caused by climate change, in order

to maintain the continuity and stability of business operations. In both documents and interviews, accounts relating to operational resilience positioned climate change as a material risk (i.e., one that could significantly affect companies' financial performance) and climate action as a form of financial risk management aimed at maintaining operational resilience, thereby reproducing economic discourse on climate action.

In sampled company documents, all three companies in my research identified climate-related disruptions, such as extreme weather events or resource scarcity, as material risks. For example, Teva projected cost increases for manufacturing inputs like lactose and methanol under various climate change scenarios [202], while GSK noted in their sustainability report that *"there is no business if there is no environment"* [198][pg7]. Interviewees further reinforced this framing of climate change as a financial risk to operations. One representative from an international health organisation noted: "*Floods, storms are a concern and anywhere in the world, climate change can really cause disruptions"* (HS3). One lead from a pharmaceutical collaboration expanded on this, highlighting the economic vulnerability of *"high value"* manufacturing operations reliant on nature-derived ingredients, *"there's lots of risk associated with any kind of manufacturing business, particularly one with kind of high value products... and a recognition that a fairly significant proportion of active ingredients are derived from nature in one way or another"* (IN2). All three companies reported actions to mitigate the risk of climate change on operational resilience, for example, reducing reliance on climate-vulnerable or economically volatile resources such as fossil fuels [193, 199, 202].

Across documents and interviews, climate change was framed as a source of financial and operational risk, while climate action was positioned by actors within this discourse-coalition, particularly those who reported on climate risk in companies' documents, as a strategy to ensure continued operational resilience. This suggested that economic discourse was reproduced in discussions of climate mitigation as well as climate adaptation and operational resilience.

To summarise this section, I have shown how economic discourse, underpinning the storyline that climate action is contingent on financial viability, extended beyond cost-benefit calculations around implementation to permeate multiple domains of company practice, including regulatory compliance, reputation management, market positioning, and operational resilience. Within each of these domains, climate action was framed in terms of compliance, reputation, market strategy, and material risk, reflecting the institutionalisation of economic discourse on climate action across company decision-making and practices. Based on my analysis, economic discourse shaped companies' decisions about whether and how to pursue climate action, legitimised it by embedding it within financially driven domains of company practice, and simultaneously reduced it to a financial calculation that either enabled or constrained action, depending on its alignment with companies' financial interests.

6.4. Climate action is contingent on maximising profit

In this section, I unpack a counter-storyline shared by a distinct discourse-coalition comprising exclusively health system actors: pharmaceutical companies' climate action is contingent on maximising profit. My findings showed that actors within this discourse-coalition drew upon a normative discourse, framing climate action as a normative expectation and responsibility that should be undertaken by companies regardless of financial viability, and critiquing companies as only implementing climate action when it aligned with profit. All health system actors I interviewed (e.g., health system policymakers, regulators, prescribers) contributed to this discourse-coalition, contesting the legitimacy of company climate action, characterising it as selective, insufficient, or strategically performative [174], designed to signal substantive action without affecting companies' profit. While this normative discourse had yet to be institutionalised, given the continued dominance of economic discourse shaping companies'

climate actions, my analysis suggested this discourse challenged pharmaceutical companies' reduction of climate action to financial terms.

Health system interviewees within this discourse-coalition critiqued pharmaceutical companies as only implementing climate action when it did not affect profit. One member of an international health organisation argued that companies' climate actions were contingent on *"how best they can still maintain their profitability"* (HS3), while another interviewee from an insurance company remarked that companies would only implement climate action if it did not *"affect their bottom line",* critiquing the extent to which pharmaceutical companies were *"willing to go… at what cost to them as a business or a sector"* (HS7). One regulatory expert suggested that companies' claims of financial constraints to climate action were a strategy to avoid action, adding that *"everyone has a set of priorities, [they]'ve just decided it's not the highest of [their] priorities"* (O2). My analysis of these accounts suggested that the health system interviewees contributing to this discourse-coalition reinterpreted pharmaceutical companies' framing of climate action as contingent on financial viability as a way to mask companies' limited climate action while they continued to prioritise profit.

Health system interviewees in my study highlighted instances of what they perceived as selective climate action as evidence of pharmaceutical companies' prioritisation of profit. One example, offered by one representative from an international health organisation, involved a company (not named) that marketed low-carbon inhalers to meet NHSE procurement requirements while continuing to sell higher-carbon versions in other markets. The interviewee commented, *"If companies genuinely cared about reaching net zero, they would implement these actions irrespective of financial implications"* (HS3). This interviewee's comment reflected the normative discourse invoked by actors comprising this discourse-coalition – that companies should undertake climate action irrespective of financial viability and profit.

Similarly, pharmaceutical company climate actions perceived by health system interviewees as incremental and low impact were cited as further evidence of companies' prioritisation of profit. In my findings, company efforts to develop sustainable pharmaceutical packaging were emblematic of this perceived incrementalism. One health system sustainability expert described packaging initiatives as addressing only a *"0.000 whatever"* fraction of emissions, characterising them as companies *"dipping their toe"* into highly visible, low-risk, and financially negligible climate actions unlikely to drive substantive emissions reduction (HS1). Pharmaceutical interviewees themselves acknowledged the limited emissions reduction potential of packaging initiatives but attributed their implementation as a response to external stakeholder demands. As one interviewee explained: *"A lot of hospital systems and others are asking questions about the packaging – packaging isn't on the order of 1–10% of the total footprint"* (PC2). This account suggested companies engaged in climate actions to meet stakeholder expectations rather than to achieve substantive emissions reductions. This supported the preceding analysis that pharmaceutical companies pursued climate action insofar as it aligned with their financial interests (e.g., reputational or marketing benefits) and also highlighted the importance of interrogating companies' broader institutional context that shaped and legitimised such actions.

Criticism also extended to company climate reporting, which health system interviewees characterised as strategically performative [174], designed to maximise financial benefit while minimising risk. One interviewee from a non-profit organisation questioned whether "*the action actually stands up to the marketing"* (HS4), while one pharmacist recounted a case where a company (not named) only highlighted the climate benefits of a low-carbon product once climate action gained commercial relevance: *"I didn't really hear them selling the environmental benefits of this until it really became a big agenda item"* (HS8). This interviewee interpreted such strategic disclosure as a way for companies to *"maintain market position"* and *"protect their market share"* without incurring significant financial costs (HS8). One health system sustainability expert summarised this performative reporting: *"I felt they have done it-- this is what we can do without*

impacting on our finances... and it's like, okay, it looks like window dressing now" (HS1). My analysis of these accounts showed that although interviewees in this discourse-coalition also referenced economic terms in relation to climate action, they did so critically, to expose and contest the limitations of economic discourse in enabling climate action.

Building on concerns about selective public reporting, health system interviewees also described what they perceived as behind-the-scenes resistance to climate action by pharmaceutical companies, aimed at actively obstructing wider climate policy and action. One health system strategist described how companies were *"smiley and so lovely"* in public, while simultaneously engaging in lobbying and legal threats to minimise disruption to business, actions the interviewee interpreted as motivated by concerns that climate action could undermine profitability:

> *"These guys benefit from the status quo, the status quo is going really well for them. Change is a little bit annoying... They [other actors] don't actually engage with the hard edge of these guys because they never have million-dollar conversations with them... They are never aggressive to your face. They are always very smiley and so lovely, and they will invite you to award ceremonies and whatever. And at the same time, you'll get a call from someone in No. 10[10] saying, why do we have this chief executive in here again complaining about how you are, you know, interrupting good, British business or whatever. There have been all sorts of legal threats. There have been all sorts of really, very sophisticated bits of lobbying."*
>
> (HS9 – Executive Strategist, Health System, October 2023)

The same strategist accused companies of establishing *"fake NGOs"* and using health care professionals to bolster the legitimacy of their climate action. While these claims reflected the perspective of a single interviewee, this interviewee's influential position and cross-sector

[10] The official residence and office of the British Prime Minister.

exposure lent weight to their concerns about the industry's resistance to substantive climate action. Another health system interviewee reinforced this critique by referencing the pharmaceutical industry's defensive reaction to NHSE's first carbon footprint report, which identified pharmaceuticals as major contributors to health care emissions (HS1). These accounts by health system actors reinforced the dominance of economic discourse in shaping companies' practices, such as those to avoid financial exposure from climate action, and supported the storyline that companies only acted when it did not affect profit.

Despite the critique health system actors laid upon pharmaceutical companies for prioritising profit, health system actors acknowledged their own entanglement in financial concerns. Interviewees who worked in administrative roles in the NHS admitted that climate action was shaped by *"financial envelopes"* and fiscal constraints. For example, one executive reflected, "*You have a financial envelope you have to play within… You can't double the health care system's budget in order to achieve net zero"* (HS9). Another health system director explained, *"there is a finite budget that the NHS has… I think it's that fine balance between how we appropriately use our resources and getting the best, most efficient thing that we can from all aspects"* (HS2). One pharmaceutical interviewee noted that health systems prioritised cost in pharmaceutical procurement: "*nobody buys their drugs on the basis of [climate impact]. All they care about is what it costs"* (PC2). My analysis of these accounts illustrated that while health system actors critiqued pharmaceutical companies financial framing of climate action, they too operated within, and at times reproduced, the same economic discourse.

In sum, while the discourse-coalition comprising pharmaceutical company actors framed climate action as contingent on financial viability, health system interviewees articulated a counter-storyline, suggesting that companies engaged in climate action primarily when it did not affect profit. Interviewees in this discourse-coalition asserted that company climate action should be undertaken irrespective of financial return, reflecting a normative discourse, critiqued

companies' climate action as selective and performative, and recast financial viability as a strategic way for companies to avoid more substantive action. However, the entrenchment of health system actors within similar economic structures introduced possible contradictions into their critique.

6.5. Mobilising economic discourse in support of climate action

While my analysis of the storyline and counter-storyline in the preceding sections highlighted a discursive tension between financial practicalities and normative expectations, it also revealed the presence of discursive affinity amongst actors. Hajer defines discursive affinity as the convergence of actors from diverse backgrounds and value systems, who draw on different discourses, yet coalesce around a shared conceptualisation of an issue and solutions [173]. In this final section, I present two approaches to supporting climate action that were suggested across my interview data, and reflected an economic discourse mobilised by both pharmaceutical company and health system interviewees: (a) the reform and standardisation of regulation to mandate climate action, and (b) the use of financial mechanisms to enable company climate action. My analysis suggested this discursive affinity enabled actors with divergent agendas to engage economic discourse as a shared framework for advancing climate action in the pharmaceutical industry, creating space to reimagine financial structures within pharmaceutical markets in ways that more effectively integrated climate and financial considerations.

6.5.1. Reforming and standardising regulation

Regulatory reform and standardisation were identified across pharmaceutical and health system interviews as one approach to drive large-scale climate action within the pharmaceutical industry. However, interviewees cautioned that the design and implementation of regulation require careful consideration to ensure regulation is effective in driving climate action and sensitive to potential unintended consequences, particularly in contexts of uneven compliance capacity and market disparities.

All interviewees called for globally standardised, action-orientated, and enforceable corporate regulation on climate change. This shared stance was premised on a recognition amongst interviewees that voluntary approaches could not address the scale of climate action needed by the industry. One pharmaceutical interviewee stated, *"companies won't do these things at scale until it's a mandated disclosure"* (PC3). Interviewees called for regulations to go further than just mandating emissions disclosure (see Chapter 7). For example, one climate consultant proposed legal requirements for companies to set net zero targets, aligned with credible bodies like the Science Based Targets initiative, alongside binding decarbonisation roadmaps.

Pharmaceutical and health system interviewees called for reform of pharmaceutical regulation to better enable climate action. In my findings, pharmaceutical interviewees identified the current pharmaceutical regulatory environment as prohibitive to climate action, particularly with respect to initiatives targeting product eco-design (i.e., embedding sustainability across the design of products). The requirement to refile for approval of any product changes across multiple markets was consistently described as prohibitive, as one interviewee noted, *"The regulatory environment is so prohibitive to change… any change to any part of the product will likely require a refile in every single country"* (IN3). Both pharmaceutical and health system interviewees suggested that integrating climate criteria into pharmaceutical regulation could support company climate action. One interviewee from a climate consultancy cited the successful

regulatory phase-out of desflurane (an anaesthetic gas) in the UK [151] as an example of how targeted regulatory interventions could deliver climate benefits.

However, my findings also surfaced concerns about the potential unintended consequences of regulatory reform. One health system interviewee cautioned that poorly designed or excessive regulation could inhibit innovation, *"the more you put regulations… the more costly things will be, but also the less that you foster innovation"* (HS1), while one pharmaceutical interviewee emphasised the importance of finding an appropriate balance in regulation, *"it's getting the right level of compromise in any regulation"* (PC3). Interviewees involved in policy and standard development questioned whether entirely new regulatory frameworks were required or whether existing mechanisms could be adapted to integrate climate considerations. Other concerns in my data included the challenge of achieving international regulatory alignment and the inherent delays associated with regulatory change. Additionally, the need to maintain patient wellbeing as a regulatory priority (see Chapter 5) was reiterated by one regulatory interviewee. Nonetheless, this interviewee acknowledged ongoing discussions around how pharmaceutical regulation might mandate climate considerations earlier in product development: *"what we could at least do is perceive what our regulations might do in terms of how they can build sustainability into that medicine or medical product really early on in the process"* (O2).

My analysis illustrated that pharmaceutical and health system interviewees converged around proposals to reform and standardise regulation to support climate action within the pharmaceutical industry. This proposed approach illustrated how economic discourse, centred on regulatory compliance and risk management, could be mobilised to enable a level regulatory playing field that would drive substantive climate action while facilitating an equitable distribution of the financial burdens associated with compliance.

6.5.2. Leveraging financial mechanisms

Various financial mechanisms were proposed by both pharmaceutical company and health system interviewees as strategies to scale climate action across the pharmaceutical industry. These mechanisms were grounded in economic discourse, which, as my analysis showed, can make climate action more legitimate and actionable within existing company practices. However, suggested financial mechanisms remained embedded within the same capitalist economic systems that contribute to climate harm (see Chapter 1). This surfaced tensions amongst interviewees regarding whether incremental financial reforms were adequate or whether more radical economic reforms were necessary.

While my analysis showed that pharmaceutical companies implicitly employed economic discourse in their discussions of climate action, interviewees emphasised the need for explicit framing of climate action in financial terms. One interviewee from a regulatory body compared this financial framing of climate action to a "*Rosetta Stone*[11]*"* [232] that translated climate issues into boardroom language: *"a way of turning the environmental issues into a language that can be understood at the board… this is what it means to your share value, this is what it means to your personal shares, this is what it means to your growth"* (O2). Recasting climate action in terms that resonate with senior leadership was seen by this interviewee as a way to secure internal support and resources for climate action.

In my findings, carbon pricing, which assigns a monetary value to each tonne of emissions emitted or avoided [233], was a contested financial mechanism to drive climate action. One industry member suggested that referring to climate impact through a set carbon price would be a way to ensure "*everybody is talking about the same thing"* (IN3), aligning with the perspective that climate action must be explicitly framed in financial terms. However, one pharmaceutical

[11] The Rosetta Stone is an ancient stone slab inscribed with the same text in three scripts – Greek, Demotic, and hieroglyphs – which allowed scholars to decipher Egyptian hieroglyphics.

interviewee argued that carbon pricing often failed to incentivise emissions reductions, noting, "*carbon taxes and emission trading schemes, they've been out there for a while. Generally, they are not huge impacts because they are just suddenly, you know, it's just an extra cost… just part of the invoicing"* (PC3). This account suggested that carbon pricing may be absorbed as a routine business expense rather than driving substantive climate action.

Scaling health system climate-aligned procurement policies were identified by both pharmaceutical and health system interviewees as another financial mechanism for driving climate action. The NHS Supplier Roadmap was highlighted by these interviewees as a promising model to inform other health system procurement policies. However, pharmaceutical interviewees emphasised that for procurement policies to drive substantive action, they must be coupled with enforcement mechanisms such as legal mandates or financial penalties.

Other financial incentives for climate action were proposed across my findings, such as regulatory fast tracking, patent extensions, and premium pricing for lower-carbon pharmaceuticals. As one health system sustainability director explained:

> *"The other thing that industry often bring up with us is that if they are able to bring something to market that has real benefits, can they go early on the process to be reviewed… or whether or not there can be other regulatory or law changes to say that if something is more sustainable can they get patent extensions or can the NHS pay more for it to kind of more incentivise the work."*
>
> (HS2 – Sustainability Director, Health System, June 2023)

These financial incentives, suggested by pharmaceutical company actors, framed climate action as an added value proposition tied to market positioning.

My findings surfaced a tension amongst interviewees regarding the necessity for more radical economic reform. One non-profit interviewee critiqued *"the whole political economy of drugs*

and the capitalist model it's based on" and how *"markets are shaped and regulated around pharmaceuticals",* suggesting current financial models incentivised pharmaceutical sales and consumption and drove increased production, distribution, and associated emissions (HS4). One health system interviewee encapsulated this concern by stating, *"sickness pays",* describing a system *"that reward's having medicines"* (HS1). This interviewee also questioned the ethical foundations of pharmaceutical markets, asserting, *"there is way too much investment in the way that pharmaceuticals make money – it is not ethical in reality, I don't think"* (HS1). These reflections surfaced challenges to climate action within dominant economic systems shaped around financial growth and profit.

Some health system interviewees alluded to alternative economic imaginaries, visions of financial models that could facilitate low-carbon health care and challenge market structures that incentivised pharmaceutical production and consumption. Health system interviewees proposed that health system financing could be reorientated towards prevention, rather than focusing solely on treatment, and suggested that pharmaceutical companies might play a more active role in preventive and promotive care, aligning financial models with both climate action and patient wellbeing, as discussed in Chapter 5. However, my findings indicated that realising such imaginaries would necessitate restructuring institutional priorities and economic frameworks. As one health system strategist noted, this would involve *"rewriting the rules of the game"* (HS1).

In summary, despite the differing perspectives on climate action and financial viability of the discourse-coalitions described in this chapter, both pharmaceutical company and health system actors offered suggestions of financial mechanisms to drive climate action, mobilising economic discourse in support of climate action. While there was widespread recognition of the need to enhance the financial opportunity of climate action, there were different perspectives regarding the extent of economic reform required to achieve net zero. This was particularly evident in health

system interviewee critiques of pharmaceutical markets and capitalist structures that prioritised profit through pharmaceutical sales. My analysis illustrated that these critiques created space for alternative economic imaginaries of health system financial models that could generate climate, patient, and financial co-benefits.

6.6. Chapter summary

In this chapter, I have examined a storyline, articulated by a discourse-coalition primarily comprising pharmaceutical actors, that positioned climate action as contingent on financial viability. From my analysis, this storyline was underpinned by an economic discourse, with actors in this discourse-coalition framing climate action in terms of financial opportunity or risk, reflecting broader capitalistic frameworks rooted in financial growth. I identified a counter-storyline, advanced by a discourse-coalition of health system actors, who presented a more critical perspective, suggesting that pharmaceutical company climate action was contingent on maximising profit. Actors in this discourse-coalition mobilised a normative discourse to frame climate action as an obligation for companies, irrespective of financial viability, while critiquing pharmaceutical companies' climate actions as superficial and performative, designed to secure financial benefits without undertaking significant risks.

My findings showed that economic discourse was institutionalised in pharmaceutical companies' practices, evident in the prioritisation of climate actions that offered financial returns, and in the framing of climate action across other domains of company practice, through financial terms of regulatory compliance, reputation management, market positioning, and operational resilience. My analysis suggested this discourse reduced climate action to financial calculations and enabled or constrained climate action depending on its alignment with companies' financial interests. The normative discourse underpinning the counter-storyline,

although not institutionalised, revealed a discursive tension between financial practicalities upheld by pharmaceutical actors and normative expectations for climate action regardless of financial viability and profit.

My findings illustrated discursive affinity across both discourse-coalitions as actors within these coalitions collectively mobilised economic discourse to support climate action. Interviewees from both coalitions advocated for regulatory frameworks that move beyond voluntary or disclosure-based climate reporting and for financial mechanisms that support climate action. My findings showed that this discursive affinity created space for alternative economic imaginaries that could integrate climate action within pharmaceutical and health system financial models.

Finally, my analysis of interviewee accounts on regulation highlighted the inadequacy of current corporate climate-related regulation, which remain overly focused on emissions disclosure rather than actual emissions reductions. In the next chapter, I turn to this issue in depth, critically examining the limits of emissions quantification and disclosure.

Chapter 7: Climate action as emissions quantification and disclosure

7.1. Introduction

In this chapter, I unpack a third storyline I identified: climate action as emissions quantification and disclosure (Section 7.2). In my findings, all interviewees shared this storyline, contributing to a discourse-coalition that included not only these actors but also those engaged in corporate climate-related regulation, health system emissions data requests, and company emissions quantification and disclosure practices. Actors in this discourse-coalition framed climate action in terms of quantification of emissions, data, disclosure (i.e., public reporting of emissions), methodological standardisation, and compliance. This framing reflected a technocratic discourse in which an issue is treated primarily as a technical problem to be managed through measurement, data, and standardised procedures [234]. My analysis suggested that actors contributing to this discourse-coalition mobilised technocratic discourse in distinct ways that nonetheless still supported the storyline of climate action as emissions quantification and disclosure. Pharmaceutical interviewees (e.g., sustainability leads, industry collaborative members) presented emissions quantification and disclosure as a way to signal climate action and demonstrate compliance with external pressures for emissions data (e.g., from regulatory and procurement requirements discussed in Chapter 6). Health system interviewees, particularly those who worked in procurement and prescribing, employed technocratic discourse to position emissions data as a prerequisite for their own climate action, while critiquing pharmaceutical companies' selective emissions disclosures. My analysis suggested that technocratic discourse had institutionalised. This institutionalisation was evidenced by routinised company emissions

disclosure practices in sampled company documents, health system demands for more emissions data, and ongoing efforts by pharmaceutical company and health system actors to develop standardised emissions quantification methodologies at the company, product, and patient care pathway levels.

I identified a counter-storyline in my interview data: emissions quantification and disclosure as climate inaction (Section 7.3). This storyline was shared by a discourse-coalition comprising a subset of both pharmaceutical company and health system actors. My analysis suggested that actors in this discourse-coalition drew on a post-technocratic discourse. These actors explicitly challenged the primacy of emissions data, questioned the assumption that data drives climate action, foregrounded outcomes over quantification, and positioned quantification as a distraction from substantive climate action [235]. My analysis suggested this post-technocratic discourse remained marginal but revealed tensions within data-centric climate strategies.

7.2. Climate action as emissions quantification and disclosure

In this section, I elaborate on the storyline of climate action as emissions quantification and disclosure. I show how all interviewed pharmaceutical company and health system actors contributed to the discourse-coalition that shared this storyline, alongside actors involved in broader regulatory and procurement emissions data requests, methodological standardisation, and company-level quantification and disclosure practices that were reflected in the sampled company documents. Actors in this discourse-coalition mobilised and reproduced technocratic discourse across three approaches to emissions quantification and disclosure which I unpack in detail in the subsections below: (a) at the company level, (b) at the product level, and (c) across patient care pathways. Across these approaches, actors within this discourse-coalition framed

emissions quantification and disclosure as a mechanism to signal climate action through compliance with external pressures for emissions data (e.g., regulatory and procurement requirements), and as a necessary precondition for climate action. This technocratic discourse had institutionalised, evidenced by company emissions disclosure practices, health system demands for more granular emissions data, and ongoing efforts by pharmaceutical company and health system actors to develop standardised quantification methodologies.

7.2.1. Company-level emissions quantification and disclosure

I draw on document and interview data to unpack how the three pharmaceutical companies in my study engaged in the quantification and disclosure of greenhouse gas emissions at the company level. All pharmaceutical companies are subject to external pressures to disclose company-level emissions, including from regulation (e.g., Corporate Sustainability Reporting Directive), voluntary environmental, social, and governance (ESG) reporting norms (e.g., Global Reporting Initiative, Task Force on Climate-related Financial Disclosures), and market expectations (e.g., NHS England's (NHSE) procurement requirements – see Chapter 6). Responding to such pressures, the three companies in my study disclosed their company-level emissions in public documents. In doing so, they enacted the storyline of climate action as emissions quantification and disclosure and reproduced a technocratic discourse. My analysis showed that these disclosures were not neutral representations of companies' climate impact but were shaped by methodological choices, data availability, and selective disclosure, illustrating the performative dimensions of quantification and disclosure.

Reported emissions for each company are presented in Table 7 and Figure 3.

Table 7. Pharmaceutical companies' reported greenhouse gas emissions in tonnes carbon dioxide equivalents (CO_2e) in 2022; data from GSK's Environmental Data 2022 [195], Novo Nordisk's Annual Report 2022 [199], Teva's ESG Progress Report 2022 [201]

GHG Protocol Scopes	GSK	Novo Nordisk	Teva
Scope 1 total	626,418	76,000	254,632
Scope 2 total*	88,368	16,000	244,009
Scope 3 total	8,624,433	2,041,000	6,111,490
Purchased goods and service	2,724,653	1,251,000	4,393,074
Capital goods	154,433	477,000	351,137
Fuel and Energy	84,200	55,000	178,495
Upstream transportation and distribution	189,168	123,000	205,946
Waste generated in operations	63,545	5,000	
Business commuting	49,527	55,000	
Employee commuting	47,787	35,000	
Upstream leased assets	0	Not reported	
Downstream transportation and distribution	99,327	37,000	
Processing of sold products	0	Not reported	
Use of sold products	5,119,566	Not reported	762,873
End of life treatment of sold products	50,893	3,000	
Downstream leased assets	0	Not reported	
Franchises	0	Not reported	
Investments	41,334	Not reported	
Other categories combined			219,965
Total emissions	9,339,219	2,133,000	6,610,131
*Market-based Scope 2 for GSK			

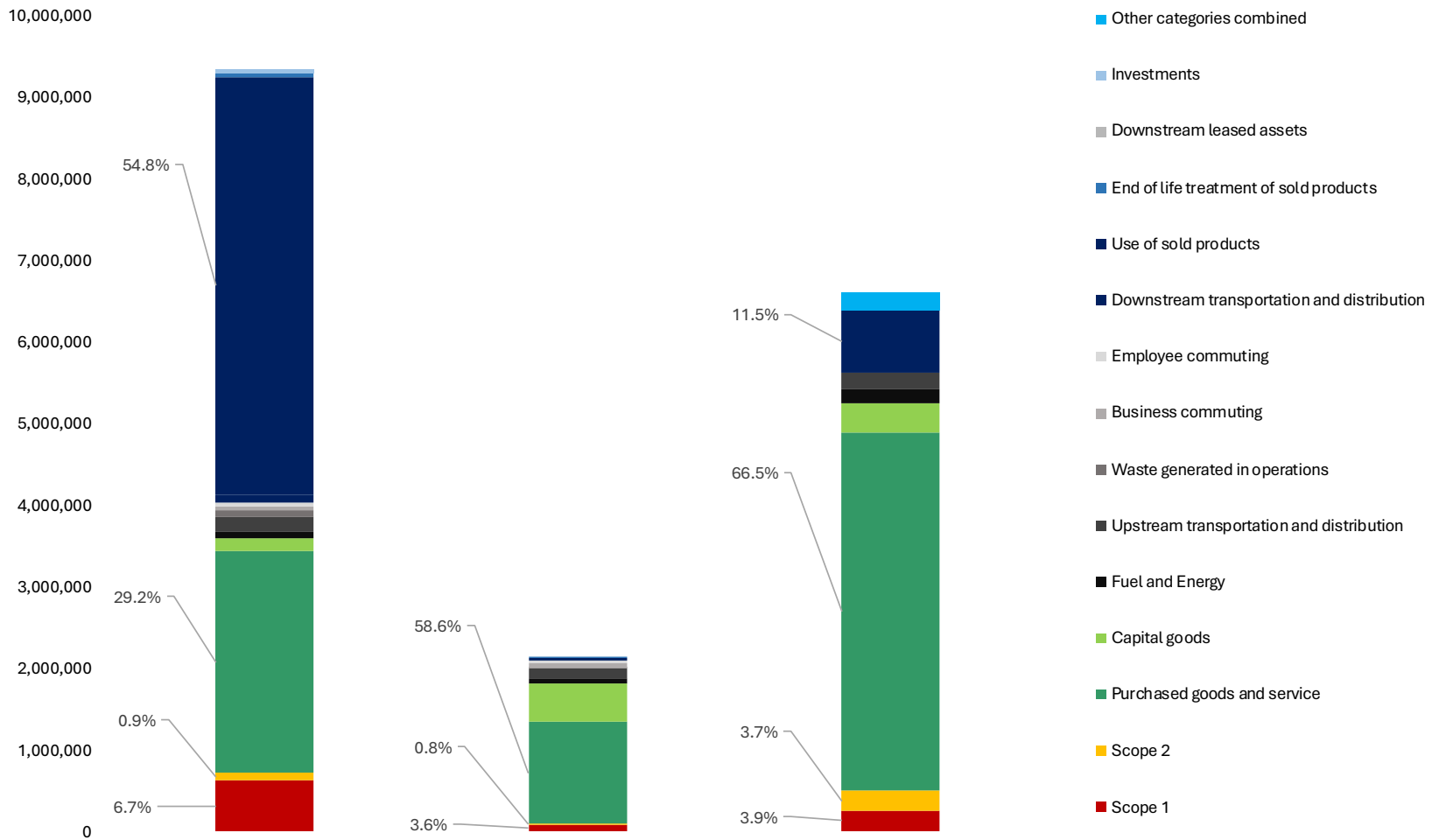

Figure 3. 2022 Greenhouse gas emissions for included pharmaceutical companies according to GHG Protocol categories; data from GSK's Environmental Data 2022 [195], Novo Nordisk's Annual Report 2022 [199], Teva's ESG Progress Report 2022 [201]

Emissions quantification involves the transformation of diverse, context-specific emission sources into a single, standardised metric (i.e., CO_2e) intended to enable comparison [236]. The three companies in my study disclosed their company-level greenhouse gas emissions in tonnes of carbon dioxide equivalents (CO_2e), quantified annually across a range of Scope 1, 2, and 3 categories as defined by the Greenhouse Gas (GHG) Protocol (see Table 1) [13]. Total annual emissions reported for 2022 varied between companies: 9,339,219 tonnes CO_2e for GSK, 2,133,000 tonnes for Novo Nordisk, and 6,610,131 tonnes for Teva[12]. For all three companies, Scope 1 and 2 emissions, from company-owned facilities and purchased energy, accounted for less than 10% of total disclosed emissions (red and orange bars in Figure 3). The majority of emissions fell under Scope 3, encompassing upstream and downstream supply chain emissions, particularly from the use of sold products (55% of GSK's total – dark blue bar in Figure 3) and purchased goods and services (59% for Novo Nordisk and 67% for Teva – green bars in Figure 3).

My analysis of company-level emissions data suggested that these disclosed emissions obscured heterogeneity of emission sources across geographies, operations, and products. For example, in the reporting year, GSK operated 37 manufacturing sites, compared to Novo Nordisk's 16 (see Table 4). Additionally, the companies' product portfolios differed, for example, Novo Nordisk focused on specialised diabetes treatments, whereas Teva offered a broader range of generic medicines. The companies disclosed emissions also reflected methodological uncertainties and variations in pharmaceutical companies' quantification and disclosure practices, which I unpack further below.

Methodological uncertainties in company-level emissions quantification and disclosure practices were recurringly voiced by pharmaceutical interviewees and climate consultants. Pharmaceutical interviewees characterised company-level emissions quantification as

[12] For perspective, the emissions produced by GSK are approximately equivalent to the annual emissions from Zambia, Novo Nordisk of the Maldives, and Teva of Latvia 237. CO2 emissions by country: Worldometer; 2025 [Available from: https://www.worldometers.info/co2-emissions/co2-emissions-by-country/.

"difficult", "nebulous", and a *"complicated quagmire"* marked by *"so much uncertainty"* and *"an absolute mess of actually quite difficult things to report*" (PC3, PC4). One climate consultant observed the lack of *"reality"* of emissions quantification: *"Most reporting is, you as a company tell me what your footprint is. It's estimated using emission factors. It's completely unrelated to any of your facilities, really. It's all an estimate. There is no reality"* (IN6). These accounts surfaced a view, particularly amongst interviewees directly involved in quantification, that emissions quantification was an uncertain process that rested on assumptions and estimations.

Frameworks like the Greenhouse Gas Protocol and the Global Reporting Initiative (GRI) aim to overcome some of the uncertainty voiced by these interviewees and streamline and standardise emissions quantification and disclosure [13, 76]. However, my analysis revealed variation in how companies applied these frameworks. Table 8 draws on sampled documents, summarising variation in companies' methodological approaches, emission factors (i.e., coefficients for converting activity data into emissions), data sources, and exclusions, all of which shaped disclosed emissions data. For example, emission boundaries included by companies varied: GSK included all sites under operational control, while Novo Nordisk focused on production and office sites. Each company relied on different data sources, such as metre readings, invoices, or expenditure records, and reported different exclusions in their emissions quantification. For example, GSK omitted sites with annual energy consumption below 4,750 mega-Watt hours, while Novo Nordisk excluded trucking emissions. My analysis of these variations in methodological approaches suggested that, despite the appearance of standardisation promoted by reporting frameworks, these frameworks obscured methodological diversity and facilitated the performative nature of emissions quantification, as companies controlled how their data was constructed.

Scope 3 quantification, in particular, varied across companies. GSK included 11 of 15 Greenhouse Gas Protocol categories (see Table 1), Novo Nordisk 9, and Teva 5, with other

categories combined (see Table 8). My findings showed that Scope 3 emissions quantification was fraught with assumptions and estimations. One climate consultant explained that in the absence of primary data from suppliers, *"which takes years to improve"*, companies often relied on proxy values, "*at first, their Scope 3 footprint might be completely spend-based [i.e., converting a spend value into an estimated emission figure [238]], until they are able to start engaging with their suppliers to gather more primary data to improve their footprint"* (IN5). Pharmaceutical interviewees highlighted their efforts to collect more robust supplier data to inform Scope 3 quantification. One industry representative noted: *"for us to get better data collection, we are going to have to engage more with suppliers"* (IN1). Other pharmaceutical interviewees emphasised the difficulty of accessing supplier data: *"having to engage with suppliers and gathering data and things like that can be a huge challenge"* (IN4); and *"actually getting data from these organisations that aren't used to having, you know, in developing markets, people aren't quite used to sort of disclosure obligations in collecting data and reporting data"* (IN2). Companies' focus on procedural improvements to supplier data collection for emissions quantification reflected the institutionalisation of a technocratic discourse.

Table 8. Reporting frameworks, emission categories, data sources, and emission factors for pharmaceutical companies' reported greenhouse gas emissions in 2022; drawn from GSK's Basis of Reporting 2022: Environmental Data [194], Novo Nordisk's Annual Report 2022 [199], Teva's ESG Report Progress Disclosures 2022 [202]

Methodology	GSK	Novo Nordisk	Teva
ESG reporting standards and guidelines	-Greenhouse Gas (GHG) Protocol -Global Reporting Initiative -Sustainability Accounting Standards Board -Task Force on Climate-related Financial Disclosures -Carbon Disclosure Project	-GHG Protocol -Sustainability Accounting Standards Board -Task Force on Climate-related Financial Disclosures -Carbon Disclosure Project	-GHG Protocol -Global Reporting Initiative -Sustainability Accounting Standards Board -Task Force on Climate-related Financial Disclosures -Carbon Disclosure Project
GHG categories	Scope 1 Scope 2 Scope 3 (11/15 relevant categories)	Scope 1 Scope 2 Scope 3 (9/15 relevant categories)	Scope 1 Scope 2 Scope 3 (5/15 categories reported with 'other categories combined')
Boundaries	All sites under operational control	Production sites, laboratories, and offices	Entire business, operations, and value chain
Data sources	-Accounts payable records -Internal records -Metre readings -External sources (e.g., fleet management companies, utilities providers) -Proxy data (e.g., historical data)	-Metre readings -Invoices -Power Purchase Agreements and Renewable Electricity Certifications -External sources (e.g., business flights, third-party waste management) -Proxy data (e.g., from similar site)	-Inventory data -Spend-based data
Emission factors	-International Energy Agency	-UK Department for Environment, Food & Rural Affairs/	-International Energy Agency

	-UK Department for Environment, Food and Rural Affairs/ Department for Business, Energy, and Industrial Strategy -Intergovernmental Panel on Climate Change -Emission factors provided by service providers -Internally developed emission factor for inhalers	Department for Business, Energy, and Industrial Strategy -US Environmental Protection Agency Emissions and Generation Resource Integrated Database -Regional transport emission factors	UK Department for Environment, Food and Rural Affairs/ Department for Business, Energy, and Industrial Strategy -US Environmental Protection Agency Emissions and Generation Resource Integrated Database - Intergovernmental Panel on Climate Change
Exclusions	Sites where annual energy consumption is <4,750 mega-Watt hours GHG Protocol categories 8, 10, 13, 14	3% of trucking emissions due to lack of reliable data GHG Protocol categories 8, 10, 11, 13, 14, 15	GHG Protocol category 14

There were variations in how the three pharmaceutical companies disclosed their emissions data. While all three companies published emissions data, these were dispersed across multiple documents, including Annual Reports, ESG Reports, and separate environmental disclosures, making it difficult to assemble a coherent picture of overall climate impact. For example, Teva disclosed emissions in their ESG Progress Report [201], but the underlying methodology required cross-referencing a separate document [202]. Similarly, GSK disclosed emissions data and methods across four different reports [192-195]. One pharmaceutical interviewee described this *"duplication"* as necessary to avoid accusations of greenwashing while targeting multiple audiences, referencing "*financial people", "wider stakeholder community", "governments, health care system providers", "general public",* and *"new recruits"* (PC3). These fragmented emissions disclosures reflected strategic ambiguity, a concept from impression management [174], where companies' emissions data were technically available to meet external expectations for it but

were presented in ways that limited scrutiny. This strategic ambiguity supported my analysis that emissions disclosure often functioned as a performative exercise to signal climate action.

In summary, the three pharmaceutical companies in my study engaged in company-level emissions quantification and disclosure practices, reflecting the institutionalisation of a technocratic discourse. My analysis indicated that these practices often became ends in themselves (i.e., pursued for their own sake rather than a means to support action) as companies focused on producing emissions data to satisfy external pressures. Furthermore, methodological inconsistencies, data gaps, and selective disclosure in company-level emissions reporting highlighted the performative nature of quantification and disclosure practices. As I explore in the following sections, attempts by pharmaceutical company and health system actors to extend quantification to products and patient care pathways further reinforced technocratic discourse underpinning the storyline of climate action as emissions quantification and disclosure and reproduced many of the challenges surfaced in company-level emissions quantification and disclosure.

7.2.2. Product-level emissions quantification and disclosure

I unpack a second approach to emissions quantification and disclosure that featured in my interview data: product-level emissions quantification, or product carbon footprinting. A product's carbon footprint refers to the total greenhouse gas emissions associated with its lifecycle, from raw material extraction through production, distribution, use, and disposal [239]. My findings showed that pharmaceutical companies were increasingly subject to external pressure, particularly from NHSE procurement requirements (see Chapter 6), to produce product carbon footprints of each of their pharmaceutical products. My analysis suggested that the extension of quantification and disclosure into new domains of emissions accounting, such as

product carbon footprinting, reflected the deepening institutionalisation of technocratic discourse. However, unlike company-level emissions quantification, which was already embedded in company practices and publicly disclosed in company documents, product-level emissions quantification and disclosure was emergent. My analysis suggested that pharmaceutical companies were actively shaping this emerging accounting space, influencing how product carbon footprints are defined, quantified, and disclosed. Instances of selective product carbon footprint disclosure in my data further illustrated the performative dimension of emissions disclosure.

As discussed in Chapter 6, the NHS Supplier Roadmap requires pharmaceutical companies to provide product carbon footprints by 2028 [133]. One NHSE sustainability director described these requirements for product carbon footprints as *"an enabler step that will support more information and for us to be able to progress the agenda more because a lot more data supports that"* (HS2). Similarly, one prescriber emphasised the importance of product carbon footprints to support low-carbon prescribing choices: *"When we know all the information about those medicines from the pharmaceutical companies, we can then use this information to yeah, as I earlier mentioned, augmentation of the-- when you can integrate sustainability in the treatment choice"* (HS5). Other health system actors described the absence of product carbon footprint data as a barrier to their climate action. One insurance interviewee stated, *"we don't know the lifecycle footprint of certain developments of medications or their ongoing manufacture. So, we're a bit blind on the, I suppose, the reliable data"* (HS7), while another prescriber observed, *"at the moment it just seems like we have no information"* (HS8). These accounts reinforced a technocratic discourse in which product carbon footprint data was framed as essential for enabling health system climate action, primarily by health system actors within the discourse-coalition sharing this storyline.

Pharmaceutical companies were responding to NHSE demands for product carbon footprint data. As one pharmaceutical sustainability lead explained, *"it's on all the pharma company's radar that the NHS wants carbon footprints and Life Cycle Assessments [i.e., method of determining product carbon footprints] by 2028"* (PC3). One interviewee involved in an industry collaboration revealed that many major pharmaceutical companies had already undertaken internal product carbon footprinting: *"big licence holders have been doing carbon footprinting of products for a while"* (IN3). One pharmaceutical company interviewee described how they had quantified the carbon footprints of their top twenty highest-revenue products to inform their internal climate strategy: *"[we took] the top twenty biggest revenue earners and footprint[ed] them all… they have been the underpinning of the different aspects of our sustainability strategies over the years"* (PC3). These accounts showed that companies engaged in product carbon footprint quantification to align with prevailing norms of data-driven climate action, and increasingly, to meet NHSE requirements.

My analysis, however, suggested that pharmaceutical companies were reluctant to publicly disclose their quantified product carbon footprints. When I asked pharmaceutical interviewees about companies' reluctance, several rationales were offered. The lack of standardised quantification methodologies was suggested by interviewees as potentially resulting in misleading product comparisons that could affect market positioning, as discussed in Chapter 6. As one pharmaceutical sustainability strategist questioned, *"can you compare what's the assumptions and the links and all that?"* (PC3). Pharmaceutical interviewees pointed to data limitations as barriers to accurate product carbon footprint quantification, particularly the absence of emission factors for specific processes such as active pharmaceutical ingredient (API) production. One pharmaceutical interviewee described the difficulty of allocating facility-level energy use to individual products: *"I've honestly tried for a long time to determine how much of the energy of a particular factory goes to one product versus the other versus the other"* (PC2). Other pharmaceutical interviewees emphasised the high cost and technical expertise required

to quantify carbon footprints across product portfolios, especially for small-medium-sized and generics companies, reinforcing the tension between financial viability and climate action explored in Chapter 6. These accounts suggested that technocratic discourse continued to shape pharmaceutical company interviewees' framing of climate action through terms of standardisation, quantification, and data, while also surfacing their perceived challenges with quantification and disclosure of product carbon footprints.

Pharmaceutical companies' selective disclosure of product carbon footprints contributed to tensions with health system interviewees who expressed scepticism about companies' rationales for not disclosing product carbon footprint data. One pharmacist suggested data were withheld by companies to *"maintain their market position"* (HS8), while one health system sustainability director who worked closely with pharmaceutical companies observed that, *"no one wants to share whatever data they have because they would probably see it as not comparable, but also probably think it's commercially sensitive"* (HS2). These accounts reinforced health system interviewees' critique that companies prioritised profit over climate action that I explored in Chapter 6. Refuting companies' claims of methodological challenges, one health system executive strategist remarked, *"it's not that hard to count carbon"* (HS9) and suggested that calls for standardisation were being used strategically by companies to delay disclosure and retain control over product data. These reflections suggested an awareness amongst health system actors of the selective nature of company emissions disclosures, raising questions about the intent and effectiveness of health system demands for such data.

Pharmaceutical and health system interviewees highlighted ongoing public–private initiatives to standardise product carbon footprinting methodology in response to challenges in product-level emissions quantification and disclosure identified by pharmaceutical interviewees. In my findings, the most frequently cited initiative was the Sustainable Markets Initiative Health Systems Task Force [240], involving NHSE, the WHO, and companies, including GSK and Novo

Nordisk (see Chapter 8). One interviewee involved in this initiative described it as an effort to *"create a standardised set of rules for measuring a product carbon footprint for medicine"* (O1), aiming to enable comparison of pharmaceuticals. However, interviewees also framed standardisation initiatives as a *"battle for control"* over methodologies and data (IN2). One pharmaceutical interviewee noted that companies sought to *"set the rules of the framework"* (PC3) for the NHS to adopt, while another interviewee likened standardisation initiatives to a *"game"* (PC4) of competing for recognition and control over standards. These accounts reinforced the central role of standardisation within technocratic discourse, while also surfacing how standardisation efforts were shaped by institutional interests and power dynamics between pharmaceutical company and health system actors. My analysis also suggested that standardisation efforts risked replicating the same fallacies found in company-level emissions quantification, obscuring product heterogeneity and methodological uncertainty and variability behind the appearance of objectivity and standardisation.

In sum, accounts of product carbon footprinting across interviews reinforced the storyline of climate action as emissions quantification and disclosure. Technocratic discourse was reflected across these accounts, and appeared increasingly institutionalised, evident in health system demands for product carbon footprint data and in pharmaceutical companies' product carbon footprint quantification practices. However, my analysis highlighted the selective and performative nature of product carbon footprint disclosures, shaped by strategic decisions about what to report, how, and when, that contributed to tensions between pharmaceutical company and health system actors. Pharmaceutical companies' participation in initiatives to shape product carbon footprint standards suggested their intention to define the terms of quantification and control data disclosure. Additionally, my analysis suggested that efforts to standardise and quantify product carbon footprints risked becoming another way to measure the problem, a proxy for, and a distraction from, substantive climate action (see Section 7.3).

7.2.3. Patient care pathway emissions quantification and disclosure

My analysis of interview data identified a growing focus on quantifying pharmaceutical emissions within the context of patient care pathways. In this section, I unpack this emerging approach. Patient care pathways are typically defined as standardised, evidence-based sequences of clinical interventions for specific conditions, designed to improve consistency and outcomes [241]. In practice, patient care pathways are shaped by a range of factors, including patient characteristics, socio-economic context, treatment adherence, local clinical guidelines, and health system infrastructure [242]. In my interview data, patient care pathway emissions quantification (i.e., assessing emissions across the sequences of clinical interventions, including patient travel, health care facilities, diagnostics, and treatments such as pharmaceuticals [243]), was introduced as another approach to emissions quantification. However, methodological challenges to emissions quantification persisted, particularly debates amongst pharmaceutical company and health system actors on how to define pathways and attribute emissions. Additionally, my analysis suggested that efforts to embed emissions quantification into patient care pathways reproduced challenges with technocratic discourse, as actors attempted to reduce the variability of care into standardised, quantifiable, and comparable emissions data.

From my findings, patient care pathway emissions quantification appeared to reflect efforts by pharmaceutical company and health system actors to quantify processes and outcomes beyond individual products. One industry collaborative lead explained that the patient care pathway approach was a new way of conceptualising emissions quantification: *"I think this patient care pathway question will become increasingly important… it's the same question, we are looking at it from a different angle"* (IN2). One pharmaceutical interviewee emphasised the value of this approach by critiquing the usefulness of comparing product carbon footprints, *"asking the difference in the environmental impact of one medicine versus another is kind of a goofy*

question", explaining that if a vaccine could prevent the need for multiple treatments, the emissions associated with the entire patient care pathway could be avoided: "*when in fact, if I had the vaccine, I don't need either medicine, right. So how do you compare health outcome?"* (PC2). Expanding emissions quantification to patient care pathways thus reflected attempts by pharmaceutical companies and health systems to identify the least emission-intensive pathways for optimal patient outcomes.

My analysis of interview accounts concerning patient care pathway emissions quantification surfaced debate over how patient care pathways were conceptualised. No two patient experiences are identical, complicating efforts to standardise emissions quantification across diverse clinical trajectories and to attribute responsibility for emissions. As one interviewee involved in creating standards across the pharmaceutical supply chain asked, *"where would you attribute the impact of the medicine?"* (O1). This interviewee also pointed to the contentious nature of deciding what data should be included: *"What is so hard is how do we agree on that? That is contentious right now, just like it's contentious of how far the data goes back and what depths of data"* (O1). One health system interviewee further highlighted how companies used this approach to construct counterfactual scenarios, claiming, for example, that their pharmaceutical products reduced emissions by preventing future emission-intensive health care interventions:

> *"They have got a few stories out at the moment and talk about how phenomenal the emissions reductions they achieve from their drug. You look at them and you go, holy shit, that is in aggregate, you know, the entire NHS emissions. And then you realise what they are actually doing is saying if you take my drug, you will not need all of the subsequent health care interventions required from secondary prevention, renal failure, or whatever. That is obviously kind of true, but it's a bad counterfactual."*
>
> (HS9 – Executive Strategist, Health System, October 2023)

This example illustrated how the patient care pathway approach was leveraged by this company to shape the narrative around their emissions data by framing avoided emissions as actual reductions. While the claims made by the company in this example may be valid in cases where a pharmaceutical genuinely reduces the need for further emission-intensive interventions, these claims relied on speculative counterfactuals about what would have occurred otherwise. As the interviewee noted, the use of *"bad counterfactuals"* illustrated the fragility of these claims and demonstrated how emissions data could be strategically used to signal climate action, reinforcing the performative nature of emissions quantification and disclosure.

In sum, my analysis suggested that the patient care pathway approach was intended by pharmaceutical company and health system actors to account for emissions across a patient's health care journey and facilitate cross-sector collaboration towards net zero, which I return to in Chapter 8. However, as with company- and product-level quantification, this approach was shaped by methodological uncertainty, contested conceptualisation of care pathways, and challenges in attributing emissions. My analysis suggested that patient care pathway emissions quantification risks becoming another performative exercise, producing data that signals climate action without necessarily driving substantive emissions reductions, while concealing the uncertainty and diversity inherent to this data. Efforts by pharmaceutical company and health system actors to develop patient care pathway quantification methodologies reflected the deepening institutionalisation of technocratic discourse, where the prioritisation of emissions quantification and disclosure continued to dominate climate action.

7.3. Emissions quantification and disclosure as climate inaction

In this section, I examine a counter-storyline that actively challenged the previously presented storyline: emissions quantification and disclosure as climate inaction. This storyline was articulated by a smaller discourse-coalition, comprising a subset of pharmaceutical company and health system interviewees, particularly those with long-standing involvement in sustainability work. Consistent with Hajer's insight that the same actors may simultaneously draw on multiple, even contradictory, storylines, these interviewees were part of the discourse-coalition discussed earlier, but articulated critical reflections on its limitations, thereby contributing to the construction of this alternative discourse-coalition [173]. Actors within this discourse-coalition challenged the centrality of emissions quantification and disclosure, calling for stronger alignment between data and action, and critiquing the assumption that data necessarily leads to climate action. Actors emphasised the need to focus on emissions reduction over quantification, and framed quantification as a potential distraction from substantive action. I consider this framing as reflecting a post-technocratic discourse that challenged the primacy of technocratic approaches, critiqued the over-reliance on quantification, and called for more substantive climate action. This post-technocratic discourse remained marginal; however, it exposed the limitations of data-centric climate strategies.

Interviewees contributing to this discourse-coalition critiqued the focus on quantifying data and advocated for more strategic data to support emissions reduction. As one climate consultant explained, *"what you really want to produce is data that says, here is our road map for reducing… it is about how to get the right sort of data that you could use to support reductions"* (IN6). Similarly, one lead of a climate-related industry collaboration stressed the need for data that supported *"strategic measurable action"* (IN2), while one health system sustainability director emphasised collecting the *"right"* data to inform *"the right decisions"* (HS2). These accounts

reflected a recognition that emissions quantification alone is insufficient. Interviewees who contributed to this discourse-coalition advocated for emissions data that could support substantive climate action.

There was ambiguity in my findings about what constituted the *"right"* data to support climate action. My findings showed how the three pharmaceutical companies in my study reported using emissions data to shape their emissions reduction strategies. For example, acknowledging that most of their company-level emissions arose from supply chains (see Table 7 and Figure 3), all three companies in my study targeted supply chain emissions through supplier engagement, educational initiatives, and climate-related procurement criteria (see Appendix Table 1 and Chapter 8) [193, 200, 201]. As another example, one pharmaceutical interviewee described using product-level carbon footprint data to identify emissions hotspots, such as active pharmaceutical ingredient (API) production and inhaler propellants, to target with emissions reduction strategies. These examples suggested that emissions data informed company climate action by identifying emission-intensive processes to target. However, my analysis of these examples also suggested the potential for data to direct action towards what was most easily measured, rather than what was most impactful, highlighting the persistent influence of technocratic discourse.

Other interviewees who contributed to this discourse-coalition, particularly those with long-standing experience with sustainability work, articulated a more critical view that emissions quantification and disclosure do not inherently equate to climate action. One industry collaboration lead explicitly distinguished between emissions quantification and climate action, noting: *"You've got this tension between the sort of concept of greenhouse gas accounting and action to drive down emissions... really pinpointing that action is tricky"* (IN2). Similarly, one climate consultant criticised the prevailing focus on disclosure as an *"end in itself",* particularly in light of the inherent limitations of emissions data:

> *"There is an over emphasis on data for reporting. And as a result, there is a rush to get generalised estimates and generalised estimate are not very good at all, really for managing for specific reductions… There is a preoccupation with data and unfortunately, it's become a little bit of an end in itself, rather than a means to an end. It's sort of become an ESG [environmental, social, and governance] reporting tool which is very unreliable anyway and isn't focused on reductions."*
>
> (IN6 – Executive, Climate Consultancy, November 2023)

My analysis of these accounts reflected a post-technocratic discourse that critiques what this interviewee called the *"preoccupation with data"*.

Interviewees who mobilised post-technocratic discourse articulated scepticism towards the utility of emissions quantification and emphasised that it can divert resources from more substantive pharmaceutical company climate action. For example, one climate consultant questioned the effectiveness of knowledge of a product's carbon footprint in driving emissions reductions, noting that *"reducing the number of steps [i.e., through eco-design of product manufacturing] doesn't actually change a whole lot"* (IN4). One pharmaceutical company sustainability strategist argued that *"efforts would be much better spent driving efficiency in every step, in every operation, than spending excessive time trying to figure out how to individually footprint"* (PC2). Similarly, one sustainability expert acknowledged the role of data in initially guiding action, *"you need the numbers to sort of understand where to focus your effort"* but stressed the availability of *"no regret actions"* that do not require detailed quantification, concluding that *"after you understand where to focus effort, the numbers themselves really don't do much to help"* (HS1). These reflections exemplified a post-technocratic discourse, which decentres quantification and foregrounds substantive climate action.

Actors in this discourse-coalition further challenged the assumption that more data would support climate action by health systems. One standards body interviewee questioned how

product carbon footprint data would be used by health system actors in practice: *"There is this debate, once the environmental impact is measurable and comparable, about how is the data used... how they are using the data from manufacturers to inform treatment or prescribing decisions?"* (O1). One pharmaceutical sustainability expert argued that many comparable pharmaceuticals have negligible differences in carbon footprint, rendering *"side-by-side"* analyses of product carbon footprints inconsequential in driving substantive health system climate action. This interviewee expressed further scepticism about prescribers' ability to act on emissions data: *"They ask a lot of questions that I don't think they know what to do with the answers"* (PC2). My analysis of these accounts pointed to potential misconceptions amongst health system actors that access to emissions data will necessarily drive health system climate action.

In summary, the counter-storyline of emissions quantification and disclosure as climate inaction was underpinned by a post-technocratic discourse. Actors who contributed to the discourse-coalition that shared this storyline questioned the privileging of emissions quantification and disclosure, framed emissions data as having limited utility to support climate action and described quantification and disclosure as resource-intensive exercises that distracted from and constrained rather than enabled substantive climate action. While this post-technocratic discourse had yet to institutionalise, it nevertheless exposed tensions within data-centric climate strategies. By surfacing these tensions, my analysis showed the limitations of relying on emissions quantification and disclosure and pointed towards the need to reorientate pharmaceutical company and health system climate strategies towards more substantive climate action.

7.4. Chapter summary

In this chapter, I analysed a storyline of climate action as emissions quantification and disclosure. This storyline was underpinned by a technocratic discourse through which climate action was framed by actors in this discourse-coalition as a technical challenge to be managed through standardisation, quantification, and disclosure of emissions data. My analysis found that this discourse had institutionalised across both pharmaceutical company and health system practices. This institutionalisation was evident in company-level emissions disclosures to meet regulatory and procurement requirements, health system actors' expectations for increasingly granular emissions data as a prerequisite for their own climate action, and ongoing efforts by pharmaceutical companies and health systems to develop standardised methods for quantifying emissions at the company, product, and patient care pathway levels.

My analysis revealed the performative nature of emissions quantification and disclosure, shaped by methodological choices, data availability, and selective disclosure. Companies' framing of emissions disclosures as a means to signal compliance with external expectations suggested that responsibility for limited climate action extended beyond individual companies to a broader institutional context that privileged quantification and disclosure over substantive climate action. Furthermore, companies highlighted their hesitation to disclose emissions data, which they perceived as incomparable, as a response to an institutional context increasingly seeking to use such data to inform procurement and prescribing decisions. This hesitation both contributed to joint efforts by pharmaceutical company and health system actors to develop standardised methods and revealed underlying power dynamics between these actors that were shaping quantification and disclosure practices. While emissions data can be strategically used to inform climate action, my analysis suggested that the focus on standardisation, quantification, and disclosure, across company, product, and patient care pathway levels, represented different

ways of measuring the same problem and risked turning quantification and disclosure practices into ends in and of themselves.

My analysis surfaced a counter-storyline of emissions quantification and disclosure as climate inaction. This storyline was supported by a smaller subset of actors (e.g., climate consultants, sustainability experts) who drew on a post-technocratic discourse to articulate critiques of the focus on emissions quantification and disclosure. Actors in this discourse-coalition expressed concern about the limits of emissions data and challenged the dominant framing of data as a prerequisite for action. This critique exposed tensions in the dominant technocratic discourse and highlighted the need to assess how data is used, as well as its fundamental necessity.

Finally, the focus on emissions quantification by companies and health systems may reflect genuine efforts to reduce climate impact, grounded in the technocratic assumption that data drives action. However, it may also signal uncertainty about how to achieve net zero, where calls for more data become a placeholder for action or a means of shifting climate responsibility onto those tasked with producing the data. I explore these considerations further in Chapter 8 through the storyline that climate action requires more collaboration.

Chapter 8: Climate action requires more collaboration

8.1. Introduction

In this chapter, I unpack a fourth storyline that I identified: climate action requires more collaboration. This storyline was shared by a discourse-coalition comprising a wide range of pharmaceutical company employees, industry members, climate consultants, sustainability experts, and health system actors in my study, and featured prominently across documents. My analysis suggested this storyline was underpinned by two distinct but overlapping discourses, consistent with Hajer's conceptualisation that storylines can comprise elements of various discourses [173]. The first was a techno-optimist discourse [244], in which climate action was framed unanimously by actors in this discourse-coalition as an issue to be solved through innovation and technological solutions, and collaboration as a means to collectively drive such innovation (Section 8.2.1). The second was a network governance discourse [245] where climate action was framed, primarily by pharmaceutical actors in this discourse-coalition, as interdependent on the decisions and actions of others, thereby requiring collaboration with various actors across pharmaceutical supply chains, notably national governments and suppliers (Section 8.2.2). Discursive affinity was evident in my analysis, as actors, drawing on these two discourses, articulated a shared conceptualisation that climate action requires more collaboration. My findings indicated evidence of discourse structuration (i.e., where discourse shapes how a unit conceptualises an issue [173]). Across my data, climate action was conceptualised as an issue requiring more collaboration to drive innovation and shared responsibility. Signs of discourse institutionalisation were also evident, particularly in the

prominence of calls for collaboration within company documents and the presence of existing collaborative partnerships.

Across sampled documents and interviews, there were examples of existing climate-related collaborations between pharmaceutical companies and health system actors (Section 8.3). The presence of existing collaborations stood in contrast to the discourse-coalition's calls for *more* collaboration. My analysis surfaced further tensions between how collaboration was described and idealised and the way in which collaborations functioned in practice. Some collaborations appeared to be performative, with pharmaceutical companies leveraging them to signal a commitment to climate action. Collaborations appeared, at times, to be strategically employed by pharmaceutical companies to shift responsibility for climate action onto other actors. Additionally, the effectiveness of these collaborations in practice appeared to be undermined by conflicting institutional interests, agendas, and ways of working, interorganisational mistrust, and competitive concerns.

8.2. Climate action requires more collaboration

The storyline that climate action requires more collaboration was consistently featured across documents and unanimously shared by all interviewees, forming a discourse-coalition. My analysis indicated that this storyline was primarily underpinned by two discourses: (a) a techno-optimist discourse, through which actors in this discourse-coalition unanimously framed climate action as an issue to be solved through innovation and technological solutions amidst uncertainty about achieving net zero, and collaboration as means to collectively drive such innovation; and (b) a network governance discourse, through which climate action by pharmaceutical companies was positioned as dependent on decisions and actions by other actors, particularly national governments and suppliers. Despite originating from different

assumptions, one grounded in faith in collective innovation, the other in a belief in shared responsibility, these discourses showed discursive affinity, as actors drawing on them articulated a common view that climate action requires more collaboration. The recurring calls for collaboration indicated some degree of institutionalisation of these discourses. However, my analysis suggested that calls for more collaboration were often vague, underdefined, and aspirational, or served to deflect responsibility to other actors, offering limited direction for substantive climate action.

8.2.1. More collaboration is required to drive innovation

In this section, I focus on the techno-optimist discourse underpinning the storyline that climate action requires more collaboration. A discourse-coalition comprising all interviewees, including pharmaceutical employees, industry members, sustainability experts, climate consultants, and health system actors, shared this storyline. Actors in this discourse-coalition framed climate action as an issue to be solved through innovation, and collaboration as essential to collectively drive this innovation. This framing reflected a techno-optimist discourse in its confidence in innovation and technological solutions [244]. This framing appeared rooted in widespread uncertainty, evident across documents and interviews, about how pharmaceutical companies might achieve net zero, thereby necessitating collective innovation to identify solutions. My analysis suggested that this discourse had undergone structuration [173]; repeated, unanimous calls for collaboration and innovation indicated that actors within the discourse-coalition had internalised a shared understanding of climate action as best achieved through collaboration and innovation. In practice, these calls were vague, underdefined, and aspirational, a placeholder for action, marked by limited concrete examples of innovation and little clarity about who should collaborate, how, or towards what ends.

All three pharmaceutical companies in my study had set climate targets; however, there was widespread uncertainty across interviews about how to reach these targets. One director of a non-profit health organisation summed up this uncertainty: *"Nobody knows what net zero really looks like. There are road maps to get there which are very fraught. And actually, applying that and implementing at an operational level, at a health systems level, as a supplier, as part of the supply chain. All of that remains to be created and established"* (HS4). Amidst this uncertainty around reaching net zero, all interviewees expressed doubt about whether any company, globally, would reach net zero, especially Scope 3 targets. As one interviewee from a climate consultancy stated, *"all the world is going to miss them though, on Scope 3"* (IN4). Interviewees from the pharmaceutical companies I studied voiced concerns about their ability to meet net zero targets, citing uncertainties related to evolving climate science and the solutions required. One pharmaceutical collaboration lead noted, "*the solutions aren't necessarily clear exactly at the moment"* (IN2). These accounts pointed to widespread uncertainty on solutions needed to reach net zero.

There was a noticeable disconnect between the uncertainty expressed by interviewees and the way companies presented their climate action in public documents. For example, GSK repeatedly emphasised that they had set *"clear and measurable targets"* [193][pg16] and had mapped a *"clear pathway to net zero"* [196][pg2]. Only in rare instances did companies publicly acknowledge uncertainty. For example, in a blog on Novo Nordisk's website, the Corporate Vice President of Global Public Affairs and Sustainability admitted *"It's one thing to know what to do and another to actually deliver it"* [246]. GSK's Sharing our Journey report also conceded that they did not have all the answers but preferred to start the journey and learn along the way [197]. These accounts indicated that, although uncertainty around achieving net zero was acknowledged internally, it was rarely reflected in public-facing documents, reinforcing the performative nature of company climate reporting which projected an impression that net zero progress was on track.

In sampled company documents, collaboration was framed as necessary for collective innovation to achieve net zero. For instance, GSK emphasised: *"GSK has an ambitious plan to reduce our own impacts on climate change and nature loss, fast. We know we can accelerate our own reduction – and simultaneously promote protection and restoration – by working collaboratively and innovatively right across our business, supply chain and the healthcare sector at large"* [198][pg3]. Similarly, Novo Nordisk acknowledged that to reach their net zero goal they would "*need to collaborate with innovative partners to create new, improved and more sustainable solutions together"* [246]. One sustainability executive from Novo Nordisk noted in a publicised blog that "*more than anything, I've learnt that working together with other companies triggers innovation"* [246]. Teva similarly cited the need to collaborate with "*strategic partners who understand our challenges and processes and who are able to work with us to find the most innovative solutions"* [203]. The consistent use of language around both collaboration and innovation in these accounts reinforced a techno-optimist discourse. At the same time, it also illustrated the vagueness of calls for collaboration and innovation, which often lacked specificity about who should collaborate and around what forms of innovation.

Across all interviews, collaboration was also framed, in conjunction with the need for innovation, as essential for climate action. One interviewee overseeing a pharmaceutical portfolio at a climate consultancy emphasised, *"there is a lot of innovation and collaboration that will be needed in order to get us there"* (IN4). Another interviewee who was a sustainability lead at a health care insurance company described climate action as *"all about finding ways of innovation and how to innovate, how we can collaborate, how we can partner with others using research and insights to really drive that central transformation that we need"* (HS6). One sustainability expert from a health system noted, *"we are going to need to be very innovative, very collaborative"* (HS1). One lead of a pharmaceutical collaboration echoed the need for collaboration to overcome uncertainty around solutions: *"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. They can't be solved by one single company. It needs collective systemic action" (IN2). My analysis of these accounts suggested that interviewees acknowledged the limits of their individual capacities to reach net zero and framed collaboration as a way to navigate the risks and responsibilities inherent in climate innovation. However, as in documents, these calls for collaboration and innovation remained poorly defined.

The pharmaceutical industry's longstanding history of scientific inquiry was suggested by interviewees as an asset in collaborative efforts to research and develop innovative solutions for climate action. As one sustainability project manager at a pharmaceutical company explained, *"It is quite like, an innovative industry... that leaks into almost all company cultures... to be innovative across the board in terms of climate impact as well"* (PC4). One senior lead involved in a pharmaceutical collaboration added that *"these collaborative approaches are going to become increasingly important",* supported by the industry's deep roots in *"science, and kind of, logic and innovation"* (IN2). Health system interviewees acknowledged the industry's capacity and expressed a desire to engage in collaborative partnerships to enable collective learning and joint problem solving. *"We want to help and support industry",* explained one sustainability director from a health system, *"bring along their collective learning to come together to solve some issues"* (HS2). These portrayals of the pharmaceutical industry as scientific and innovative reinforced a techno-optimist discourse that framed climate action as a challenge to be resolved through 'science' and innovation.

In sum, climate action was framed by actors in this discourse-coalition as a problem to be solved through collective innovation in the face of widespread uncertainty about how to reach net zero, and collaboration as a way to achieve this innovation, reflecting a techno-optimist discourse. My analysis suggested evidence of discourse structuration, as calls for collaboration and innovation reflected actors' conceptualisation of climate action as a problem that can be addressed primarily through collective innovation. This discourse also showed signs of institutionalisation,

evident in its widespread use across companies' public documents. However, my analysis also found that this techno-optimist framing was frequently invoked without specifying who should collaborate, how collaboration should occur, or what kinds of innovation were envisioned.

8.2.2. More collaboration is required to enable company decarbonisation

In this section, I focus on the network governance discourse that underpinned the storyline that climate action requires more collaboration. Network governance is typically characterised by informal networks of diverse actors (e.g., private companies and public institutions) operating across multiple levels of governance (e.g., organisational, institutional) to cooperate on complex issues (e.g., climate change), where actions and outcomes are interdependent and require shared responsibility [247]. Actors, specifically those who held roles related to decarbonising pharmaceutical companies (e.g., pharmaceutical sustainability leads, climate consultants, and sustainability experts) framed company climate action and decarbonisation as interdependent on decisions and actions by other actors, notably governments and suppliers, and highlighted the need for coordinated action by multiple actors. This framing reflected a network governance discourse. I examine how this discourse was mobilised across two domains of company practice, what Hajer describes as sites where discourse is produced, reproduced, and transformed [173]: (a) efforts to decarbonise operational (Scope 1 and 2) emissions, and (b) efforts to decarbonise supply chain (Scope 3) emissions. Across these domains, my analysis highlighted challenges with the network governance discourse, specifically, in how companies were perceived by health system actors to use it to deflect responsibility for climate action, and in the practical challenges of working collaboratively across diverse institutional contexts.

8.2.2.1. Efforts to decarbonise operational emissions

In this section, I unpack efforts by the pharmaceutical companies in my study to decarbonise their operational (Scope 1 and 2) emissions from direct energy use in operations, company-owned vehicles, and purchased electricity [13]. Reported efforts to decarbonise operational emissions were largely implemented at the level of individual companies. Pharmaceutical interviewees, in particular, described companies' operational decarbonisation as constrained by limited actions by other actors, particularly national governments responsible for renewable energy policy and infrastructure. Interviewees called for wider action by these actors, reflecting a network governance discourse.

Operational emissions accounted for less than 10% of the three pharmaceutical companies reported greenhouse gas emissions (see Figure 3 in Chapter 7). Each of the companies reported individual actions to reduce operational emissions (see Appendix Table 1), such as measures to optimise energy efficiency (e.g., LED (Light Emitting Diode) lighting, equipment upgrades) and transition to low-carbon (e.g., electric) vehicles [193, 201, 224]. All three companies also reported actions to increase their use of renewable energy, including on-site generation and external procurement of solar, wind, and other renewable energy sources [248]. For example, GSK reported that 85% of the energy used at a Scottish site came from on-site renewables and biogas, while Teva sourced 28% of a Croatian site's energy from a solar facility built in partnership with a large energy provider [192, 201].

The three companies also reported employing market-based mechanisms to demonstrate their use of renewable energy and subsequent operational decarbonisation. These mechanisms included (a) power purchase agreements, contracts between a company and an energy provider in which renewable energy is supplied at a fixed price over a defined period, and (b) renewable energy certificates, which verify the generation of one megawatt-hour of electricity from renewable sources and enable companies to claim associated Scope 2 emissions reductions

[249]. While these mechanisms can be used by companies to demonstrate operational decarbonisation, one pharmaceutical interviewee questioned their transparency and impact, describing them as potentially misleading: *"you are just paying a tariff that says it's renewable energy. You are getting exactly the same electricity through your plughole as anybody else in the country"* (PC4). Another pharmaceutical interviewee cited the legal complexities of these mechanisms, noting that *"power purchase agreements are complicated"* and that *"it's hard to buy renewable energy"* (PC2). These accounts showed that companies employed market-based mechanisms to demonstrate operational decarbonisation, but that these mechanisms – shaped by national governments and regulatory bodies – have inherent limitations in driving substantive emissions reduction. My analysis of these accounts suggested that companies actively framed these constraints as external, complex, and beyond their control, thereby positioning limited decarbonisation not as inaction, but as an issue of their wider institutional context. These accounts also reflected a network governance discourse, in which operational decarbonisation was framed by pharmaceutical interviewees as dependent on decisions and actions of a broader set of actors, including policymakers and regulators.

As referenced to in the above accounts, the electricity the three companies directly consumed came from local grids, and thus companies' renewable energy and operational decarbonisation claims were contingent on the energy mix of the countries in which they operated. Both pharmaceutical company and health system interviewees recognised the difficulty in directly accessing renewable energy in some countries. One health system strategist emphasised this challenge:

> *"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."

(HS9 – Executive Strategist, Health System, October 2023)

My findings indicated that efforts by some countries to transition to renewable energy were impeded by geopolitical constraints. Singapore, where many pharmaceutical companies operate, was frequently cited by pharmaceutical interviewees to illustrate geopolitical challenges of accessing renewable energy. As one pharmaceutical environmental strategist explained: "*there's plenty of room there [Malaysia], but Malaysia and Singapore don't talk to each other because they're mad because, you know, Singapore split off at some point. But the, the practicality of it is there's lots of room in Malaysia to put renewable energy. So why do these political things get in the way?"* (PC2). As explained in this account, Singapore has limited land area which restricts the development of renewable energy infrastructure, while strained relations with its neighbour Malaysia[13] complicate cross-border renewable energy projects. Further geopolitical events that impact national energy transitions (e.g., war, the energy crisis, economic recession), and subsequently, companies access to renewable energy, were noted by GSK in their ESG Performance Report [193]. These critiques of geopolitical constraints to climate action reflected pharmaceutical interviewees' perspective that effective climate action is inherently interdependent, requiring shared responsibility and coordinated efforts by actors across sectors, such as national governments responsible for energy infrastructure.

Pharmaceutical company and health system interviewees described ways in which pharmaceutical companies actively engaged with external actors to advance operational decarbonisation. For example, one health system sustainability executive highlighted a pharmaceutical company that was leveraging its political and economic influence to *"pressure*

[13] Singapore was part of the Federation of Malaysia, but tensions between the predominantly ethnic Chinese population in Singapore and the Malay-dominated government led to Singapore's separation in 1965, with continued diplomatic tension.

the Indian government" to support grid decarbonisation (HS9). This example illustrated how pharmaceutical companies could informally influence climate action by other actors, reflecting the principles of network governance. In contrast, one pharmaceutical interviewee argued that addressing issues such as limited local energy infrastructure fell outside companies' responsibility: *"We're only one player in this, and it's not necessarily our job to fix the issues of local government"* (PC2). These contrasting views revealed tensions stemming from differing perceptions of with whom responsibility for climate action resides.

In sum, operational decarbonisation was framed as interdependent on the decisions and actions of other actors, particularly related to renewable energy policy and infrastructure. This framing reflected a network governance discourse that highlighted the interdependent and negotiated nature of climate action, requiring action by multiple actors.

8.2.2.2. Efforts to decarbonise supply chain emissions

Decarbonising supply chain emissions (i.e., Scope 3, indirect emissions that occur across pharmaceutical companies' supply chains) was another domain of company practice through which a network governance discourse was reproduced. Reducing supply chain emissions is necessary to achieve company climate targets; however, my analysis illustrated that supply chain decarbonisation was interdependent on the climate actions of companies' global supplier base. Collaboration with suppliers was consistently framed by actors in this discourse-coalition as essential to sharing responsibility for and reducing supply chain emissions.

Supply chain emissions formed the bulk of the three companies' reported greenhouse gas emissions: GSK 92%, Novo Nordisk 96%, and Teva 92% (see Figure 3 in Chapter 7). In their company documents, GSK, Novo Nordisk, and Teva reported having approximately 24,000, 60,000, and 48,000 suppliers respectively (see Table 4 in Chapter 4), located across many

countries, whom they relied on for raw materials, active pharmaceutical ingredients, outsourced production, third-party distribution, waste management, and other services. Pharmaceutical interviewees described pharmaceutical supply chains as *"complex"*, *"opaque",* and at "*arm's length*", over which pharmaceutical companies had limited oversight or direct control (IN4, IN6). One sustainability director of a health organisation summed these *"complex"* supply chains:

> *"When you look at the complex supply chain… maybe manufacturing in China and then they go to India and then they are either produced as generics or produced for a large pharmaceutical company, and then they are shipped and packaged and whatever happens with them in the next place, and there are multiple scopes there, not to mention the extraction of the raw material, which is often fossil fuel based and it's like-- that is a huge challenge. I think it's, you know, it's just so complex that nobody, very few people, really know what it looks like."*
>
> (HS4 – Sustainability Director, Non-profit Health Organisation, June 2023)

Greater collaboration across supply chains was frequently suggested by pharmaceutical interviewees, and across documents, as necessary for climate action: *"engage with suppliers"* (IN4)*, "engage more with suppliers"* (IN1)*, "engage with suppliers to help them"* (IN5)*, "work with suppliers"* (PC2)*, "more focused on engagement with the suppliers"* (O1)*, "really engage with those tiers of suppliers"* (IN2)*,* and "*when it comes to supply chain, they have to be working collectively with each other*" (HS3). As one pharmaceutical collaboration environmental lead noted, *"we cannot do this on our own… we need to work with others and health care providers and suppliers to really transform the whole health care system."* (IN2). Similarly, on their website, Novo Nordisk reiterated the need to work with suppliers to achieve net zero: *"If we want to achieve zero impact, both up and down our supply chain, working with our suppliers is paramount"* [224]*,* while GSK noted that "*supply chain emissions are a shared challenge across our industry sector and we are collaborating to find shared solutions"* [193][pg17]. These accounts illustrated the

prominent view across my data of the need to collaborate with suppliers to achieve decarbonisation.

All three companies in my study reported strategies to reduce supply chain emissions, centring on supplier engagement and education and the integration of climate criteria into procurement processes (see Appendix Table 1). For example, in 2022, GSK hosted a Supplier Forum attended by their top suppliers, Novo Nordisk worked with suppliers to embed sustainability thinking throughout their supply chain, and Teva organised a supplier capacity-building webinar aimed at encouraging resource conservation [193, 199, 201]. All companies implemented internal and third-party assessment mechanisms to monitor supplier climate performance [250]. Climate criteria were also embedded in companies' procurement processes. For example, GSK's Sustainable Procurement Programme, launched in 2022, required suppliers to disclose emissions, set climate targets, and act on environmental impacts [193]. Teva assigned at least 5% weighting to environmental, social, and governance (ESG) criteria in their supplier selection process [201]. My analysis of these activities illustrated how companies are actors within a network governance system, reliant on collaboration with suppliers to reduce supplier emissions.

My analysis, however, suggested that pharmaceutical companies had limited influence over suppliers' climate actions, revealing limitations of companies' supply chain decarbonisation strategies. One interviewee from an industry trade association challenged the assumption that multinational companies hold leverage over suppliers, stating, *"[we] cannot influence suppliers that easily",* and explaining that companies *"rely heavily on a number of suppliers – those suppliers are not reliant the other way round"* (IN3). One interviewee from an intergovernmental health organisation similarly highlighted the industry's dependence on a small number of highly specialised suppliers, whose expertise and capacity made them indispensable and whose services were typically distributed across many multinational pharmaceutical company clients.

As one climate consultant remarked, if a company attempted to pressure such a supplier to reduce emissions, they would *"likely be told to take a high jump"* (IN6), that is, dismissed outright. These accounts illustrated a limitation in the enactment of a network governance discourse; while climate action was framed by this discourse-coalition as a shared responsibility amongst interdependent actors, in practice, divergent interests and asymmetrical power relations appeared to constrain collaborative action.

Additionally, my analysis revealed that pharmaceutical companies' calls for greater collaboration across supply chains were, at times, perceived by health system interviewees as attempts to deflect responsibility for climate action. For example, one health system sustainability strategist observed a tendency for companies to *"blame"* the complexity of their supply chains in public communications, thereby deflecting responsibility: *"then they look at Scope 3, and they say, okay, that's a supply chain, the responsibility is over here"* (HS1). Similarly, one climate consultant suggested that companies often highlighted supplier-related challenges in public reporting as a pre-emptive defence against missing climate targets: *"then you can always say, yeah, it's not us, it's the rest of the industry"* (IN4).

In sum, reducing supply chain emissions was a domain of company practice in which a network governance discourse was repeatedly reproduced. Actors in this discourse-coalition, who mobilised a network governance discourse, framed climate action as dependent on supplier action requiring collaboration across supply chains. My analysis suggested that this network governance discourse had undergone structuration as actors in this discourse-coalition conceptualised supply chain decarbonisation as a shared problem to be solved by collaboration and coordination with multiple actors across supply chains. However, my analysis revealed limits to the network governance principles underpinning this discourse. Efforts to engage suppliers were often constrained by the inherent complexity of supply chains and asymmetrical power dynamics between companies and suppliers. Additionally, my findings highlighted concerns

amongst health system interviewees that some companies were strategically mobilising a network governance discourse to shift responsibility for climate action onto suppliers, thereby justifying inaction. The institutionalisation of this discourse remained minimal as my data revealed limited supply chain collaboration in practice.

8.3. Climate-related pharmaceutical collaborations

I unpack a range of existing climate-related pharmaceutical collaborations I identified across sampled documents and interviews, and which are outlined in Table 9. These included (a) intra-industry collaborations between pharmaceutical companies, and (b) cross-sector collaborations involving pharmaceutical companies and other actors, such as health system actors. My analysis of these collaborations surfaced tensions in the storyline that climate action requires more collaboration. Firstly, calls for more collaboration by the discourse-coalition sharing this storyline stood in contrast to the presence of existing collaborations. Secondly, there appeared to be a disconnect in how collaboration was described and idealised through techno-optimist and network governance discourses (i.e., as a way to collectively innovate and share responsibility for decarbonisation) and how collaborations functioned in practice. Some collaborations appeared to operate primarily as a performative act for companies to signal climate action or were employed by companies to deflect responsibility for climate action to others. Existing collaborations were often undermined by conflicting interests, mistrust, and competition between actors.

Table 9. Examples of pharmaceutical company climate-related collaborations

Collaboration type	Examples	Actors involved	Purpose/ focus	Features/ critiques
Intra-industry collaborations	Pharmaceutical Environmental Group (PEG)	Sustainability leads from multinational pharmaceutical companies	Collaborative platform for pharmaceutical climate and environmental action	Offers safe space, and action-focused approach to sharing solutions within the industry; limited by commercial sensitivity and difficulty aligning perspectives across companies
	Activate	Multiple pharmaceutical companies, convened by Manufacture2030	Supplier sustainability capacity-building and engagement	Focus on improving supplier climate literacy, data, and action; early-stage
Cross-sector collaborations	ENERGIZE	19 pharmaceutical companies and Schneider Electric	Aggregated renewable energy procurement support for suppliers	Collectively addresses renewable energy barriers for suppliers; educational rather than structural transformation
	Novo Nordisk – Maersk, SKYNRG, Little Bricks	Novo Nordisk, Maersk, SKYNRG, Little Bricks	Sustainable transportation, logistics, and circular economy	Multi-actor partnership across Novo Nordisk, shipping, sustainable fuel, and climate innovation; focus on decarbonising logistics and transport emissions and products
	Sustainable Markets Initiative Health Systems Task Force	CEOs from GSK, AstraZeneca, Novo Nordisk, Sanofi, NHS, WHO, etc.	Public-private leadership to drive health system decarbonisation	Senior leadership commitment, but pharmaceutical companies critiqued for potentially employing it to control climate narrative
	Novo Nordisk and NHS England	Novo Nordisk, NHS England	Innovation and funding of low-carbon insulin cold chain	Seen as a strong example of practical collaboration; shared accountability and co-financed innovation

8.3.1. Intra-industry collaborations

The three pharmaceutical companies in my research reported participating in several climate-related intra-industry collaborations with pharmaceutical peers. These included collaborations through trade associations, such as the Association of the British Pharmaceutical Industry (ABPI) and the European Federation of Pharmaceutical Industries and Associations (EFPIA), where climate action was incorporated into broader industry workstreams. The three companies also engaged in more targeted, climate-specific collaborations (see Table 9), such as the Pharmaceutical Environmental Group (PEG), a network of sustainability leads from multinational pharmaceutical companies focused on environmental issues, and the Activate Programme, run by the consultancy Manufacture2030, which supports suppliers of active pharmaceutical ingredients by helping them access funding and practical support to reduce emissions.

These intra-industry collaborations were suggested by pharmaceutical interviewees in my study to provide companies with a platform to share insights and learnings, and to work together on climate action. One pharmaceutical collaboration lead emphasised the need to create a *"safe space for challenging conversations"* and to *"share ideas"* for climate action (IN2), while one former member of a trade association collaboration suggested that this collaboration gave companies a *"common voice"* on climate action (O2). The lead of an industry collaboration highlighted that these collaborations reflected pharmaceutical companies desire to find actionable ways to reduce emissions, citing their members as showing *"a real willingness to take action and to put their heads above the parapet and to really try and find ways to decarbonise"* (IN2). These accounts, which were typically put forward by interviewees involved in collaborations, framed collaborations as offering opportunity for companies to work collectively on climate action.

However, my analysis surfaced challenges in how these intra-industry collaborations functioned in practice. The volume of existing pharmaceutical collaborations described by interviewees

stood in contrast to calls for more collaboration as a solution for climate action, as discussed in the previous sections. One sustainability director involved in an industry collaboration highlighted the proliferation of climate-related pharmaceutical collaborations and suggested that companies often delegated participation to individual employees primarily to signal climate action. These individuals, however, often lacked the internal authority to advance climate action within their company:

> *"I could join one of fifty collaborations focused on pharma or connected to pharma in some way for sustainability. I think there is a real misconception that if you have somebody from [name of pharmaceutical company] in your group, that you have [their] perspective. I don't think you-- I think you have that person's perspective in that moment from their world."*
>
> (IN3 – Sustainability Director, Industry Collaboration, July 2023)

This account cast doubt on some companies' climate action, suggesting a lack of resource allocation towards achieving climate targets and raised questions about the sincerity of their engagement in the collaborative efforts they publicly advertised.

Interviewees external to pharmaceutical companies critiqued some pharmaceutical collaborations as a performative play to maintain an impression of climate action. One environmental lead at an insurance company remarked that *"pharma companies have their fingers in lots of pies and lots of coalitions and different partnerships"* but described this as *"more of a strategic play than a, let's say, philanthropic genuine ESG [environmental, social, and governance] play"* (HS7). Similarly, one director of an industry collaboration reflected, *"when I am in my most cynical, I think this is just like dressing up, like, we just look like we are doing something over here"* (IN3). My analysis of these accounts illustrated how these interviewees characterised pharmaceutical collaborations as performative, serving as a means for companies to advertise their involvement in multiple collaborative efforts, without necessarily driving

climate action. These accounts showed the tension in how collaborations were spoken about and how collaborations functioned in practice.

Pharmaceutical interviewees universally acknowledged the difficulties of forming successful intra-industry collaborations, citing differing interests, agendas, and communication styles, legal barriers and competitive concerns as challenges. One pharmaceutical executive remarked that reaching consensus on a single issue could take months due to these obstacles: *"It took us half a year to agree because all companies have their own way of thinking and their own way of communicating"* (PC1). These challenges were echoed by GSK who highlighted, in their Sharing our Journey report, how differing levels of ambition, priorities, and commercial sensitivities complicated collaboration: *"It can be challenging: we have different levels of ambition, different drivers, different priorities and commercial sensitivities"* [197][pg6]. One industry trade association member noted the pharmaceutical industry's reluctance to collaborate: *"pharmaceutical companies are notorious at not being able to work together"* (IN1).

In sum, pharmaceutical companies engaged in a variety of intra-industry climate-related collaborations. Interviewees involved in these collaborations described them as opportunities to collectively advance climate action. However, my analysis highlighted challenges of climate-related pharmaceutical collaborations in practice, particularly perceptions of their performativity and the presence of conflicting interests and agendas, that stood in tension with how collaboration was described and idealised as necessary for climate action.

8.3.2. Cross-sector collaborations

The three pharmaceutical companies in my study also reported engaging in a range of cross-sector collaborations, both with other industries and with health system actors (see Table 9).

One example of a cross-industry collaboration that featured in my data was the ENERGIZE programme, involving 19 pharmaceutical companies (including those in my study) in partnership with Schneider Electric, aimed at supporting suppliers in gaining access to renewable energy [251]. Novo Nordisk reported several additional cross-industry collaborations, including participation in the Kalundborg Symbiosis, a network of seventeen companies engaged in circular production (i.e., reusing, recycling, reprocessing, and regenerating materials in production) in Kalundborg, Denmark. Novo Nordisk also described a partnership with Little Bricks, a toy manufacturer, focused on developing methods to convert captured carbon into methanol for plastic production, as well as collaborations with logistics companies, as published on their environmental, social, and governance (ESG) portal:

> *"Additionally, we have entered into an agreement with the Danish shipping company, Mærsk, to transport our products using sustainable biofuels. All Mærsk shipments are covered in this agreement and represent an estimated 50% sea-freight in primary distribution. We have entered into a partnership with SKYNRG with the aim of reducing our emissions from product distribution's air freight by 27% as of 2025."*
>
> (Novo Nordisk, ESG Portal) [200]

These collaborations were positioned by pharmaceutical interviewees as a way to benefit from cross-industry learning and were examples of how collaboration might drive innovation as reflected in the techno-optimist discourse. As one industry trade association interviewee noted, there was value in working with actors who *"are way ahead"* in their climate efforts to *"learn from them, rather than keep trying to reinvent the wheel"* (IN1). Large-scale, cross-industry collaborations with a pre-competitive focus (i.e., where companies cooperate on shared challenges without compromising market competition) such as ENERGIZE, were seen by participating pharmaceutical interviewees as especially valuable for creating more open, action-orientated platforms for addressing shared climate challenges.

The three companies also reported collaborations with health systems. Examples included a Novo Nordisk partnership with NHS England (NHSE) to co-develop low-carbon cold chains for temperature-sensitive medicines and the Sustainable Markets Initiative Health Systems Task Force [240], a collaboration of several multinational pharmaceutical companies (including GSK and Novo Nordisk) and public organisations (e.g., WHO, NHSE, academic institutions) working to decarbonise health systems.

My analysis indicated that pharmaceutical company and health system interviewees in these collaborations recognised the interdependence of their activities and engaged in joint initiatives to advance collective climate action, reflecting the aforementioned network governance discourse. As one health system sustainability expert described, *"It's not about one side telling the other side what to do... it's about saying, okay, we have got this joint challenge. What are we going to do about it?"* (HS1). This perspective reflected a view of collaboration as a dialogic and generative process, grounded in a willingness to *"learn from each other"* and to seek common ground in addressing climate change (HS1). The public-private partnership between NHSE and Novo Nordisk to develop low-carbon cold chains was cited by one health system sustainability executive as an example of this approach. In this partnership, Novo Nordisk provided funding and conducted research into low-carbon cold chains, while NHSE guaranteed future purchase of insulin products. While acknowledging the presence of friction between the private and public sector, both parties chose to prioritise shared climate goals. As the interviewee explained, *"Let's not just yell at each other about how I am the private sector and you're whatever. Let's talk seriously about how we are going to run a low-carbon cold chain and think about the innovation pathway there"* (HS9). The Sustainable Markets Initiative Health Systems Task Force, led by the CEOs of several major pharmaceutical companies, was similarly highlighted by one pharmaceutical interviewee as an example of how senior leadership engagement could facilitate collaboration between private and public sectors. These accounts illustrated the potential for

collaboration between pharmaceutical companies and health systems to enable more coordinated climate action.

However, my analysis of collaborative efforts between pharmaceutical companies and health systems reinforced some of the challenges I identified in collaborations. As discussed in Chapter 7, collaborative efforts to co-develop product carbon footprint standards were viewed by health system interviewees as attempts by pharmaceutical companies to control data disclosure. Similarly, the patient care pathway approach to measuring emissions was seen by health system interviewees as a means for companies to deflect climate responsibility. Health system interviewees noted that by highlighting emissions elsewhere in the care pathway, particularly in hospitals, pharmaceutical companies appeared to minimise the impact of their own products. As one sustainability expert noted, *"they were looking at the carbon footprint of health care and saying, most of it is in hospitals... that is just shifting the blame"* (HS1). One pharmaceutical interviewee added credibility to this view, stating, *"if you think about the health care system, then we are only playing one part of it, right? We are producing and delivering the drug that will help patients get better. If you take a more patient perspective, then that patient has a long history of carbon emissions you can say, visits to the doctor and so on"* (PC2). These accounts illustrated health system interviewees' perception that pharmaceutical companies leveraged collaborative attempts to develop product and patient care pathway emissions quantification methodology to distribute responsibility for climate action.

In sum, my analysis identified a diverse array of existing climate-related collaborations involving pharmaceutical companies, other industries, and health system actors. While these collaborative initiatives appeared to promote collective and innovative climate action by multiple actors, reflecting techno-optimist and network governance discourses, my analysis suggested that they were also frequently leveraged to deflect climate responsibility and challenged by conflicting interests, mistrust, and competition between actors.

8.4. Chapter summary

In this chapter, I unpacked a storyline that featured prominently across my sampled documents and was shared by a discourse-coalition comprising all pharmaceutical company and health system actors I interviewed: climate action requires more collaboration. My analysis showed that this storyline was underpinned by two distinct yet overlapping discourses. Firstly, all actors within the discourse-coalition mobilised a techno-optimist discourse to frame climate action as a problem solvable through more collaboration and innovation, particularly amidst uncertainty over how to achieve net zero. Secondly, a network governance discourse, primarily invoked by pharmaceutical interviewees, framed climate action as inherently interdependent, with decarbonisation contingent on the decisions, actions, and infrastructures controlled by multiple actors across different levels of authority, notably governments and suppliers. Despite their different origins, these discourses exhibited discursive affinity, as actors mobilising these discourses articulated a shared conceptualisation of more collaboration as essential for climate action. My findings suggested evidence of discourse structuration, with collaboration serving as a dominant lens through which climate action was conceptualised, and of a degree of discourse institutionalisation, as seen in the prominence of calls for collaboration within company documents and the presence of existing partnerships.

A range of climate-related collaborations, both intra-industry and cross-sector, were cited as evidence of shared efforts to drive climate action. However, my analysis revealed tensions in how collaboration was described and idealised as a way to collectively innovate and share responsibility for climate action and how collaborations functioned in practice. My analysis suggested that in practice, collaborations were frequently performative, used to signal climate action or to deflect responsibility. In practice, collaborations were reported to be fraught with

conflicting interests, mistrust, and competitive concerns that challenged their potential to drive substantive climate action. Despite these tensions in how collaborations operated in practice, actors in this discourse-coalition continued to support the storyline that climate action required more collaboration. My analysis indicated that these calls for more collaboration were frequently vague and underdefined, lacking clarity on who should collaborate, how collaboration should be structured, and what mechanisms might be needed to acknowledge and work through, and with, tensions.

Chapter 9: Discussion

9.1. Introduction

In this chapter, I summarise my findings, linking them to my research questions and situating them within broader theoretical and empirical literature. I begin by unpacking how the three pharmaceutical companies approached climate action and how this aligns with existing literature (Section 9.2.1). I then discuss the dominant discourses (i.e., biomedical, economic, technocratic, techno-optimist, and network governance) I identified that appeared to shape, and often constrain, pharmaceutical company climate action (Section 9.2.2). From my analysis, I identified a set of alternative discourses (i.e., planetary health, normative, reorientated economic, and post-technocratic) and I discuss how these might offer potential to support net zero progress (Section 9.2.3).

I unpack my contributions to (a) wider academic literature at the intersection of the pharmaceutical industry and climate change (Section 9.3.1), (b) pharmaceutical company leadership to support climate action (Section 9.3.2), and (c) my theoretical and methodological contributions (Section 9.3.3). Finally, I reflect on my research approach and its strengths and limitations (Section 9.4).

9.2. Summary of research findings

My thesis set out to understand how multinational pharmaceutical companies are approaching climate action and what could support net zero progress. I asked: (a) How are multinational

pharmaceutical companies approaching climate action? (b) What shapes, constrains, or enables pharmaceutical companies' climate action? And (c) What alternative approaches to pharmaceutical company climate action are emerging, and how might they support net zero progress?

I address each of these research questions in the sections that follow. Firstly, I unpack my findings on how the three pharmaceutical companies in my study approached climate action, why they were engaging in climate action, in what ways, and how this aligns with broader literature. Secondly, I discuss the dominant discourses I identified and how these shaped, and often constrained, pharmaceutical company climate action. Thirdly, I unpack the alternative discourses I identified and how these might offer potential to support pharmaceutical company net zero progress.

9.2.1. Pharmaceutical company climate action

In this section, I unpack my findings related to my first research question: how are multinational pharmaceutical companies approaching climate action. The three pharmaceutical companies I studied – GSK, Novo Nordisk, and Teva Pharmaceuticals – had each set climate targets, disclosed their greenhouse gas emissions, and reported a range of emissions reduction strategies in response to various pressures for climate action from their institutional context.

My research identified several pressures for pharmaceutical companies to engage with climate action. These pressures included corporate climate-related regulatory requirements to disclose their greenhouse gas emissions (e.g., Corporate Sustainability Reporting Directive); market pressures, from health system procurement teams and investors, for companies to set climate targets, disclose emissions, and create decarbonisation plans (e.g., NHS Supplier Roadmap); and growing climate-consciousness of external actors, for example, individual health care

providers, compelling company climate action for reputational purposes. These pressures align with well-documented regulatory, financial, and reputational drivers of corporate climate action across other industries [252, 253].

In response to such pressures, companies globally are increasingly setting net zero targets [254]. Frameworks, such as the Science Based Targets initiative (SBTi), provide guidelines for setting climate targets including target baselines, scopes to be included, and timelines for reaching targets [15]. All three studied companies had aligned with the SBTi, setting near-term (Teva) and long-term (GSK, Novo Nordisk) targets that covered all three greenhouse gas emission scopes (see Appendix Figure 1). This target setting by the studied companies contrasts with a 2023 report that approximately 90% of pharmaceutical companies have yet to set any climate targets [98]. While climate targets can promote accountability, a growing body of literature, across industries, critiques the gap between setting a target and reducing emissions, warning that unless backed by substantive climate action, targets risk becoming a form of greenwashing [255, 256]. Calls from, for example, academics, regulators, and civil society actors for greater transparency around emissions disclosures and action to reach targets continue to intensify [101, 102].

The three companies in my research reported their greenhouse gas emissions across a range of emissions categories according to the Greenhouse Gas Protocol [13]. Scope 1 and 2 emissions comprised less than 10% of their total emissions, with Scope 3 emissions accounting for the majority. This distribution of emissions is consistent with wider emission trends in the pharmaceutical industry and beyond. For example, Scope 3 emissions in the pharmaceutical industry have been estimated to be, on average, five times greater than Scope 1 and 2 emissions [98]. My research revealed variability in the methodologies and transparency of emissions disclosures, highlighting a persistent challenge, identified in both pharmaceutical and broader industry literature, of gaining a comprehensive view of company emissions due to incomplete and inconsistent reporting [48, 96, 103].

All three companies reported engaging in actions to reduce their emissions. To reduce Scope 1 and 2 emissions, companies reported converting to renewable energy sources, optimising energy efficiency, and using electric vehicles. Actions to reduce Scope 3 emissions included supply chain engagement, incorporating sustainability criteria into supplier contracts, and integrating sustainability into product design (e.g., green chemistry, sustainable packaging, take-back programmes). There is limited research assessing the emissions reduction potential of such actions, in both the pharmaceutical and other industries [257]. However, these actions align with reported emissions reduction strategies across the wider pharmaceutical industry [48, 158] such as energy optimisation [159], green chemistry principles [85], and supply chain engagement [98].

My findings provided critical insights on these emissions reduction strategies that extended beyond the existing descriptive literature. For example, while renewable energy is consistently cited as a simple and accessible strategy [87], my findings on renewable energy challenged this perspective and highlighted difficulties with, for example, market-based renewable energy procurement mechanisms and limited access to renewable energy infrastructure in certain regions (e.g., Singapore). In examining supply chain emissions reduction efforts, such as supplier engagement, my findings confirmed difficulties tied to supply chain complexity common to other industries [258]. They also revealed challenges specific to the pharmaceutical industry, including a reliance on a niche group of suppliers who appeared resistant to climate-related demands. Additionally, my findings surfaced some actions that appeared more performative and incremental, such as packaging initiatives and some climate-related collaborations.

In sum, my findings confirmed that the three pharmaceutical companies are engaging with climate action and provided detailed analysis of their reported emissions and emissions reduction strategies. The companies' climate action aligns with existing literature across both the pharmaceutical and other industries, which documents a growing trend in corporate climate engagement. Given the considerable gaps in setting targets and reporting emissions identified in

existing literature, my findings suggested that the studied companies may be comparatively advanced in their climate action. My research sought to go beyond such a descriptive analysis of how multinational pharmaceutical companies approached climate action (see also Chapter 3) to analyse what shaped, enabled, or constrained it, ultimately aiming to understand what may support progress towards net zero. I turn to this more critical discussion next.

9.2.2. Dominant discourses shaping and constraining climate action

Here, I unpack findings related to my second research question: what shaped, constrained, or enabled pharmaceutical companies' climate action. I focus primarily on what appeared to shape and constrain climate action here, and unpack what appeared to enable climate action, and therefore, what might support net zero progress, in the next section. I identified four storylines, each underpinned by dominant discourses (i.e., biomedical, economic, technocratic, techno-optimist, and network governance) that appeared to shape and often constrain pharmaceutical companies' climate action (see Table 10). As Hajer argues, discourse is not neutral; it actively shapes the nature of action, making it essential to examine which discourses dominate (i.e., reflected by discourse structuration and institutionalisation), how, and to what effect [173]. My findings suggested that through these dominant discourses, climate action was framed as conditional, requiring the fulfilment of specific preconditions, such as upholding patient wellbeing, ensuring financial viability, generating emissions data, or more collaboration, before substantive action could be taken. I introduce the novel term 'discursive conditionality' to conceptualise this discursive mechanism through which action is framed as necessary but contingent (see also Section 8.3.3). I argue that dominant discourses converged to construct this conditionality, thereby normalising the delay and deferral of substantive climate action and ultimately constraining pharmaceutical companies' progress towards net zero. I discuss each of the dominant discourses below and unpack discursive conditionality.

Table 10. Dominant discourses and discursive conditionality shaping and constraining pharmaceutical company climate action

Dimension	**Storyline 1** *Climate action conflicts with patient wellbeing*	**Storyline 2** *Climate action is contingent on financial viability*	**Storyline 3** *Climate action as emissions quantification and disclosure*	**Storyline 4** *Climate action requires more collaboration*
Dominant discourse	Biomedical	Economic	Technocratic	Techno-optimist; network governance
Discourse-coalition	Broad coalition of pharmaceutical company employees, industry members, providers, prescribers, patients, policymakers	Primarily pharmaceutical company employees and those tasked with implementing climate action	Pharmaceutical company employees (framing data for compliance); health system actors (framing their action as dependent on data)	Broad coalition across companies and health systems employing techno-optimist discourse; pharmaceutical employees mobilising network governance
Structuration *(How climate action is conceptualised)*	Climate action seen as conflicting with patient care; biomedical framework equates wellbeing with pharmaceutical intervention	Climate action framed through financial terms; reflects capitalist principles of growth and profit	Climate action seen as a technical task of data quantification and disclosure; assumes that data will lead to action	Climate action framed as an issue to be solved through collective innovation and shared responsibility
Institutionalisation *(Solidification of discourse in practice, reflecting dominance)*	Evident in production, procurement, and prescribing practices that prioritise patient wellbeing over climate action	Evident in financial considerations legitimising climate action and shaping the nature of climate action implemented	Evident in emissions reporting, pressures for data, efforts to develop standardised emissions quantification methods	Evident in repeated calls for collaboration and innovation and presence of existing collaborative initiatives
Discursive tension	Between assumed patient harm and climate action, often without evidence	Between financial practicalities and normative expectations	Between the perceived necessity of data and the critique that data-centric approaches can distract from climate action	Between vague and aspirational calls for more collaboration and how collaboration functions in practice
Discursive conditionality (overarching effect)	Across all four storylines, climate action was framed as conditional on resolving certain preconditions such as ensuring patient wellbeing, financial viability, data availability, and more collaboration. This convergence of dominant discourses contributed to the delay and deferral of substantive climate action.			

I identified a biomedical discourse that underpinned the storyline that climate action conflicts with patient wellbeing. This discourse was mobilised by a broad coalition of actors, including pharmaceutical employees, industry representatives, health system policymakers, and prescribers, to frame climate action to reduce pharmaceutical emissions as in conflict with patient wellbeing. Through this discourse, patient wellbeing was framed by these actors as dependent on the continued availability and use of pharmaceuticals, effectively equating patient wellbeing with pharmaceutical provision. This framing was employed by actors to justify the production and consumption of pharmaceuticals despite their climate impact and to legitimise climate inaction, thereby constraining substantive climate action. Notably, this framing constructed a conflict between climate action and patient wellbeing despite a lack of empirical evidence that such a conflict exists in practice.

The biomedical discourse I identified reflects prevailing biomedical models of health care which prioritise immediate, individualised, and treatment-focused care [220, 259]. Biomedical models of health care emphasise the diagnosis and management of disease, typically through pharmaceutical interventions, often at the expense of proactive and preventive approaches to health [260]. My findings showed that this biomedical discourse had attained dominance, as evidenced by the continued privileging of pharmaceutical interventions within health care delivery, the acceptance of emissions from pharmaceutical provision, and in procurement and prescribing practices that prioritised patient wellbeing (i.e., pharmaceutical provision) over climate action. My findings, therefore, suggested that the perceived conflict between climate action and patient wellbeing was largely a construct of this dominant biomedical discourse – that equated wellbeing with pharmaceutical provision and thereby placed limits on climate action to reduce pharmaceutical emissions – rather than representing a genuine conflict in practice.

An economic discourse underpinned the storyline that climate action was contingent on financial viability that was shared primarily by pharmaceutical company and broader industry

actors responsible for implementing climate action. Throughout my data, climate action was consistently framed in financial terms across multiple domains of pharmaceutical company practice. Climate action was articulated as reputational value and risk, a market positioning strategy, and necessary for regulatory compliance and operational resilience, reflecting the perceived financial implications of engaging (or not engaging) in climate action. As a result, climate action appeared to be legitimised within wider financially-orientated company practices, while simultaneously reduced to a financial calculation, enabled or constrained depending on its alignment with companies' financial interests.

This economic discourse reflects global capitalist frameworks that privilege financial growth and profitability. Drawing on theorists such as Anthony Giddens, my findings align with the view that modern society is embedded within a world capitalist system that transcends national borders and shapes social, economic, and political structures [21]. Multinational pharmaceutical companies, including those in my study, operate within this world capitalist system and face pressure to ensure financial viability, growth, and profitability, deliver shareholder returns, and maintain global competitiveness, which shapes company priorities, decisions, and actions, including climate action [261]. Within this capitalist system, the pharmaceutical industry is increasingly considered to be driven by financial priorities over, for example, public health or climate action [262, 263]. In mobilising economic discourse, financial considerations were privileged by pharmaceutical actors as self-evident and depoliticised within the wider context of capitalist economies, thus reinforcing the legitimacy of considering the financial viability of company climate action.

The institutionalisation of economic discourse, and therefore its dominance, was evident not only in the ways companies framed climate action in financial terms across multiple domains of practice, but also in how they appeared to weigh the financial costs (e.g., of implementing specific climate actions) against anticipated benefits (e.g., reputational gains). These financial

considerations shaped the types of actions pursued, often favouring actions such as energy efficiency initiatives that offered clear financial returns. Further evidence of the dominance of economic discourse was seen in its institutionalisation within the wider institutional context that shaped company action; for example, in the financialisation of corporate climate-related regulation such as the EU Taxonomy [229] and the use of financial incentives in procurement policy to promote climate action, as exemplified by the NHS Supplier Roadmap [133]. The influence of economic discourse can also be seen in academic literature that consistently shows that corporate climate action tends to advance when supported by financial opportunities, such as government investment, market incentives, and operational cost reductions [252, 264]. Although, scholarship on corporate climate action has noted that economic discourse often shapes climate action in ways that justify minimal or incremental action while ensuring 'business as usual' [263]. My findings extend this literature by showing how such economic discourse operates within the pharmaceutical industry, and shaped, enabled, or constrained climate action depending on its alignment with companies' financial interests.

A technocratic discourse underpinned the storyline that framed climate action primarily as a matter of emissions quantification and disclosure. This technocratic discourse was mobilised by a broad range of actors including pharmaceutical employees, who emphasised emissions data for compliance purposes, and health system actors, who viewed such data as essential for informing their own climate action. This discourse reflects broader societal tendencies to place trust in quantification and data as tools for managing risk and demonstrating 'objective' accountability, premised on the assumption that data drives action [235, 265]. The institutionalisation of this discourse was evident in the widespread prioritisation of emissions quantification and disclosure across my findings, as well as in ongoing efforts by pharmaceutical company and health system actors to develop new and standardised methods for quantifying pharmaceutical emissions, at both the product level and across patient care pathways. Technocratic discourse was further reinforced by the wider institutional context in which

companies operated. For example, corporate climate-related regulations such as the EU Corporate Sustainability Reporting Directive [80] and procurement policies like the NHS Supplier Roadmap [133] require companies to provide emissions data, thereby privileging quantification and disclosure as central to pharmaceutical companies' climate action.

My findings illustrated the constructed and performative nature of companies' emissions data, which were generated through inconsistently applied methodologies and selectively disclosed. The constructed nature of companies' emissions data challenges the presumed objectivity and actionability of data advanced by the dominant technocratic discourse. These findings resonate with Espeland and Stevens' work on the socially constructed nature of commensuration, the process of translating diverse and complex phenomena into comparable units, such as carbon dioxide equivalents [236]. Their work highlights how standardised methodologies do not neutrally represent 'reality' but instead shape what becomes visible, valuable, and governable. The socially constructed nature of commensuration was evident in my study, as companies and health systems attempted to condense varied operations, products, and patient care pathways into a single metric.

To my knowledge, no research has assessed the socially constructed nature of emissions quantification, by pharmaceutical companies, wider industries, or at a national level. Academic literature continues to privilege emissions quantification (see Chapter 2 for the range of research quantifying pharmaceutical emissions), emphasise the need for greater data transparency [142], and advance new methods for standardising measurement [157], thereby reproducing this technocratic discourse. By exposing the limitations inherent in standardisation, quantification, and disclosure, my research calls into question the reliability of emissions data as objective, transparent, or inherently actionable. In doing so, my research contributes to the literature on emissions accounting by illustrating how the politics of measurement delimit the scope of climate action, not only for pharmaceutical companies, but for institutions more broadly.

The storyline that climate action requires more collaboration was underpinned by two distinct discourses: techno-optimist and network governance. All actors in my data framed climate action as a problem to be solved through innovation, and collaboration as a way to drive this innovation. This reflected a techno-optimist discourse, grounded in the belief that technological advancements and innovation offer a pathway to net zero. Such techno-optimism aligns with a broader societal tendency to favour technological solutions over structural change, a tendency that has been critiqued for overlooking the social, economic, and political conditions that shape, constrain, or enable technological development and implementation [27, 266]. Pharmaceutical actors, in particular, mobilised a network governance discourse, framing climate action as dependent on the decisions and actions of a wide range of actors, including governments, suppliers, and other health system actors, thereby positioning climate action as a shared responsibility requiring coordination across multiple levels of authority [245, 247]. This discourse aligns with wider research that emphasises the need for collective, shared action on climate change [267, 268].

My findings showed how these discourses on collaboration shaped how actors conceptualised climate action – as a problem to be solved through collective innovation and shared responsibility. However, there appeared limited embedding of this conceptualisation in practice (i.e., discourse institutionalisation). Rather, my findings surfaced a tension between the idealised portrayal of collaboration as a vague, aspirational solution to climate change and how collaborative initiatives functioned in practice. In many cases, collaborations appeared performative, used to signal climate action rather than to drive substantive change [174]. They often served to deflect rather than share responsibility, and were characterised by persistent challenges, including conflicting interests, misaligned agendas, and competitive concerns. These challenges reflect broader research on a longstanding ‘crisis of trust’ between pharmaceutical companies and health system actors that undermines collective efforts [269, 270]. By surfacing these challenges, my research exposes limitations in uncritical appeals for

collaboration and highlights the need for more reflexive and critical engagement with the discourses surrounding collaborative climate action.

Collectively, these dominant discourses appeared to shape, and often constrain, pharmaceutical companies' climate action. In particular, my analysis suggested these discourses converged to position climate action as conditional upon, for example, ensuring patient wellbeing, financial viability, availability of emissions data, and more collaboration. To help explain this finding, I introduce a novel conceptual term, 'discursive conditionality', a discursive mechanism through which actors frame climate action as necessary but contingent on the fulfilment of specific preconditions (see also Section 9.3.3). Through biomedical framings, financial rationalisations for (in)action, technocratic reliance on quantifiable data, and the portrayal of climate action as dependent on technological fixes and multi-actor engagement, climate action was not rejected but made contingent, thereby normalising the delay and deferral of substantive climate action and constraining progress towards net zero.

This discursive conditionality shaped what climate action was perceived by companies and wider actors as viable and legitimate. For example, when climate action was framed as conditional on emissions data, the proposed solution became further data collection and quantification rather than substantive changes to manufacturing or procurement practices. This emphasis on enhanced data collection and quantification was evident throughout my findings, with interviewees frequently citing ongoing efforts to improve data accuracy and develop new methods to quantify emissions at the product and patient care pathway levels. Similarly, when climate action was conditioned on ensuring a biomedical framing of patient wellbeing (i.e., equated with pharmaceutical provision), the responses often involved justifying emissions from pharmaceutical production or prioritising pharmaceutical provision within procurement and prescribing decisions. Thus, discursive conditionality functioned to accommodate and manage tensions between climate action and concerns related to patient wellbeing, financial viability,

emissions data, and collaboration, while effectively circumventing substantive changes in practice.

The dominance of these particular discourses warrants consideration on why certain discourses attain dominance, which actors are empowered to shape prevailing discourse, and whose voices are amplified or marginalised in the conceptualisation of climate action. Hajer suggests that discourses attain dominance through their reproduction by central actors and institutions, making analysis of the composition of discourse-coalitions important in understanding pharmaceutical company climate action [173]. In my findings, central actors, such as multinational pharmaceutical companies (e.g., Big Pharma), influential regulators (e.g., the European Commission), and major public health procurement bodies (e.g., NHSE), appeared to exercise considerable influence over which storylines and discourses gained dominance and, therefore, defining what constituted legitimate climate action. For example, in my findings, economic discourse was mobilised across pharmaceutical companies, featured prominently in company documents (e.g., to attract investors), and was strategically employed by health system policymakers to incentivise climate action. The dominance of these discourses was further reinforced by their alignment with entrenched societal institutions and value systems, such as capitalism and a technocratic faith in quantification [22, 235].

My findings suggested that actors within pharmaceutical companies' wider institutional context (e.g., regulators and procurers) were complicit in reproducing dominant discourses and, consequently, the discursive conditionalities embedded within them. For example, pharmaceutical regulation's focus on patient safety reinforces the framing of patient wellbeing as a precondition for climate action, thereby limiting the scope for companies to act on climate change. Similarly, corporate regulatory and health system procurement bodies require emissions disclosures but rarely demand evidence of actual emissions reductions. This reinforces the

framing of climate action as conditional on data availability, positioning quantification and disclosure as the primary objective and diverting attention away from substantive climate action.

The complicity of companies' institutional context in reproducing discursive conditionality exposes the constraints of a system in which company legitimacy is tied more closely to alignment with external expectations than to actual climate outcomes [271]. When external pressures privilege, for example, patient prioritisation and emissions reporting over substantive emissions reductions, companies are incentivised to conform accordingly [272]. Rather than critically interrogating the capacity of these practices to drive genuine net zero progress, academic literature often reinforces these discursive conditionalities by, for example, calling for increased financial incentives, standardised data, and more collaboration [86, 87, 157, 273]. In the context of my study, therefore, companies' institutional context emerged as an active participant in shaping pharmaceutical company climate action and perpetuating discursive conditionalities that constrain net zero progress.

In sum, I identified dominant discourses that shaped, and often constrained, pharmaceutical companies' climate action. These discourses were reproduced by influential actors (e.g., multinational pharmaceutical companies, regulatory bodies, and health system policymakers), and reinforced by companies' wider institutional context (e.g., entrenched conceptualisations of wellbeing and health care, regulatory frameworks, and prevailing economic systems). My research found that these dominant discourses converged to construct discursive conditionality, a framing of climate action as necessary but contingent on the fulfilment of specific preconditions, ultimately constraining net zero progress.

9.2.3. Alternative discourses that can support net zero progress

In this section, I discuss my findings related to my third research question: what alternative approaches to pharmaceutical company climate action are emerging, and how might they support net zero progress. My analysis surfaced counter-storylines underpinned by planetary health, normative, reorientated economic, and post-technocratic discourses (see Table 11). These discourses were visible throughout my data and offered alternative conceptualisations of climate action: as interconnected with patient wellbeing rather than in conflict with it; as a moral obligation that must be decoupled from profit; as a financial opportunity rather than a risk; as emissions reduction rather than quantification; and as necessitating productive collaboration rather than vague appeals to collective effort. While not yet dominant, these discourses represented fissures in the dominant discursive landscape, potential points of leverage to overcome discursive conditionality and support more substantive progress towards net zero. I discuss each of these discourses below.

Table 11. Counter-storylines and alternative discourses that challenge dominant discourses constraining pharmaceutical company climate action

Counter-storylines	Counter-discourse(s)	Discourse-coalition	Challenge to dominant discourses	Institutionalisation potential
Climate action is integral to patient wellbeing	Planetary health	Primarily health system actors; some pharmaceutical actors	Reframes climate action as essential to protecting patient wellbeing; challenges the dichotomy between patient and planetary wellbeing	Potential to embed planetary health principles in health care models, clinical guidelines, procurement, and prescribing practices
Climate action is contingent on maximising profit	Normative; reorientated economic	Primarily health system actors	Broadens responsibility beyond financial metrics; challenges economic discourse that makes climate action conditional on financial viability and profit	Potential to realign financial incentives with climate action or decouple action from profit altogether
Emissions quantification and disclosure as climate inaction	Post-technocratic	Smaller coalition of actors with long-standing sustainability experience	Prioritises outcomes over data; challenges data-centric approaches	Potential to shift regulatory and procurement frameworks towards mandating emissions reductions rather than just disclosure
Climate action requires more collaboration (no distinct counter-storyline)	Techno-optimist; network governance	No distinct or organised coalition yet	More reflective engagement with discourses challenges vague and aspirational calls for collaboration and emphasises need for more productive engagement	Potential to facilitate productive collaboration through pre-competitive partnerships that enable mutual accountability, co-learning, and shared climate action

Planetary health conceptualises patient and planetary wellbeing as interdependent and mutually reinforcing [221]. A planetary health discourse was evident across company documents, where companies highlighted the links between climate change and human health, and was mobilised by a subset of actors in my research, including health providers and sustainability experts. This discourse reflected a more long-term, holistic, and population-level approach to health that contrasted with the biomedical discourse that emphasised short-term, individual health. These contrasting discourses surfaced various actors' competing ways of thinking about patient wellbeing in the context of climate action, where climate action was framed as both conflicting with individual health outcomes while simultaneously interconnected with population health.

A substantial body of literature supports the interdependence between patient and planetary wellbeing, demonstrating both the negative health impacts of climate change [32, 35, 36, 274, 275] and the health co-benefits associated with climate action [276-278]. In my research, actors employing planetary health discourse suggested actions benefitting both patients and the planet, such as the use of low-carbon or non-pharmaceutical interventions. These suggestions align with academic literature increasingly advocating for health care practices like preventive and promotive care, deprescribing, social prescribing, and the incorporation of climate considerations into clinical guidelines – all approaches that reduce pharmaceutical dependence and mitigate emissions [130, 134-141]. The reframing of health care delivery that was proposed by some interviewees – prioritising prevention, health promotion, social determinants of health, and long-term population health – is not a new concept but appeared to be gaining traction in light of the climate co-benefits of such a reframing. This reframing aligns with a growing body of literature that advocates for employing a planetary health lens in health care delivery [279-281].

My findings also identified a normative discourse primarily mobilised by health system actors to critique what they perceived as pharmaceutical companies' prioritisation of profit over climate action. This normative discourse reflected the belief amongst health system actors that

companies have a moral obligation to address climate change regardless of financial viability. Considerable research has examined the moral dimensions of climate action, with most scholars concluding that there is a universal moral obligation for individuals, organisations, and nations to act [282-284]. Although some scholars have argued that broader environmental action by companies may conflict with companies' primary obligations to key stakeholders, such as employees, customers, and shareholders [285, 286]. To my knowledge, no research has examined the moral dimensions of pharmaceutical companies' responsibilities in relation to climate change. My findings contribute to this gap by surfacing a perception amongst health system actors that pharmaceutical companies have a moral duty to act on climate change.

Scholarship suggests that moral obligation alone often fails to galvanise action in practice [287]. Climate policies, regulation, and financial incentives (e.g., tax credits, carbon pricing) typically play a more decisive role in driving climate action [23, 288]. Consistent with this, my findings showed that despite invoking a normative discourse, actors across different discourse-coalitions tended to revert to an economic discourse when proposing approaches to advance pharmaceutical companies' net zero progress. These actors (e.g., health system policymakers, regulators, prescribers) suggested aligning financial incentives with climate action, for example, by incorporating climate criteria into procurement policies or offering financial incentives such as patent extensions for low-carbon products. In doing so, they leveraged economic discourse but reorientated its focus away from purely financial objectives towards supporting climate action (i.e., a reorientated economic discourse).

A niche group of actors in my research, primarily those with a long-standing history of working in sustainability, critiqued the capitalist financial models underpinning pharmaceutical markets. These actors argued that capitalist economic systems are fundamental drivers of climate change and questioned whether incremental financial reforms were sufficient or if more radical economic reforms were necessary. These perspectives align with research that contends the

foundational principle of capitalism, anchored in perpetual consumption and growth, is structurally incompatible with the demands of a net zero world [28, 289, 290]. Literature at the intersection of health and economic systems has also critiqued the role of pharmaceutical companies in perpetuating capitalist models of health care that commercialise health, reinforcing biomedical approaches centred on pharmaceutical interventions and prioritising profit over health outcomes, with implications for how companies' approach climate action [262, 291].

Growing dissatisfaction with capitalism's role in exacerbating health and environmental inequalities has fuelled interest in alternative economic paradigms, such as degrowth and doughnut economics, which seek to balance human wellbeing within ecological limits [289, 292]. In my findings, actors, including health system policymakers, sustainability experts, and non-profit members, suggested reorientating health system financial models towards disease prevention and health promotion. This suggested reorientation integrated patient, planetary, and financial outcomes, aligning with planetary health discourse and echoing broader scholarship on alternative economic paradigms. Such propositions also resonate with wider calls to shift health care from primarily treating illness to promoting health [293, 294], aligning with health economics literature advocating for value-based care models that prioritise preventive over reactive treatment [295].

While such a reorientation of health care holds promise for aligning patient, planetary, and financial concerns, it remains constrained by prevailing economic interests that dominate pharmaceutical markets. The responses observed in my findings, such as corporate lobbying, defensive posturing, and performative climate actions [174], indicated an industry perception that achieving net zero may threaten profitability. These entrenched economic interests challenge the reconfiguration of health system financial models to support substantive climate action and help explain some of the performativity observed in my findings, where companies

sought to construct an impression of climate action to satisfy external pressures without significant financial or operational implications. For example, in my findings, pharmaceutical companies' selective disclosure of emissions data, efforts to control product carbon footprint methodologies, and the construction of counterfactuals in patient care pathway calculations that diverted attention from pharmaceutical product emissions, exemplified the financial motivations underlying some of their performative actions.

Building on this critique of emissions quantification and disclosure, a post-technocratic discourse was evident in my research, mobilised by a subset of actors such as climate consultants and sustainability experts who challenged the dominant framing of data as a neutral or inherently beneficial practice. These actors questioned the assumption that more data leads to action and outcomes and critiqued the privileging of quantification over actual emissions reductions. Through this discourse, the emphasis on producing ever more granular emissions data, rather than addressing the sources of emissions, was problematised, reflecting wider concerns about the limits of technocratic approaches [235]. In surfacing this critique, specifically of emissions quantification, disclosure, and data, my findings offer critical perspectives on the role, and capacity, of emissions data in driving substantive climate action. At the same time, it is worth considering whether this discourse constitutes a fully 'post-technocratic turn' or rather represents a more reflexive strand within technocratic framings that critiques how data is used but still operates within the broad assumption that data remains central to action.

While there was no distinct counter-storyline or discourse that directly challenged the framing of climate action as requiring more collaboration, my analysis identified instances of more productive engagement that may serve as exemplars of effective collaborative practice. These collaborative initiatives appeared to embody, in practice, the aspirations embedded within techno-optimist and network governance discourses, specifically the emphasis on collective innovation and shared responsibility.

One such example was the collaboration between NHS England (NHSE) and Novo Nordisk to develop a low-carbon insulin cold chain. This collaboration illustrated how productive – and innovative – climate action can emerge from partnerships grounded in a shared understanding of the problem, a clear recognition of each actor's resources and capabilities, and a willingness to openly acknowledge and navigate tensions. This willingness to navigate tensions resonates with literature on constructive friction and agonistic governance, which highlight the value of disagreement, dissent, and negotiation in facilitating more resilient and inclusive forms of collaboration [296]. At the same time, while critiques of techno-optimist discourse and the overreliance on technological innovation remain valid [244], this example demonstrated that innovation can play a valuable role in supporting net zero progress. This example also reflected, in practice, principles of network governance that recognise the importance of multi-stakeholder engagement in addressing complex challenges such as climate change [245, 297]. Therefore, my research contributes to the literature on collaboration in corporate climate action by offering empirical examples of pharmaceutical industry collaborative initiatives and demonstrating how more reflective engagement with discourses surrounding collaboration can be mobilised to enable productive collaboration.

In sum, I identified a set of counter-storylines and discourses that challenged the assumptions underpinning dominant discourses and offered alternative conceptualisations of climate action that could support pharmaceutical company net zero progress. These discourses were primarily advanced by actors with limited institutional power, such as individual health care providers committed to sustainability, members of non-profit organisations, and sustainability consultants. However, there were indications of their uptake by more central actors. For instance, some pharmaceutical companies had begun to reference the link between patient and planetary wellbeing in their public reporting, signalling a potential shift towards planetary health discourse. This suggests the possibility of emerging discursive shifts and reconfiguration of discourse-coalitions, which may, over time, reshape how climate action is conceptualised and

implemented within the pharmaceutical industry. I return to the implications of this in Chapter 10.

9.3. Research contributions

Below, I discuss my original contributions to (a) academic literature at the intersection of the pharmaceutical industry and climate change, (b) pharmaceutical company leadership to support climate action, and (c) theory and methodology.

9.3.1. Contributions to academic literature

My research makes five key original contributions to the nascent body of academic work at the intersection of the pharmaceutical industry and climate change. Firstly, my research provides detailed empirical contributions on pharmaceutical company climate action. Secondly, I contribute critical insights on the discursive landscape shaping and constraining climate action. Thirdly, I illustrate the socially constructed nature of emissions quantification, disclosure, and data and the limits of their assumed objectivity and actionability. Fourthly, I unpack how pharmaceutical companies' broader institutional context can be complicit in delaying and deferring climate action. Finally, I surface alternative discourses that could support pharmaceutical company net zero progress. I discuss each of these contributions below.

Firstly, my research provides detailed empirical contributions on the climate actions pharmaceutical companies report implementing. By examining how interviewees described the implementation of climate actions reported in documents (e.g., renewable energy, product eco-design, supplier engagement), I offer a level of detail largely absent from existing literature, which has tended to focus on surface-level descriptions of reported climate action from company

reports [48, 158]. For example, I highlighted the challenges of pharmaceutical company renewable energy procurement amidst complex energy markets, the incrementalism of packaging initiatives, the regulatory constraints to pharmaceutical eco-design, and the tensions inherent to climate-related pharmaceutical collaborations. These findings challenge the more normative or aspirational tone of much existing work, which often calls for expanded use of such actions without examining the nuances of their implementation [86, 87, 158]. In this way, my research enriches the descriptive literature and also offers a more critical lens on the feasibility and limitations of commonly cited climate actions in the pharmaceutical industry.

Secondly, my research contributes critical insights into the discursive landscape that shapes and constrains pharmaceutical company climate action. While existing literature has highlighted financial, operational, and technical barriers to action [87], my findings illustrate how the meanings actors assign to climate action have implications for how it is enacted. For example, I showed how dominant discourses converged to place preconditions on climate action, helping to explain why climate action, although widely accepted as necessary, was often delayed and deferred. I also identified discursively constructed tensions that further constrained action. One such tension was the perceived conflict between climate action and patient wellbeing: a tension not grounded in empirical evidence but rooted in a dominant biomedical discourse that equated patient wellbeing with pharmaceutical provision. I highlighted tensions between financial practicalities and normative expectations around pharmaceutical company climate action, contributing to broader critiques of how financial considerations shape corporate climate responses [252, 264] while offering specificity regarding how such considerations operate within the pharmaceutical industry. I surfaced how health system actors perceived pharmaceutical companies to have a moral obligation to act on climate change regardless of profitability. This perception generated friction between pharmaceutical company and health system actors who, reflecting the network governance discourse I identified, were interdependent in advancing climate action. To my knowledge, these discursive tensions have not been explored in existing

literature, and as such, my research offers novel contributions to understanding how such tensions have constrained pharmaceutical company climate action.

Thirdly, my research offers a novel contribution to literature on emissions data. Academic literature on pharmaceutical company climate action either focuses on quantifying emissions or calls for more data transparency and standardisation [95, 96, 101], reproducing an assumption that emissions data are objective and actionable. My findings challenge this assumption by illustrating the socially constructed nature of pharmaceutical companies' emissions data which were shaped by inconsistent methodologies, selective disclosure, and the commensuration of diverse processes into simplified metrics. My analysis drew on and extends sociological work on quantification and commensuration [236], offering an empirical application of these theories to the context of emissions quantification.

Fourthly, my research highlights how pharmaceutical companies' wider institutional context has been complicit in reproducing dominant discourses and discursive conditionality, thereby delaying and deferring climate action. Much of the literature on pharmaceutical company and broader corporate climate action is divorced from its social, economic, or political context, or focuses on how companies respond to external pressures for climate action [252, 253]. My findings showed how these pressures themselves, such as regulatory frameworks and health system procurement demands for more emissions data, can reinforce delays in pharmaceutical companies' progress towards net zero by privileging processes that are quantifiable over those that would more directly reduce emissions. Thus, my research offers a more critical perspective on the institutional context shaping and constraining pharmaceutical company climate action.

Finally, I contribute to academic literature on pharmaceutical company climate action by surfacing alternative ways of conceptualising climate action that may help overcome discursively constructed tensions and conditionalities, thereby supporting progress towards net zero. I identified discourses that challenged the prioritisation of pharmaceuticals in dominant

biomedical framings of health care, highlighted alternative economic imaginaries that could support pharmaceutical climate action, and exposed the limitations of emissions quantification, emphasising the need to prioritise actual emissions reductions. I also identified examples of productive collaboration rooted in active engagement with tensions to facilitate innovation and shared responsibility. Through identifying and analysing these alternative discourses, my research moves beyond existing literature, that largely offers descriptive summaries of emissions reduction strategies companies could implement, to offer novel and critical contributions to what might support pharmaceutical company climate action and net zero progress.

9.3.2. Contributions to pharmaceutical company leadership to support climate action

By identifying dominant discourses and theorising discursive conditionality, my research illustrates how actors within pharmaceutical companies and across wider health systems framed climate action in ways that often rendered it conditional, delayed, and deferred (see Table 10). Drawing on the alternative discourses I identified in my findings (see Table 11), I offer three key contributions specifically aimed at pharmaceutical company leadership (e.g., CEOs, board members, executives, and sustainability leads), focused on how they might more effectively support climate action and net zero progress. Firstly, I contribute empirical insights into the business case for pharmaceutical company climate action, shedding light on why companies are, and should be, engaging in it. Secondly, I discuss climate actions that pharmaceutical companies might pursue, particularly those with the potential to achieve more substantive emissions reductions. Thirdly, I offer observations on how climate reporting practices can be improved to better support progress towards net zero. I outline these contributions in Figure 4 and elaborate on them in the sections that follow, with further targeted recommendations presented in Chapter 10 and Table 12.

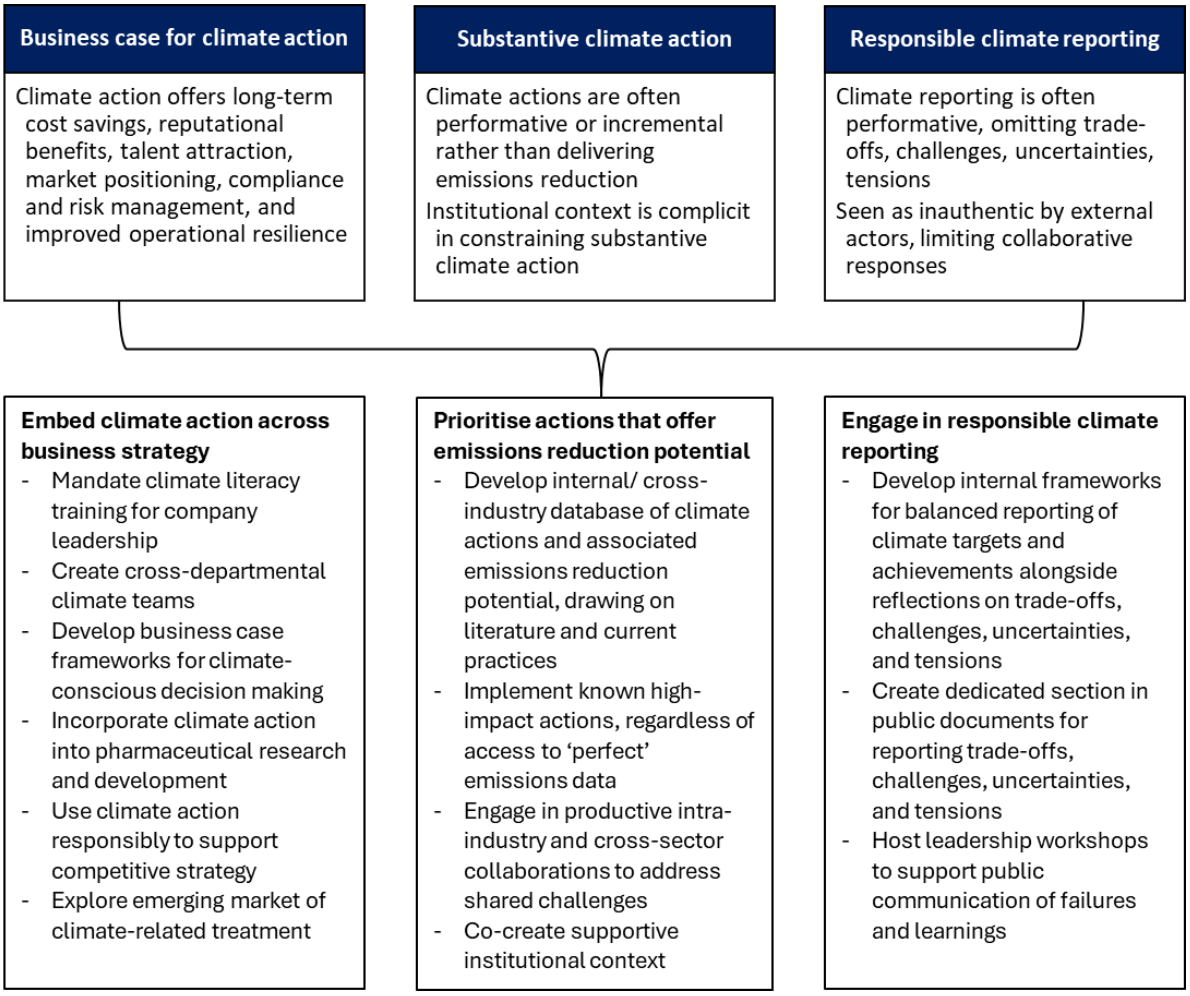

Figure 4: Contributions to pharmaceutical company leadership to support climate action

Firstly, from my findings, I contribute insights on the business case, or cost-benefit justification, of climate action. The three companies in my study, purposively selected for their proactive climate engagement, all appeared to recognise and foreground the financial opportunities of climate action. These opportunities included long-term cost savings from climate actions (e.g., energy efficiency), mitigating regulatory risk, leveraging climate action for reputational and indirect financial value, attracting and retaining talent, and securing competitive positioning in increasingly climate-conscious markets. In addition, the three companies acknowledged climate action as a means of enhancing operational resilience, particularly in the face of climate-related

resource and supply chain volatility, and there was indication of engagement with an emerging market for treatments targeting climate-related illness – an area with potential commercial value.

By surfacing the business case for climate action and illustrating how it is already shaping strategy within parts of the pharmaceutical industry, my research offers insights into how pharmaceutical company leadership might justify and integrate climate action across the wider industry. My findings suggest a need for pharmaceutical company leadership to adopt a long-term approach to integrating climate action into business strategy, challenging the short-termism that often dominates industry practices. To support this integration, companies could take several steps: invest in climate literacy training for company leadership; establish cross-departmental climate leadership teams with representation from, for example, finance, sustainability, operations, and research and development to ensure climate action is embedded across company practices; develop internal business case frameworks that outline the long-term financial, reputational, or operational benefits of climate action to inform company decision-making; design toolkits for embedding climate action (e.g., eco-design) into pharmaceutical research and development; and use climate action responsibly to competitively position companies as a way to scale action across the industry.

Secondly, my research sheds light on the types of climate action pharmaceutical companies were implementing and which of these have potential for more substantive emissions reduction. For example, the three companies I studied reported initiatives such as transitioning to renewable energy, incorporating eco-design into products, optimising distribution logistics, and integrating climate criteria into supplier procurement (see Appendix Table 1). These strategies, although not without challenges (e.g., limited access to renewable energy, restrictive regulations, and weak supplier engagement), have potential to offer both climate and business benefits and could serve as exemplars for broader industry adoption. My research also surfaced more performative and incremental actions. For example, some collaborations appeared performative, packaging

initiatives were seen as marginal, and emissions quantification and disclosure, while often framed as action, does not inherently reduce emissions and can distract from substantive action. Indeed, efforts to standardise emissions quantification at the product and patient care pathway level may risk reframing rather than addressing the problem if not linked to actual emissions reduction. Additionally, my findings indicated that some of the more performative and incremental practices were not necessarily solely the responsibility of pharmaceutical companies, but rather a product of an institutional context that set demands (e.g., regulatory, procurement) for certain types of action.

By illustrating that some climate actions are more substantive while others tend to be performative or incremental, my research better equips pharmaceutical company leadership with a more nuanced and actionable understanding of how to prioritise and scale those actions most likely to support net zero progress. Distinguishing between substantive and performative or incremental pharmaceutical company climate actions could be supported, for example, by developing internal or cross-industry databases that catalogue various climate actions and their associated emissions reduction potential, drawing on both existing literature and current practice. This would enable pharmaceutical company leadership to prioritise the implementation of high-impact actions, even in the absence of 'perfect' emissions data. Pharmaceutical company leadership could also engage in intra-industry and cross-sector collaborations to address shared climate challenges, such as limited renewable energy infrastructure and supply chain constraints. Existing initiatives, such as the Sustainable Markets Initiative Health Systems Task Force, are useful models for such collaboration. Additionally, by surfacing how the institutional context often constrains substantive action, my research provides pharmaceutical company leadership with insights to more actively engage with that context, for example, by co-creating regulation and incentives in ways that better enable substantive climate action.

Thirdly, my research contributes observations on how pharmaceutical company climate reporting practices can be improved to better support progress towards net zero. My analysis showed that climate reporting was often performative, highlighting positive progress, projecting a linear pathway to net zero, and omitting trade-offs, challenges, uncertainties or tensions. For example, company documents rarely acknowledged uncertainty about data quality, solutions to reach net zero, or difficulties with collaboration. This performative reporting is understandable given the pressures of corporate reporting norms, which are typically designed to present companies in a favourable light and meet investor, regulatory, or public expectations. However, my findings showed that external actors, especially within health systems, perceived such reporting as inauthentic, leading to scepticism, mistrust, and disengagement. This performative reporting, therefore, appeared to fail to galvanise climate action, as well as actively undermined it by deterring productive collaboration.

My research, therefore, suggests that pharmaceutical company leadership should cultivate what might be termed 'responsible' climate reporting. Such reporting would explicitly acknowledge tensions, share challenges faced in implementing climate actions (e.g. renewable energy infrastructure, supply chain constraints), openly reflect on what is not working and why, and signal where support, collaboration, or wider policy, regulatory, or economic change is needed. Sporadic examples of this type of responsible reporting were seen across the three companies that might be used as inspiration. Additionally, to make such reporting actionable, pharmaceutical company leadership might introduce internal reporting frameworks that require various departments to report targets and outcomes as well as reflective narrative on trade-offs, challenges, uncertainties, and tensions. Public company reports might include a dedicated section that explicitly outlines these trade-offs, challenges, uncertainties, and tensions, while companies could host internal workshops to prepare leadership to speak openly about failures and learnings. Through such practices, company leadership could begin to facilitate a long-term

cultural shift in corporate climate reporting that rewards transparency and honesty and ultimately supports net zero progress.

9.3.3. Theoretical and methodological contributions

My research makes two key theoretical and methodological contributions to the literature on corporate climate action, particularly within the underexplored context of the pharmaceutical industry. Firstly, I adapted and extended Hajer's argumentative discourse analysis by integrating impression management theory, as well as additional sensitising concepts, and applied this framework to a novel setting – pharmaceutical companies' climate action. This approach enabled a nuanced analysis of how discourse and performance shaped company climate action. Secondly, I identified the concept of discursive conditionality to theorise how dominant discourses converged to construct climate action as conditional and in doing so, constrained the range of responses. These insights open new pathways for researching, understanding, and potentially transforming how organisations respond to the climate crisis.

Firstly, my research expands the application of argumentative discourse analysis beyond its conventional domains, such as environmental policy and urban governance [298], demonstrating its analytical utility within corporate and health care settings. My integration of impression management concepts illuminated how pharmaceutical companies engaged in performative practices to maintain a particular impression of climate action amidst growing scrutiny. In analysing the interplay between discourse and performativity, my research contributes a theoretical insight: what companies 'say' about climate action is embedded in broader struggles over credibility and legitimacy. Throughout my research, I also drew on additional sensitising concepts, such as planetary health, techno-optimism, and network governance, highlighting the inherent interdisciplinarity of climate action. These diverse concepts

illustrate the complexity of climate change as an issue that resists narrow disciplinary framing. By bringing these concepts together, I demonstrate the potential for more pluralistic and integrative approaches to theorising corporate climate action that support deeper contextualisation and critical engagement.

Secondly, a key original theoretical contribution of my research is the introduction of the concept of discursive conditionality. This concept captures a discursive mechanism through which the way actors talk about and make sense of issues, such as climate action, systematically places preconditions on them, thereby delaying and deferring substantive action. Discursive conditionality extends Hajer's framework by illustrating how the convergence of dominant discourses can constrain the range of plausible or legitimate actions. Discursive conditionality aligns with related ideas such as discursive inertia [299], which refers to the persistence and resistance to change of dominant discourse, and with scholarship on discourses of climate delay in policymaking, where delay is achieved through narratives that shift responsibility, minimise the urgency of climate change, or promote incremental rather than transformative solutions [300]. However, I argue that discursive conditionality offers a more explicit analytical lens for understanding how dominant discourses converge to construct action as conditional, and thereby, limit the scope of responses. I argue that this concept holds analytical utility beyond the pharmaceutical industry, for analysing how climate action is discursively shaped and potentially constrained through conditionality in a range of corporate and institutional contexts.

9.4. Strengths and limitations of research approach

A key strength of my research approach was its facilitation of a critical, detailed analysis of pharmaceutical company climate action, moving beyond the predominantly quantitative and descriptive research. Existing research on pharmaceutical company climate action often adopts

a surface-level analysis, relying on limited methodological approaches (e.g., emissions quantification, content analysis), rarely situating climate action within the context of wider societal institutions, and lacking critical engagement with how climate action is interpreted and enacted. I adapted argumentative discourse analysis, a methodological approach suitable for examining complex issues, such as climate change, particularly, how actors produce, reproduce, and transform interpretations of an issue, and how these interpretations shape the range of conceivable and legitimate actions.

Hajer's concepts – storylines, discourses, discourse-coalitions, discourse structuration and institutionalisation – provided a robust framework for identification and detailed analysis of the discourses at play, the actors involved in producing them, and the dominance of various discourses. These concepts were useful in helping me answer my research questions, allowing me to trace how actors within pharmaceutical companies approached climate action and how the discourses these actors mobilised shaped, constrained, and, in some cases, enabled climate action. In my findings, I presented storylines and counter-storylines as distinct and neat dichotomies. I acknowledge that these storylines sometimes overlapped and blurred and that this framing inevitably simplified the discursive landscape. However, this was a useful heuristic approach that allowed me to make sense of complex discursive patterns and the key debates and arguments around an issue.

Argumentative discourse analysis contends that actors' interpretations and actions are embedded within broader social, economic, and political contexts, ensuring that discourse is not analysed in isolation from the contexts that shape it. This was critical for analysing an issue as interconnected with societal institutions as climate change. Additionally, the flexibility of argumentative discourse analysis (i.e., its openness to multiple theoretical perspectives) enabled me to integrate diverse sensitising concepts that allowed me to deepen my analysis. I employed concepts from impression management theory which complemented argumentative

discourse analysis, providing an additional lens through which to understand how, and why, actors mobilised particular storylines and discourses and engaged in performative practices to project a particular impression of climate action.

My research design was deliberately interpretive and qualitative. While argumentative discourse analysis provided a critical lens for examining how climate action was discursively constructed, it did not allow for analysis of the material effectiveness of climate action, quantification of emissions reductions, or exploration of, for example, how micro-level individual beliefs and values shaped climate action. Alternative research approaches, such as those rooted in emissions quantification, business studies, behavioural sciences, or econometric modelling, would likely have yielded different insights, particularly concerning the operational and technical aspects of company decarbonisation.

Interpretive, qualitative methods necessarily entail a degree of researcher subjectivity. Acknowledging and actively navigating my subjectivities contributed to a more reflexive, critically engaged analysis. My incorporation of Peshkin's concept of 'subjective I's' (see Chapter 4), allowed me to identify and reflect on the multiple subjectivities I brought to my study, and engage in an ongoing process of examining how my own background, assumptions, and professional experiences shaped my research. This facilitated, for example, my attentiveness to the influence of my 'Doctor I' in shaping my epistemological lens and informing my perspectives on the pharmaceutical industry, as well as to my 'Doomist I', which although brought passion and purpose to my research, also necessitated deliberate reflexive practices to preserve analytical rigour.

My data was drawn from a purposive, but small, sample of pharmaceutical companies, documents, and interviews with pharmaceutical company and health system actors, primarily based in Europe and the USA. The companies selected for analysis – GSK, Novo Nordisk, and Teva – were chosen due to their active climate commitments. Companies with less developed or

less public-facing approaches to climate action may have exhibited different discursive patterns. The inclusion of both industry and health system interviewees enriched my analysis; however, it is likely that the small sample size may not have fully captured the diversity of perspectives across the global pharmaceutical industry, particularly from actors in low- and middle-income countries or from smaller companies. Although interview participants held varied roles, there remains the possibility that interviewees, especially pharmaceutical employees, may have moderated their accounts due to company loyalty or reputational concerns, potentially underreporting tensions related to climate action. These accounts were also reported by people; I did not have direct insight into what happened in practice.

Nonetheless, the qualitative design of my study facilitated the depth and richness of analysis of this diverse, albeit small, dataset collected through different methods. The inclusion of documentary and interview data enabled analysis of both formal representations of climate action in company documents as well as more nuanced, situated understandings of climate action expressed by a wide range of relevant actors. The use of narrative interviewing provided insights into how climate action was interpreted by actors, while also maintaining sensitivity to their positioning and the contexts that shaped their perspectives. The rigour of my analysis was strengthened through practices such as peer debriefing, which provided opportunities to check and enhance the credibility of my findings.

My research offers a snapshot of discourses at a specific moment in time, within a dynamic and evolving landscape. Climate agendas, policy and regulatory developments, market pressures, and public expectations are continuously shifting. Over the course of my research, for example, NHS England was dismantled [301], the Trump administration withdrew from international climate agreements [302], the EU Corporate Sustainability Reporting Directive was introduced [80], and there was rapid rise in semaglutide drugs used for weight-loss, such as Ozempic, all with potential to influence pharmaceutical companies' and wider health systems' climate action.

Accordingly, the discourses I identified may evolve or reconfigure in response to broader social, economic, or political changes. Additionally, discourse-coalitions, by nature, are fluid; the actors involved, the storylines they promote, and the discourses that underpin them are subject to transformation over time. Given my sampling strategy, targeting companies and individuals who were, in some way, engaged with or aware of pharmaceutical company climate action, it is likely that these actors shared similar storylines or drew on particular discourses that may not be as prominent amongst actors less directly engaged. As a result, the storylines, discourses, and discourse-coalitions identified in my study reflect my interpretation of the perspectives of those actors who were accessible and visible within my sample, at a specific time, within a specific segment of the industry and its interfaces with health systems, rather than providing a comprehensive or representative account of the entire pharmaceutical industry or broader health systems.

Finally, my thesis focused specifically on climate change as a distinct environmental concern. Climate change is just one of several intersecting environmental crises confronting the pharmaceutical industry, including biodiversity loss, pollution, and resource depletion. While these issues often overlap with climate action, sometimes enabling co-benefits and other times producing trade-offs, they were beyond the scope of my study.

9.5. Chapter summary

In this chapter, I have unpacked my research findings about how pharmaceutical companies approached climate action, identified the dominant discourses shaping that action, and introduced the concept of discursive conditionality to explain how these discourses converged to constrain climate action. I have also surfaced alternative discourses that challenge the

conditionality imposed by dominant discourses and which might offer potential to support net zero progress.

My findings contribute to the limited academic literature at the intersection of the pharmaceutical industry and climate change which has thus far largely comprised quantification of pharmaceutical emissions or surface-level descriptive summaries of companies' reported emissions reduction strategies and has paid comparatively little attention to the broader social, economic, and political contexts in which companies operate. My research contributes to these gaps by providing empirical and critical insights into strategies companies reported using to reduce emissions, illustrating the discursive landscape shaping and constraining climate action, interrogating the focus on emissions quantification, unpacking the role of companies' broader institutional context in delaying climate action, and surfacing alternative discursive framings that could support net zero progress. I offer contributions to pharmaceutical company leadership, providing empirical insights into the business case for climate action in the industry, the types of climate actions companies might partake in, and how companies might report on climate issues.

Theoretically and methodologically, my study advances research on pharmaceutical company climate action by applying argumentative discourse analysis to this research area, something not previously undertaken. My adaptation of argumentative discourse analysis through the integration of additional sensitising concepts opens new pathways for exploring, theorising, and contextualising corporate climate action. Additionally, my introduction of the novel concept of discursive conditionality provides a new lens for understanding how discourse operates to delay or defer action by placing preconditions on it.

In my final chapter, I offer concluding thoughts on the implications of my findings for policy, practice, and research, and recommendations for how more substantive climate action might be enabled within the pharmaceutical industry and wider health systems.

Chapter 10: Conclusions and recommendations

10.1. Conclusions

Given the deep interconnections between climate change and human health, the pharmaceutical industry and wider health systems have a unique and critical role to play in limiting climate destruction. My thesis set out to understand how multinational pharmaceutical companies are approaching climate action, what shapes, constrains, and enables that action, and what might support net zero progress. I brought my clinical background together with a sociological lens to approach this inquiry, recognising that climate change and pharmaceutical companies are intertwined with the discourses, practices, and institutions of society. Drawing on argumentative discourse analysis, alongside other sensitising concepts, I conducted qualitative analysis of purposively sampled documents from three pharmaceutical companies – GSK, Novo Nordisk, and Teva Pharmaceuticals – and narrative interviews with a range of relevant actors across the pharmaceutical industry and wider health systems. I identified storylines and counter-storylines across my data, the discourses underpinning storylines, the actors that mobilised these discourses, the dominance of various discourses, and how these shaped, constrained, and enabled the climate action companies undertook and might support net zero progress.

My findings have implications for key actors in this space – pharmaceutical companies, health care policymakers and regulators, health care providers, patients and public, and researchers – who each have a role to play in either reproducing or transforming the discursive conditions that shape climate action in the pharmaceutical industry.

If key actors continue to reproduce the dominant discourses identified in my research, I argue that pharmaceutical company climate action will remain conditional, incremental, and insufficient to meet the scale and urgency required for net zero. The implications of this are sobering but also potentially generative. If discourse can constrain climate action by naturalising certain assumptions, such as the notion that data must precede action, it can also be resisted and reconfigured. As Hajer suggests, discourse is not fixed; discursive shifts become possible when new storylines gain traction and are taken up by central actors, prompting a reordering of discourse-coalitions and enabling the institutionalisation of alternative discourses [173].

Counter-storylines and alternative discourses exist, offering glimpses of more climate-conscious practices within segments of the pharmaceutical industry and health systems. These alternative discourses collectively provide a discursive framework through which pharmaceutical company climate action can be reimagined. Though currently marginal, these discourses may function as catalysts for transformative change, intersecting to disrupt discursive conditionality, and generating discursive momentum for more rapid and substantive climate action. For these alternative discourses to gain traction, a redistribution of power within existing discourse-coalitions is essential. I argue that if accepted, reproduced, and institutionalised by central actors, such as multinational pharmaceutical companies, regulatory authorities, and health system policymakers, these discourses have the potential to support net zero progress in the pharmaceutical industry.

Planetary health discourse, for example, offers a way to transcend the dichotomy between climate action and patient wellbeing produced by dominant biomedical discourse, thus overcoming a key precondition for action. Greater alignment with planetary health discourse by key actors, pharmaceutical companies, health system providers, and patient communities, could support health care practices (e.g., prevention, promotion, social prescribing, low-carbon prescribing) that improve both patient and climate outcomes. For planetary health discourse to

gain traction, actors must directly confront the continued dominance of biomedical discourse which shapes conceptions of patient wellbeing, positions pharmaceutical products as the default mode of treatment, and is sustained through prevailing clinical guidelines, medical education, and public expectations [303-305]. It is important to note that a planetary health discourse does not dismiss the value of pharmaceuticals in health care delivery. In fact, pharmaceutical interventions may, in many cases, represent the lowest-carbon treatment option, for example, insulin prescriptions that reduce the risk of kidney failure and the need for emission-intensive dialysis. Rather, this discourse challenges the over-medicalisation of health and the dominance of pharmaceutical interventions in health care, and advocates for more intentional approaches to treatment, with both patient outcomes and planetary health in mind.

My findings point to the value of exploring alternative economic imaginaries (i.e., shared visions or assumptions about how economies could or should function) to support health care delivery that aligns with planetary health principles such as low-carbon, preventive, and promotive models of care. While structural shifts in health care delivery towards these models may be essential for long-term sustainability, such shifts are politically and institutionally slow. In the meantime, my findings suggest that key actors (e.g., health economists, policymakers) could mobilise economic discourse within existing health system financial models to assign value to climate action, thereby facilitating more immediate action. Climate action can be framed as competitively advantageous, or even profitable, within capitalist frameworks, and actions might be derived from this framing to also influence pharmaceutical company climate policy and practice [264, 306]. However, careful design of such financial incentives is needed to avoid reinforcing existing market and health system inequities, commodifying climate action (and health), and potentially undermining the normative discourse championed by health system actors that seek to decouple climate action from financial considerations [262, 307].

When used strategically and reflexively, emissions data can play a role in supporting climate action. Indeed, it was quantification of health systems and the pharmaceutical industry's emissions that raised awareness about the climate impacts of this sector at the outset [95]. Emissions data has proven instrumental in identifying emissions hotspots of pharmaceuticals and enabling targeted interventions, such as the successful phase-out of the anaesthetic gas desflurane in Scotland [151]. Within the pharmaceutical industry, emissions quantification has informed mitigation efforts [48], guided decisions on product eco-design [308, 309], and underpinned benchmarking against climate targets [257, 310]. These examples illustrate how data can support transparency, accountability, and evidence-based decision-making.

However, my research surfaced the need to avoid the pitfalls of data becoming an end in itself, and for institutional mechanisms (e.g., regulation, financial incentives) to explicitly link emissions data to emissions reduction while preserving space for post-technocratic critique to guard against over-reliance on data. My findings suggest that engaging with post-technocratic discourse offers an opportunity to reorientate climate strategies within pharmaceutical companies and health systems, shifting away from privileging emissions quantification and disclosure, embedded in current regulatory and procurement demands, and instead facilitating more substantive climate action. Such a shift necessitates moving beyond calls for 'more data' to a more reflective assessment of whether, how, and under what conditions current emissions data supports effective climate action.

A key finding from my research was the need to shift from uncritical calls for more collaboration to engage in more productive collaboration. While techno-optimist discourse on collaboration and innovation was often vague and aspirational, moderate engagement with it might support collective innovation for net zero progress, provided that such engagement also acknowledges its limitations and the broader social, economic, and political contexts that shape innovation. Similarly, although network governance discourse was at times deployed to deflect responsibility

onto other actors, my findings indicate that it nonetheless offers principles for designing institutional structures and processes that enable diverse actors (e.g., pharmaceutical companies, health policymakers, regulators) to engage constructively with climate action [245, 297]. Realising the potential of network governance requires cultivating trust, fostering shared responsibility, and institutionalising relational accountability in contexts shaped by mistrust and power asymmetries [245]. By allowing tensions, such as those observed in my research (e.g., conflicting organisational interests), to surface and be negotiated, this approach positions conflict as a potential catalyst for collective innovation and shared responsibility [311, 312].

Finally, pharmaceutical company climate action remains an underexplored area in academic research and my findings have implications for future research in this space. Specifically, they highlight the value of moving beyond approaches in existing literature, which predominantly focuses on the quantification of pharmaceutical emissions and surface-level descriptions of company targets or emissions reduction strategies. My research shows the importance of engaging more deeply with the discourses and institutional contexts that shape climate action.

Future research could benefit from applying argumentative discourse analysis to examine how dominant and alternative discourses shape climate action, not only within pharmaceutical companies, but also across different geographies (e.g., 'Global South') and sectors (e.g., transport, agriculture). Such research might include testing the applicability of the concept of discursive conditionality in different contexts. Further investigation is needed to understand how discursive shifts that support climate action might occur and what impact these shifts could have on actual emissions reductions and health outcomes, particularly if alternative discourses become institutionalised in practice.

Research might explore alternative models of health care delivery, such as those prioritising prevention and health promotion, and assessing how these models can advance both patient and planetary wellbeing, as well as the potential role of the pharmaceutical industry in supporting

such health care models. In parallel, there is a need to explore economic imaginaries that might reform pharmaceutical markets, how alternative conceptions of value could reframe climate action, and identifying the types of financial incentives most likely to drive industry decarbonisation. Research could also examine how emissions data is utilised in practice and how regulatory and procurement frameworks might evolve to prioritise emissions reductions over quantification and disclosure. Collaborative climate action remains a fertile area for further study, with comparative case studies of existing pharmaceutical collaborative initiatives offering opportunities to identify the conditions under which collaboration becomes genuinely productive rather than aspirational.

Beyond climate change, future research is needed to explore how pharmaceutical companies engage with other environmental issues, such as biodiversity loss, pollution, and waste, and whether distinct discourses and practices emerge in these contexts. Finally, there is a need to bridge discourse and action. Future studies could contribute to the development of practical tools and frameworks, informed by the alternative discourses I identified, to support climate policy and practice within the pharmaceutical industry and beyond.

To conclude, through my research, I argue that the discursive conditionality of dominant discourses has enabled the delay and deferral of substantive pharmaceutical company climate action and ultimately constrained net zero progress. The implications of continuing to reproduce dominant discourses risks entrenching an approach to climate action that is conditional, incremental, and delayed, in opposition to the scale and urgency of action needed to reach net zero. I argue that if alternative discourses – that frame climate action as interconnected with patient wellbeing, as a moral obligation decoupled from profit, as a financial opportunity rather than a risk, that prioritise emissions reduction over quantification, and that promote productive collaboration – are accepted, reproduced, and institutionalised by central actors, such as large pharmaceutical companies, regulatory bodies, and health system policymakers, these

alternative discourses hold the potential to support pharmaceutical company progress towards net zero.

In the next section, I offer recommendations for various actor groups to inform the practical implementation of my findings.

10.2. Recommendations

Drawing on my findings, I offer targeted recommendations to guide pharmaceutical companies (see also Chapter 9), health care policymakers and regulators, and health care providers in supporting net zero progress. These recommendations adopt a pragmatic approach, intending to facilitate action within existing structures while preparing the way for more transformative change that might come from accepting, reproducing, and institutionalising alternative discourses. I acknowledge the rapidly evolving context that the pharmaceutical industry and health systems operate in. Emerging developments, such as the appropriating of semaglutide drugs like Ozempic for weight-loss and the implications of this for public health and climate action [313], structural upheavals in health systems such as the dismantling of NHS England [301], and ongoing political and social manifestations of climate change denial [44], complicate the terrain for implementing climate action. At the same time, there are already existing climate initiatives within the industry and health systems, such as a rise in commitments to net zero [128], introduction of corporate climate-related regulation [80], and climate-related industry collaboratives [240], that point to some organisational readiness and momentum for change. These developments highlight the volatility of the landscape, yet I argue that the recommendations made here remain relevant and necessary, and can be adapted and applied within shifting social, economic, and political conditions. To demonstrate how the storylines, counter-storylines, and their underlying discourses informed my recommendations, Table 12 maps these to the recommendations

proposed for pharmaceutical companies, health care policymakers and regulators, and health providers. I then outline, in greater depth, some of the key recommendations for each actor group in text below.

Table 12: Linking storylines, counter-storylines, and underlying discourses to recommendations across actor groups

Recommendation	**Linked storyline(s), counter-storylines(s), and underlying discourse(s)**	Rationale/ discursive link
Pharmaceutical companies		
Mandate climate literacy training for all employees	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health); Climate action as emissions quantification and disclosure (technocratic); Emissions quantification and disclosure as climate inaction (post-technocratic)	Recommends expanding climate literacy training across employees and departments to embed climate considerations in company decision-making and practice, drawing on planetary health discourse to enhance awareness of the interconnections between patient and planetary wellbeing, and on post-technocratic discourse to emphasise the need to prioritise action, emissions reduction, and outcomes over data.
Embed climate action across business strategy	Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (normative; reorientated economic)	Situates climate action as integral to business strategy, reframing it as both a moral necessity, drawing on normative discourse, and a competitive advantage, drawing on economic discourse.
Develop internal business case frameworks to support climate decision-making	Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (reorientated economic)	Draws on economic discourse that emphasises the regulatory, reputational, market, and operational resilience business case for climate action, as well as on reorientated economic discourse which supports alignment of financial incentives with climate action.
Use existing emissions data and known emissions reduction strategies to inform climate action	Climate action as emissions quantification and disclosure (technocratic); Emissions quantification and disclosure as climate inaction (post-technocratic)	Draws on post-technocratic discourse to counter the deferral of action pending perfect data (technocratic discourse) by promoting use of existing knowledge to drive substantive emissions reduction, prioritising action and outcomes over data as an endpoint.

Ensure climate reporting is transparent and avoids performativity	Supported by all storylines, counter-storylines, and underlying discourses within which there is evidence of performativity	Responds to findings of performative reporting (e.g., patient wellbeing as justification for climate impact, performativity around collaborations) and recommends honest, transparent, and reflective reporting.
Leverage economic and political power to engage with policymakers and regulators	Supported by all storylines, counter-storylines, and underlying discourses where companies have a role to play in accepting, reproducing, and institutionalising alternative discourses that might support net zero progress	Recommends employing companies' influence to reform the institutional context that reinforces discursive conditionality: shifting to health care models that meet the needs of patients and the planet, realigning financial incentives to support climate action, informing procurement and regulatory criteria that focus on outcomes rather than data, and engaging in productive, cross-sector collaboration.
Explore pathways for business diversification to align with low-carbon health care models	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health); Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (reorientated economic)	Challenges biomedical discourse by supporting preventive, promotive, and non-pharmaceutical models that align patient and planetary wellbeing, drawing on planetary health discourse, and by exploring ways to align financial incentives with such health care models, drawing on reorientated economic discourse.
Shift industry organisational culture to align patient, planetary, and financial goals	Supported by all storylines, counter-storylines, and underlying discourses where companies have a role to play in accepting, reproducing, and institutionalising alternative discourses that could support net zero progress, and shifting organisational culture to align.	Encourages an organisational shift towards alternative discourses that can support net zero progress.
Health care policymakers and regulators		
Mandate climate literacy training for health care policymakers and regulators	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health); Climate action as	Recommends expanding climate literacy training for policymakers and regulators to support integration of climate considerations in decision-making and practice,

	emissions quantification and disclosure (technocratic); Emissions quantification and disclosure as climate inaction (post-technocratic);	drawing on planetary health discourse to enhance awareness of the interconnections between patient and planetary wellbeing, and on post-technocratic discourse to emphasise the need for pharmaceutical policy and regulation to focus on action, emissions reduction, and outcomes over data.
Incorporate staggered climate requirements into pharmaceutical procurement policy	Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (normative; reorientated economic); Climate action requires more collaboration (network governance)	Draws on economic and network governance discourses to recommend aligning procurement criteria with climate action and adopting a collaborative approach to develop these criteria and support companies in meeting them.
Task health bodies to integrate climate considerations into guidelines and formularies	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Embeds planetary health principles into clinical guidelines and formularies, recognising the interconnections between patient and planetary wellbeing and the need to consider climate change and action in clinical decision-making and practice.
Commission pilot projects on low-carbon prescribing and non-pharmaceutical interventions	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Draws on planetary health discourse to explore alternative health care models that move beyond biomedical, illness-focused care towards models that support both patient and planetary health.
Establish funding mechanisms for preventive, non-pharmaceutical interventions	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health); Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (normative; reorientated economic)	Reallocates resources to preventive and promotive health care, aligning patient, planetary, and financial considerations, drawing on planetary health and reorientated economic discourse.
Adapt pharmaceutical regulation to incorporate	Climate action contingent on financial viability (economic); Climate action contingent on	Draws on economic discourse to reinforce the financial opportunities and business case for climate action by

climate requirements for approval pathways	maximising profit (normative; reorientated economic)	embedding climate criteria into pharmaceutical regulation.
Shift health care delivery towards prevention and promotion through supportive policy and funding	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health); Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (normative; reorientated economic)	Reinforces the shift in health care delivery towards preventive and promotive models that support both patient and planetary wellbeing, drawing on reorientated economic discourse and leveraging financial mechanisms to sustain this transition.
Actively resist and challenge industry lobbies obstructing climate action	Climate action contingent on financial viability (economic); Climate action contingent on maximising profit (normative)	Recognises active resistance by companies against policy and regulatory change to support climate action, driven primarily by financial concerns, and recommends efforts to challenge this resistance to advance net zero progress.
Health providers		
Engage in climate literacy training during medical and continued professional education	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Builds practitioner understanding of the interconnections between patient and planetary wellbeing, drawing on planetary health discourse, and supports cultural change within health care decision-making and practice.
Use existing clinical tools to support low-carbon prescribing and integrate non-pharmaceutical interventions	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Challenges the perceived dichotomy between patient wellbeing and climate action, embedding principles of planetary health discourse in clinical decision-making and practice, leveraging existing tools and resources.
Communicate climate impacts of pharmaceuticals to patients during consultations	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Helps raise awareness of the climate and long-term population harms from pharmaceuticals, reframing patient expectations by linking individual health to planetary wellbeing.

Raise wider awareness about climate impact through co-developed campaigns or media platforms	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Disseminates planetary health discourse beyond professional settings to help shift wider societal norms about patient and planetary wellbeing.
Embed climate considerations across care delivery through prevention, promotion, and low-carbon treatment options	Climate action conflicts with patient wellbeing (biomedical); Climate action is integral to patient wellbeing (planetary health)	Supports the institutionalisation of planetary health discourse within clinical decision-making and practice, encouraging long-term alignment between patient and planetary wellbeing.
Overarching recommendation		
Facilitate and engage in pre-competitive, knowledge-sharing, action-oriented collaboration to meet shared climate targets	Climate action requires more collaboration (techno-optimist; network governance)	Surfaces tensions in current discourses around collaboration and recommends a more reflexive use of these discourses to transform vague, aspirational calls for collaboration into structured, accountable, and action-oriented partnerships across pharmaceutical companies, policymakers, regulators, and health providers. Encourages shared learning and responsibility rather than the displacement of responsibility.

10.2.1. Key recommendations for pharmaceutical companies

1. **Accept and embed climate action as integral to business strategy:** Positioning climate action as essential to business continuity and competitiveness is recommended to facilitate consideration of climate action and co-benefits across company strategy and practices. Senior pharmaceutical company leadership (e.g., CEO's, board members, executives) should integrate climate action across corporate mission statements, business strategies, research and development priorities, and public messaging. This will require education, awareness, and capacity building in the short-term, and a long-term shift in organisational culture within companies, from senior leadership to employees. To support this, company leadership should invest in climate literacy training for employees and develop internal business case frameworks that highlight the financial and operational benefits of climate action to be used in decision-making.
2. **Prioritise substantive climate actions that offer emissions reduction:** Pharmaceutical companies must focus on climate actions that offer substantive emissions reduction potential. In the short-term, pharmaceutical employees involved in developing and implementing companies' climate strategy should use existing emissions data, either from their own company or from literature, to identify emission-intensive operations and products and then implement known strategies to reduce these impacts (e.g., renewable energy, product eco-design), rather than delaying action in pursuit of perfect data. To facilitate this, companies should develop databases of climate actions and associated emissions reduction potential, decision-making tools that facilitate prioritisation of high-impact actions, and guidance for their implementation. In the medium- to long-term, company leadership could leverage their economic and political power to engage with policymakers and regulators to help shape a supportive

institutional context to drive emissions reduction (e.g., regulation that demands reduction, improved renewable energy infrastructure).

3. **Engage in and facilitate more productive collaboration:** Climate action by pharmaceutical companies is interdependent on the decisions and actions of other actors. Actors across pharmaceutical companies, including senior leadership and employees involved in companies' climate strategy, must engage in and facilitate pre-competitive partnerships with peers and other actors (e.g., regulators, health systems actors) focused on shared climate challenges (e.g., supply chain emissions reduction), knowledge-sharing, and action on emissions reduction. Actors could use existing collaborative initiatives (e.g., Sustainable Markets Initiative Health Systems Task Force) as exemplars for action, or leverage existing pharmaceutical collaborative platforms (e.g., Association of British Pharmaceutical Industries) and incorporate specific climate-focused units (e.g., on supply chain emissions, product eco-design) within those.
4. **Ensure responsible climate reporting that is transparent and avoids performativity:** Responsible climate reporting is recommended to facilitate net zero progress. Corporate sustainability teams, ESG strategists, and executives responsible for drafting and approving climate reporting (e.g., within ESG and Annual Reports) should prioritise transparent, honest, and detailed accounts of their company's climate actions. Rather than emphasising only achievements or future aspirations, reporting should acknowledge trade-offs, challenges, uncertainties, and tensions, for example, by having a dedicated section for this in public company documents. This transparency could enhance credibility, invite constructive scrutiny from other actors (e.g., regulators, health policymakers, investors, and civil society), and create space for collaborative problem-solving in areas where solutions are still emerging. In the long-term, these practices could enable a shift in the purpose and nature of public climate reporting that rewards transparency, honesty, and mutual learning.

5. **Support alternative health care models that align patient and planetary wellbeing:** Health care models that focus on prevention, promotion, and non-pharmaceutical interventions offer potential to align patient and planetary wellbeing. Key actors within pharmaceutical companies (e.g., CEO's, board members, senior leadership) should advocate for and support low-carbon, preventive, and promotive models of health care. In the short-term, this might include supporting or funding pilot research on preventive or non-pharmaceutical models, through co-participation with other actors (e.g., health economists, policymakers), and exploring how these models might be commercialised to align with financial considerations of pharmaceutical companies. In the medium- to long-term, company leadership might explore pathways for business diversification to align with new models of health care delivery.

10.2.2. Key recommendations for health care policymakers and regulators

1. **Design and deliver alternative health care models that align patient and planetary wellbeing:** Health care models that focus on prevention, promotion, and non-pharmaceutical interventions offer potential to align patient and planetary wellbeing. Health system policymakers (e.g., NHS Department of Health and Social Care) must reform, adapt, design, and deliver health care that aligns patient and planetary wellbeing. In the short-term, this could involve commissioning pilot projects (e.g., with pharmaceutical company support) focused on low-carbon prescribing and non-pharmaceutical interventions (e.g., social prescribing, low-carbon prescribing, behavioural interventions). Policymakers could task health bodies (e.g., NHS) to integrate climate considerations into frameworks for low-carbon care delivery, existing clinical guidelines, or formularies. Additional support might be needed for

smaller health bodies (e.g., local health facilities), who might lack the resources for such actions. Targeted funding, capacity-building, or shared frameworks could help bridge this gap and ensure consistent integration of low-carbon principles across health systems. In the medium-term, policymakers should establish funding mechanisms for low-carbon, preventive, non-pharmaceutical interventions, while in the long-term, reflective engagement with a patient care pathway approach might support the design of health care delivery that achieves patient outcomes in the most low-carbon manner. Such reform might be supported by further research and long-term policy (e.g., NHS 10-year plan).

2. **Regulate and incentivise substantive pharmaceutical company climate action:** Pharmaceutical regulatory and procurement bodies can incentivise pharmaceutical company climate action. Health system policymakers and pharmaceutical buyers (e.g., the NHS, health facilities, health insurance companies) should incorporate criteria for substantive climate action that demonstrates emissions reduction in procurement contracts and reimbursement decisions, leveraging purchasing power to influence pharmaceutical markets, and favouring pharmaceutical suppliers who meet climate criteria. This might be a staggered process to allow companies with fewer resources and capacity (e.g., small-medium-sized companies) to adapt. In the long-term, pharmaceutical regulatory bodies (e.g., MHRA, FDA) should reform, adapt, and design regulations to incorporate substantive climate action (e.g., decarbonisation plans, demonstrated emissions reduction, eco-design of products) into pharmaceutical approval pathways. In developing these incentives, policymakers and regulators engaging with the pharmaceutical industry must actively challenge the influence of powerful industry lobbies that seek to obstruct health sector climate action, potentially drawing lessons from the tobacco control movement.

3. **Enable productive cross-sector collaboration on climate action:** Climate action must be supported by collaborative action across pharmaceutical supply chains. Health system policymakers (e.g., UK's Department of Health and Social Care) should establish and facilitate neutral convening platforms where various actors (e.g., pharmaceutical employees, health providers, and patients) can share knowledge and co-develop solutions, with clear rules for accountability, navigating tensions, power-sharing, and decision-making. Existing collaborative initiatives (e.g., Sustainable Markets Initiative Healthcare Task Force) might be expanded to include wider actor groups.

10.2.3. Key recommendations for health care providers

1. **Incorporate climate action into health care practices:** Health care providers should use their prescribing practices to drive upstream demand for low-carbon pharmaceuticals and minimise pharmaceutical emissions. In the short-term, health care providers (e.g., doctors, allied health professionals, pharmacists) could use existing clinical tools such as local clinical guidelines, formularies, and routine medication reviews to support low-carbon prescribing and integrate known non-pharmaceutical interventions (e.g., social prescribing, dietary changes) where clinically appropriate. Such practices should be supported by medical training and capacity building on the climate impact of pharmaceuticals and ways to reduce this impact (e.g., reducing unnecessary pharmaceutical use, non-pharmaceutical interventions, low-carbon prescribing). In the long-term, there must be a fundamental shift in care delivery practices, ensuring that climate-conscious choices are embedded into routine care. Such a shift could be supported by instilling a focus on optimising health as the purpose of health care and embedding this across medical

training, local practice, and health system policies (e.g., such as the NHS 10-year plan which focuses on prevention and primary care). This shift must be accompanied by careful consideration of long-term outcomes for patients, which often align with planetary health. For example, reducing the use of hormonal contraceptives may appear environmentally beneficial in the short-term, but could ultimately lead to negative consequences for both patients (e.g., increased rates of unintended pregnancies) and the environment (e.g., higher resource demands of obstetric and neonatal care).

2. **Promote wider awareness of the value of planetary health amongst patients and public:** Health care providers must play a part in shifting patient and public expectations around health care to value planetary health and recognise its necessity for patient wellbeing. In the short-term, health care providers (e.g., doctors, pharmacists, public health officials) could use brief communications during consultations to link health advice to planetary wellbeing (e.g., "walking instead of driving supports your heart and planetary health"). Aligned visual materials could be displayed in health facilities and prompts and short pieces of advice included in digital health applications (e.g., NHS App). Examples of such materials already exist, such as the Canadian guide for planetary health for primary care [281], and might be adapted for different contexts. In the long-term, health care providers could work with patient groups or community health forums to raise awareness about low-carbon care and its benefits and embed planetary health themes in public-facing health campaigns on, for example, health system government websites, television advertisements, or social media posts.

10.3. Final thoughts

I began my thesis by highlighting the urgency of climate change. Climate change is an emotionally challenging topic to research. This thesis has demanded that I think about a deeply existential crisis daily. I have teetered between hope and hopelessness. I have, at times, been overwhelmed with frustration at the entrenched behemothic political and economic structures – and actors – that continue to prioritise personal gain over the survival of humanity. It is daunting to imagine the scale of change necessary to reverse what several generations of our species has put into motion. But we must start somewhere. Or rather, continue the fight. In a new place, from a novel angle. That is what I intended to do with this thesis. Add my voice to the cause.

Throughout my thesis, I have been reflexive, attempting to maintain academic rigour while actively fighting my desire to be radical. My findings reflect this intentional reflexivity and, I hope, offer some practical pathways towards net zero for pharmaceutical companies and wider health systems. By surfacing alternative discourses, I have shown how actors might align patient and planetary wellbeing, promote more imaginative and sustainable health care financial models, shift the emphasis from emissions quantification to substantive reduction, and support genuinely productive collaborations. If accepted by key actors and embedded into institutional practice, these alternative discourses hold the potential to reorientate pharmaceutical company climate action to support net zero progress.

The pharmaceutical industry's – and humanity's – journey, either to a point where it lives alongside nature or continues an irrevocable path of destruction, is opaque. If we have learnt anything about change in the past, it will be non-linear, disruptive to society, and painful at times, but with the hope of something better to come. I remain genuinely concerned about humanity's future but simultaneously optimistic in people's ability to survive, adapt, and thrive.

I conclude by envisioning a future where health no longer comes at the planet's expense; where patient and planetary wellbeing are aligned, not in tension; a future where health systems draw strength, nourishment, and wisdom from the living world, treating nature not as an economic resource but as a teacher and partner; a future where climate action is not viewed as a financial burden or reduced to metrics but transcends the arbitrary dictates of numbers and profit, embraced as a vital expression of our duty to life itself; and where collaboration is a daily practice of shared responsibility for conserving our planet.

Let us hold hope that this future is not lost, but already being constructed.

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Appendices

Ethics documents

Informed consent form

Record of Consent

Decarbonising the pharmaceutical industry: An exploration of the pharmaceutical industry's approach to greenhouse gas emissions reduction

Central University Research Ethics Committee (CUREC) Approval Reference: R84575/RE001

Version: 1.0.

Purpose of Study: The purpose of this study is to better understand the global pharmaceutical industry's approach to reducing its greenhouse gas emissions in order to inform change in practice and policy.

Please indicate if consent was: Written ☐ Verbal ☐

	Please initial each box if you agree with the statement (or initialled by researcher if taking verbal consent)
I confirm that I have read and understand the information sheet for the above research. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
I understand that my participation is voluntary and that I am free to withdraw at any point until 30/04/2024, without giving any reason.	
I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.	

I understand the extent to which I could be identifiable from the written thesis, any publications, or presentations.	☐
I consent to being audio recorded during interviews.	☐
I understand how the interview audio recording will be used in research outputs.	☐
Use of quotations: Please indicate your preference (select *one* option):	
a) I do not wish to be quoted, **or**	☐
b) I agree to the use of quotations in research outputs if I am not identifiable, **or**	☐
c) I agree to the use of direct quotations, attributed to my name, in research outputs.	☐
I give permission for you to contact me again to clarify information.	☐
I understand how to raise a concern or make a complaint.	☐
I agree to take part.	☐

_____	dd / mm / yyyy	_____
Name of participant	Date	Signature

_____	dd / mm / yyyy	_____
Name of person taking consent	Date	Signature

Interview information sheet

Decarbonising the pharmaceutical industry: An exploration of the pharmaceutical industry's approach to greenhouse gas emissions reduction

Participant Information Sheet: Interviews

Central University Research Ethics Committee Approval Reference: R84575/RE001

Version: 1.0.

Introductory paragraph

You are being invited to take part in the above research project because you are involved in or have expertise on reducing greenhouse gas emissions in the pharmaceutical industry. This research is being conducted as part of the requirements for completing a Doctor of Philosophy in Translational Health Sciences.

Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part.

Why is this research being conducted?

The need to address climate change and reduce greenhouse gas (GHG) emissions from all human activities is becoming increasingly urgent. Health systems are estimated to contribute between 4-5% of national GHG emissions in countries with data. Of this, pharmaceuticals contribute between 13-55% of national health system GHG emissions. 20% of the National Health Service (NHS) emissions come from 'medicines and chemicals' and an additional 5% from 'anaesthetic gases and metred-dose inhalers', emphasising the significant contribution of the pharmaceutical supply chain to climate change.

The bulk of pharmaceutical emissions are released at the industry-level, but there are gaps in knowledge on how and where emissions are produced and reported by the industry, current and planned reductions, and the ways in which the global context shapes and influences change in the industry. The need for consistent data on pharmaceutical industry emissions, and initiatives to reduce these emissions has begun to be realised, but significant gaps remain.

This research aims to better understand the pharmaceutical industry's approach to reducing its GHG emissions, explore how the global context shapes, enables and/or constrains the actions of pharmaceutical companies, and to use emerging findings to inform industry practice and policy relating to GHG emissions.

Why have I been invited to take part?

This research aims to gain insight on the pharmaceutical industry's approach to GHG emissions reduction and the global context influencing this. You have been identified as:

A pharmaceutical industry representative involved in or with understanding of/ expertise in GHG emissions in your pharmaceutical company.

OR

A stakeholder with expertise on the global (national or international) context within which the pharmaceutical industry operates and which influences their engagement with their GHG emissions

We want to learn from your perspectives and experience with the pharmaceutical industry's GHG emissions.

Do I have to take part?

No. It is up to you to decide whether to take part. You can withdraw yourself from the study, without giving a reason, and without negative consequences, by advising us of this decision. The deadline by which you can withdraw any information you have contributed to the research is 30/04/2024. Any data that has already been collected from you prior to your notification of withdrawal will be destroyed.

What will happen to me if I take part in the research?

If you choose to take part in this research, you would be agreeing to take part in an interview with the purpose of gaining information on the approach your company or the wider industry is taking in relation to their GHG emissions (and what are the gaps) or to understand the global context that influences the industry's engagement with its emissions. A researcher will ask you to consent to take part. If you attend the interview in-person you will be asked to sign the consent form. If you attend the interview online, the information in the consent form will be read to you by the researcher and you will then be asked to give verbal consent which the researcher will note. You will be given a copy of the consent form, either in -person or via a password-encrypted email if you attended the interview online. A copy of the consent will be given to you or sent by email for you to keep.

The interview will take place in person if location allows, or alternatively, online via Microsoft Teams. The interview will last 45-60 minutes. It will be a one-off interview, but you may be contacted again to clarify any of the points you made, and to confirm whether it is alright to use any of your comments as quotes in the research publications. With your consent, we would like to audio record and transcribe the interview so that we can have an accurate record of our conversation. You can ask to pause or stop the interview and recording at any point.

The interview will be largely conversational with the aim to cover the follow topics:

If you are an industry representative:

- Introduction of yourself and your role
- Overview of your company's approach to GHG emissions reduction (e.g., actions you are taking to reduce them, how you are sharing information on your emissions to external stakeholders)
- Insight on what has influenced your company's approach to its GHG emissions
- Your opinion on what the future holds for your company's (and the wider industry's) engagement with its GHG emissions.

OR

If you are a stakeholder with expertise on the context within which the industry is operating:

- Introduction of yourself and role
- Insight on how the context within which the industry is operating is influencing their engagement with their GHG emissions (this will be specific to the context in which you have expertise on e.g., policy and regulations, industry trends, generics/branded companies etc.)
- Your opinion and suggestions on how pharmaceutical industry GHG emissions can be reduced
- Your contributions will form part of a Doctor of Philosophy thesis and may be used in published research, conference presentations, policy briefs, and social media posts/ blogs. We may request your consent to use quotes which will be anonymised or named depending on your preference.

What are the possible disadvantages and risks in taking part?

This research is expected to be low risk for participants. We appreciate that you may provide us with confidential information on GHG emissions that has not been made publicly available by your company/ institution. We will make every effort to ensure that any information you do not want included in the findings is not and that you remain anonymous (unless you wish otherwise). We realise that you may be part of easily identified institutions and companies, and as such, anonymity may be difficult to obtain. In order to reduce the risk of participants being identified by the information they provide, participants and data will be pseudonymised and collated into 'industry' and 'contextual' groups. Company/organisation and individual names will be removed, although you will be offered the opportunity to be named in the research if you feel it would help to advance the agenda.

The actual record of what you say will be securely stored and accessible only to members of the project team.

Are there any benefits in taking part?

While there are no immediate benefits for those people participating in the project, it is hoped that this research will provide guidance to improve reduction of GHG emissions across the pharmaceutical industry, taking health systems closer to achieving net zero emissions.

What information will be collected and why is the collection of this information relevant for achieving the research objectives?

The following data will be collected from you:

- Consent records including your name
- Contact details should we need to re-contact you for the purposes of this research
- Transcribed audio recordings of interviews containing data to be used as findings in the research
- Consent records will be scanned and secured in password-encrypted files only accessible by the research team. Consent records will be kept for 3 years after the research ends and will then be destroyed.
- Your contact details (i.e., name and email) will be kept in a separate data log on a password-encrypted file, only accessible to the research team. Any data that you provide will be de-identified and allocated a unique participant ID number. A list of participant numbers that are connected to your contact details will be stored separately in a password-encrypted file. The purpose of keeping your contact details is to allow the

researchers to re-contact you to clarify any information you provide, ask permission to use any direct quotes and to share the research once results are published. The list of contact details will be destroyed at the end of the study.

- Audio recordings of your interview will be immediately transcribed and stored in a password-encrypted file. The audio recording will be immediately deleted. The transcribed notes will be de-identified and only accessible to the research team. They will be kept for 3 years after the research ends and will then be deleted.

The study will comply with the UK General Data Protection Regulation (UK GDPR) and the Data Protection Act 2018, which require data to be anonymised as soon as it is practical to do so and personal data to not be retained once no longer needed for the research.

Will the research be published? Could I be identified from any publications or other research outputs?

The findings from the research will be written up as a Doctor of Philosophy thesis. A copy of the thesis will be deposited both in print and online in the Oxford University Research Archive where it will be publicly available to facilitate its use in future research.

There will be publications that will arise from the findings from this research. Results may also be presented at conferences, on social media channels, or form part of policy briefs. Participants will remain anonymous in these research outputs unless you choose for your name to be attributed to your input. We will request your permission should we feel any of your direct quotes will be of value in these research outputs.

Data Protection

The University of Oxford is the data controller with respect to your personal data and, as such, will determine how your personal data is used in the study. The University will process your personal data for the purpose of the research outlined above. Research is a task that is performed in the public interest. Further information about your rights with respect to your personal data is available at https://compliance.admin.ox.ac.uk/individual-rights.

Who is funding the research?

The primary researcher, Amy Booth, is funded by a Rhodes Scholarship. The Rhodes Trust has no input on this research.

Who has reviewed this study?

This study has received ethics approval from a subcommittee of the University of Oxford Central University Research Ethics Committee. (Ethics reference: R84575/RE001**)**.

Who do I contact if I have a concern about the research or I wish to complain?

If you have a concern about any aspect of this study, please contact Dr Amy Booth (amy.booth@phc.ox.ac.uk or +44 1865 289300) or Professor Sara Shaw (sara.shaw@phc.ox.ac.uk), and we will do our best to answer your query. We will acknowledge your concern within 10 working days and give you an indication of how it will be dealt with. If you remain unhappy or wish to make a formal complaint, please contact the Chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter as soon as possible:

The Chair, Medical Sciences Interdivisional Research Ethics Committee; Email: ethics@medsci.ox.ac.uk; Address: Research Services, University of Oxford, Boundary Brook House, Churchill Drive, Headington, Oxford OX3 7GB

Further Information and Contact Details

If you would like to discuss the research with someone beforehand (or if you have questions afterwards), please contact:

Amy Booth
Nuffield Department of Primary Care Health Sciences
OX2 6GG
01865 289300
amy.booth@phc.ox.ac.uk

Sample interview and documentary extracts

Interview extract 1, reflecting normative and economic discourses, commentary on patient care pathway quantification, and collaborative initiatives

It strikes me that if that [carbon footprint] report was published in 2009 and it's 2023, what is stopping the industry from acting on their climate impact?

R: There is way too much money. It's a bit like the tobacco industry. There is way too much investment in the way that pharmaceuticals make money is not ethical in reality I don't think. And although a lot of them try to position themselves as health organisations, they really, they are still medicine organisations. I think if they were truly orientated towards health, deep down, culturally, it would look a bit different. Having said that, it's a huge tank to shift.

I: Absolutely is. Not just the pharmaceutical industry, just globally. Lots of things that we need to shift. You said that there needs to be this conceptual shift, have you seen it at all in the last decade or so?

R: I do think one that the likes of, well, the Sustainable Market's Initiative they, you know, the Sustainable Healthcare Coalition, they are paying into a mechanism to try and contribute case studies, different ways of looking at it. We did acknowledge that it wasn't just important to talk about the product, but we developed care pathway, ways of calculating emissions so that you would start shifting. I do believe, actually, we need to start transforming health care by looking at care pathways and not just looking at buildings, transport and products and just shifting the way we look at it because it would make for a more real conversation. But that's going to take a long time because of the way the finances are structured.

Interview extract 2, reflecting technocratic discourse and tensions in collaborations

Interesting. I want to return to some of the challenges that you are having and some of the tensions between these different stakeholder groups. I wonder if you can chat a little bit about that.

R: I touched on one of them and so there is this debate, once the environmental impact is measurable and comparable, about how is the data used. There is I think some push back from the manufacturers to say, we are doing this to improve the planet and not necessarily to influence how patients are treated. Also, really specifically within pharma organisations because they see their individual medicines as completely unique. There is no comparable alternative in their minds because of the specific efficacy levels and how it's really focused on specific illnesses or treatment plans. I would say there is a debate over the care pathway link. The NHS, not NHS, the health systems are saying whoa, whoa, that's our job. Don't step over your boundaries. That is our job to decide what and how we use the information. We are ultimately responsible for the delivery of care of the patients with the input from yourselves, but that's our job. And the manufacturers are saying, yeah, but environment shouldn't be a way that you decide how to treat or care for patients. There is that debate, I would say. There are also some tensions around, I mean, one of the major drivers for this is transparency. There is a huge amount of or a huge lack of transparency. And from both parties, the health systems and how they are designing the expectations for manufacturers and kind of going in a black box and then launching it for and then also manufacturers and how they are calculating and gathering data and the depths of the data or the accuracy of the data. And so, I think there are a huge amount of transparency issues that are happening. And as a result of that there is kind of a fight for control, I would say that is happening.

Six areas of action to impact climate, nature and health

We want health to be at the centre of action on climate change and nature loss.

Fundamentally, the world is facing a set of important challenges – from air pollution to forest loss to declining wellbeing. And these challenges are interrelated. For instance, the economy creates carbon emissions, this creates air pollution, air pollution then negatively impacts human health.

It is a complex picture. So, we have looked closely at a series of interlinked challenges and identified opportunities to make an impact that really matters. The answers aren't easy, nor are the actions that businesses, including GSK, need to take, but there is no time to waste.

We have identified six key areas of action where business can start making a big difference right away, helping to mitigate climate change and nature loss and, crucially, protecting human health.

The six areas of action are:

- Air pollution
- Water security
- Forest protection
- Healthcare resilience
- Disease burden
- Wellbeing

At GSK there are ways we can help, both through reducing our own impact and by acting on the consequences with medicines and vaccines that alleviate the burden of changing disease.

In each area, we are working alongside leading organisations that are setting out to make a positive impact.

"Global heating is directly impacting on all our health today. It strains those at the forefront of healthcare – impacting systems already under immense pressure. From floods and fires to new science, it's time we recognise climate change, biodiversity loss, and global health are interconnected. Only by doing so can we mitigate the full impact these crises bring."

Sir Jeremy Farrar OBE
Director of the Wellcome Trust

Documentary extract from GSK Putting Health at the Centre of Action on Climate and Nature [198][pg4], illustrating planetary health discourse

CO_2 emissions from company cars
CO_2 emissions from company cars cover cars leased or owned by Novo Nordisk. Emissions are calculated by multiplying emission factors by the volumes of diesel and petrol used.

Scope 1 and 2 emissions
Scope 1 emissions comprise direct CO_2 emissions from sources that are owned or controlled by Novo Nordisk A/S.
Scope 2 emissions comprise CO_2 emissions from purchased or acquired electricity, heat and steam.
For a full overview of location-based emissions, please visit cdp.net.

Scope 3 emissions
Novo Nordisk has identified nine relevant categories, out of the 15 categories of Scope 3 emissions as defined by the GHG protocol.

Purchased goods and services
Purchased goods and services includes emissions related to all spend from external suppliers except for investment spend and travel categories. Purchased goods and services contribute to the greatest share of Scope 3 emissions and mainly comprise of raw materials for products, marketing, packaging materials as well as consumables for laboratory and IT office equipment.

Direct spend is converted using the average data method into CO_2e emissions. Material weights are matched with CO_2e factors depending on data availability. A spend-based factor is applied for direct spend data where no weight can be obtained. Indirect spend is converted into CO_2e using a spend-based method.

Capital goods
Capital goods includes emissions related to all indirect investment spend from external suppliers, specifically production utilities and equipment. Indirect spend is converted via the average spend-based method into CO_2e emissions using emission factors.

Fuel and energy related activities not included in Scope 1 and 2
Fuel and energy related activities includes all upstream CO_2e emissions of purchased fuels and energy (beyond Scope 1 and 2 emissions). Energy consumption is converted from GJ to kWh and multiplied by DEFRA's country-specific emissions' factors to assess CO_2e tonnes. The category comprises upstream emissions from electricity, steam and heat, upstream emissions from transportation and distribution of electricity, steam and heat and emissions from upstream fuel.

Upstream transportation and distribution
Upstream transportation and distribution includes CO_2e emissions from product distribution and transportation from tier 1 suppliers to Novo Nordisk facilities.

CO_2e emissions from product distribution are calculated by an external supplier managing the transportation and distribution processes on behalf of Novo Nordisk and using the industry standard EcoTransit solution. CO_2e emissions are calculated based on the worldwide distribution of semi-finished and finished products, raw materials and components by air, sea and road between production sites and from production sites to subsidiaries, direct customers and importing distributors. CO_2e emissions from product distribution from subsidiaries to pharmacies, hospitals and wholesalers are not included. Due to the lack of reliable emissions data from specific freight forwarders, an estimated 3% of trucking emissions are not included in the Scope.

CO_2e emissions from tier 1 suppliers to Novo Nordisk facilities are calculated based on the assumption that all purchased direct materials are transported 1,000 km by a diesel truck.

Waste generated in operations
Waste generated in own operations includes CO_2e emissions associated with third-party disposal and treatment of waste generated from production sites, offices and labs. Currently, waste data is available for production sites and offices as well as labs within Denmark. Waste data is not available for offices and labs outside of Denmark, for which CO_2e emissions are therefore extrapolated using waste-type-specific method.

Business travel
Business travel includes CO_2 emissions from business flights and other travel, such as hotel stays and taxis.

CO_2 emissions from business flights are estimated based on mileage and passenger class details obtained from travel agencies. These are multiplied by emission factors for short-, medium- and long-haul flights. EPA emission factors are used to perform the calculations. Currently, 90% of emissions from flights are calculated based on data provided by travel agencies and the remaining 10% are extrapolated based on the average CO_2 emissions per employee. CO_2 emissions from other travel-related activities are calculated using a spend-based approach.

Employee commuting
Employee commuting includes CO_2e emissions associated with commuting by all employees except those with company cars, since these emissions are reported as Scope 1 emissions. CO_2e emissions are estimated using the average data method and based on assumptions for the top six countries (Denmark, USA, India, China, France and Brazil) in terms of number of employees, which account for 85% of the employee base. Average distance and mode of transportation are used to calculate the CO_2e emissions for the remaining 15% of employees.

Downstream transportation and distribution
Downstream transportation and distribution includes CO_2e emissions that occur from transportation and distribution of sold products in vehicles and facilities not owned or controlled by Novo Nordisk. Only transportation emissions are included in the calculations, specifically from the first receiving warehouse to pharmacies, hospitals and wholesalers. A simulation-based approach is applied to calculate downstream emissions, using a distance-based method by simulating route networks for four countries (Denmark, UK, Switzerland and Brazil). Transportation work (tonne-km) and CO_2e emissions are estimated by calculating the distance travelled for the weight of distributed products and cool boxes. Moreover, the modelled route networks provide the basis for simulating US and China transportation and distribution. Transportation work per net kg product from the six reference countries (Denmark, UK, Switzerland, Brazil, China and US) is extrapolated to the remaining countries. Emissions per country are calculated based on i) the weight of sold products, ii) reference country transportation work and iii) the emission factor for the region and mode of transportation.

End-of-life treatment of sold products
End-of-life treatment of sold products includes CO_2e from end-of-life treatment of all products sold to the market, including packaging. The amount of sold products is calculated from the realised sales data for specific devices and markets. It is assumed that devices are discarded in the markets where they are sold and that the end-of-life treatment follows the general treatment of the household waste for each market. Scenarios have been developed for end-of-life treatment for various Novo Nordisk products (FlexPen®, FlexTouch®, NovoFine® needle etc.). The scenarios cover the US, EU and Japan. The remaining CO_2e emissions from other products are extrapolated by unit sales based on average end-of-life emissions from the products.

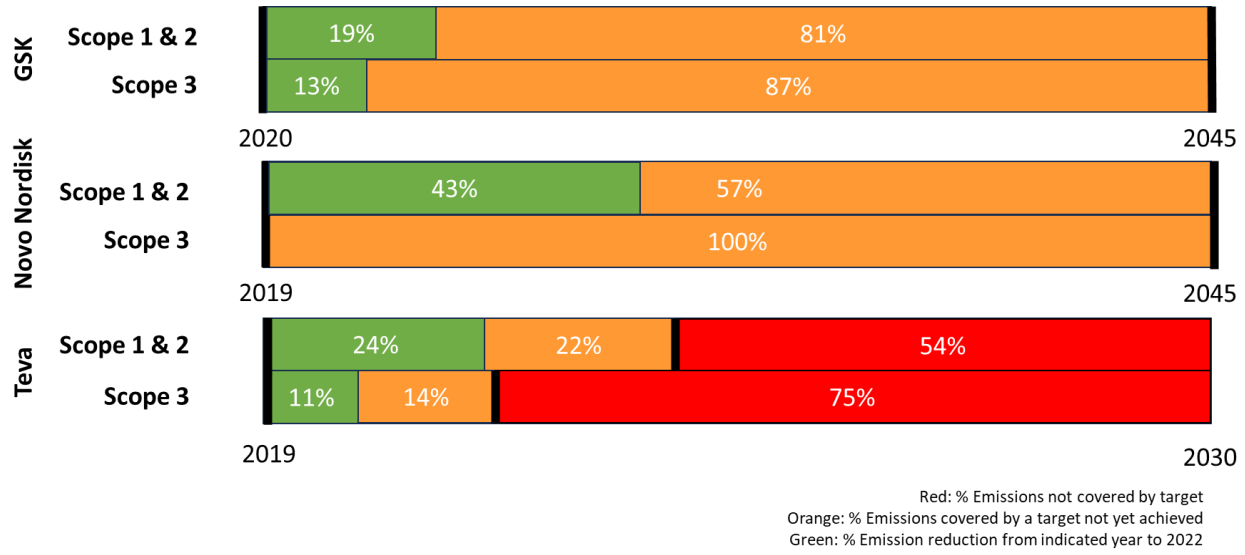
Documentary extract from Novo Nordisk Annual Report [199][pg92], illustrating the methodological choices underpinning emission quantification

Decarbonization and Energy Cost Savings

One way we realize our sustainable commitments is through increasing energy efficiency and lowering operational costs. Our Sustainability Taskforce drives energy efficiency and decarbonization projects across our global network of facilities, resulting in GHG emissions and operating cost reductions. In 2022, our Sustainability Taskforce launched the Energy Champions community, which nominates employees to manage energy consumption and lead decarbonization efforts at their sites. A training roadmap and knowledge-sharing portal help champions oversee sustainability efforts. As a result of the Sustainability Taskforce, approximately 100 projects were executed in 2022, resulting in $3.6 million in savings through energy consumption reductions, exceeding the Taskforce's target. Other Taskforce activities included mapping 23 renewable energy initiatives, establishing and exploring partnerships with energy service companies (ESCOs) to reduce consumption and GHG emissions (in some cases by more than 10%) at sites in Czech Republic, Hungary, India, Israel, Italy and the US and joining Schneider Electric's Energize program as a sponsor (see more in the Sustainable Procurement section).

Documentary extract from Teva's 2022 Environmental, Social and Governance Progress Report [201][pg17], illustrating economic discourse underpinning climate action

Appendix figure and table



Appendix Figure 1. Percentage of pharmaceutical company emissions covered by a climate target and progress on reaching the climate target as of 2022 (developed from companies reported emissions reductions plotted against their published targets)

Appendix Table 1. Reported emissions reduction strategies of GSK, Novo Nordisk, and Teva for 2022; data collated from all included company documents on climate change (refer to Table 5 for full list of included company documents)

	GSK Pathway to Net Zero	**Novo Nordisk** Circular for Zero	**Teva Pharmaceuticals** Sustainability is everyone's business
		Scope 1 & 2	
Renewable energy	-Member of RE100[14] committed to sourcing 100% of energy renewably by 2025 -Sourced 73% renewable energy -On-site generation from wind turbines and solar panels (e.g., site in Scotland used 85% onsite renewables and biogas) -Off-site power purchase agreements and certificates -Industry collaboration to investigate new clean technologies to replace natural gas	-Member of RE100 initiative -Sourced 100% renewable energy across global production since 2020 (includes on-site renewable solutions e.g., solar, wind, or biogas from own yeast slurry, as well as Renewable Electricity Certificates and Power Purchase Agreements) -Aim to shift production sites primarily towards biogas	-Currently purchased 41% of electricity from renewable sources (e.g., Chile site uses 100% renewable energy; German site in Ulm produces renewable energy via solar panels; Croatian site currently constructing 60,000 square metres of solar panels which will provide 28% of the sites total electricity needs) -Exploring alternative approaches and partnerships for renewable energy procurement in North America and Europe (e.g., mapping 23 renewable energy initiatives)
Energy optimisation	-On-site analysis to identify opportunities to drive efficiencies (e.g., upgraded lighting, replacing chillers)	-Implementation of energy efficiency programmes (in 2022, these programmes saved 63,000 gigajoules of energy) -Production of Active Pharmaceutical Ingredients in Kalundborg, Denmark, certified with ISO 50001[15] energy management -All production facilities certified according to ISO 14001[10] environmental management	-Development of the Energy Champions initiative where each facility has a nominated individual whose role and responsibility are to manage energy consumption and lead decarbonisation efforts (e.g., in Czech Republic they introduced site goals for energy reduction from using residual low-potential heat, optimising electricity consumption and saved 600,000kWh of electricity) -Globally coordinated energy inspections, audits, and surveys to identify and evaluate

[14] RE100 is a global corporate renewable energy initiative bringing together large companies committed to 100% renewable energy.
[15] International Organisation for Standardisation (ISO) 50001 provides standard on energy performance; ISO 14001 relates to environmental management.

			energy and emissions reduction opportunities (e.g., in the USA, they introduced an Energy Treasure Hunt programme where teams search facilities for quick methods to save energy such as replacing lightbulbs) -Provision of capital investment for energy reduction and decarbonisation projects (e.g., in 2022, implemented 100 individual energy projects at a cost of $1.5 million, with savings of $3.6 million; in the Netherlands, they installed an efficient hot-water tank and dry-cooling water chiller which consumed 1.5% less electricity and 30% less gas) -Engage in green chemistry principles to optimise energy efficiency (e.g., in Ireland, they run a My Green Lab programme where they conduct baseline assessments on energy, water, waste, chemistry, materials and engagement, and then have a team to implement changes to reduce these) -Nine manufacturing sites are certified with ISO 14001 or EMAS
Owned vehicles	-Member of EV100[16] -Transition sales fleet to low-carbon vehicles by 2030 -Install charging infrastructure at 100 sites	-Transition to 100% electric company cars by 2030 (currently 50% of vehicles in Denmark sites use electrical or plug-in technology)	-Introduction of low-carbon truck fleets and electric vehicles (e.g., in Netherlands, they use fully electric company vehicles; in Germany they use a climate friendly truck fleet that use liquefied natural gas-fuel and drivers undergo eco-driver training resulting

[16] EV100 is a global corporate renewable energy initiative bringing together large companies committed to 100% electric vehicles.

			in increased fuel efficiency and 30-35% reduction in emissions,)
		Scope 3	
Suppliers	-Launched Sustainable Procurement Programme in 2022 (suppliers required to disclose emissions, to set carbon reduction targets aligned with 1.5°C, and to act on carbon, power, heat, transport, water, waste, sustainable deforestation-free sourcing of materials) -Support suppliers with education -Include sustainability criteria in tender questions, contractual provisions and performance metrics -Member of Manufacture2030 Activate Programme (helps API suppliers to gain access to green funding and practical support with emissions reduction) -Member of ENERGIZE programme (supports suppliers to use renewable energy, currently have 9 suppliers on the programme) -Member of Sustainable Markets Initiative Health Systems Task Force	-Work with suppliers to embed circular thinking across value chain -Switch to circular sourcing and procurement -Work with suppliers to use renewable energy (expect >60,000 direct suppliers to source 100% renewable energy by 2030; currently 500 key suppliers have committed to source renewable energy resulting in savings of 30,000 tonnes CO_2e since 2019) -Member of ENERGIZE programme -Member of Sustainable Markets Initiative Health Systems Task Force	-Initiated environmental assessments for more than 3,500 suppliers through the EcoVadis platform (currently 56% of their 522 critical suppliers have been assessed by EcoVadis, 74% of assessed suppliers have action on energy consumption and GHG emissions; 16% of their 840 critical or top suppliers have committed to or had their environmental targets verified by SBTi; companies that have a low score receive a request for improvement) -Incorporate ESG Criteria into their vendor selection process (e.g., ESG criteria weighted at least 5%) and all contracts include reference to Teva's position on the environment and a responsible supply chain -Conduct supplier engagement programmes which encourage suppliers to conserve natural resources, avoid using hazardous materials, reduce, reuse, and recycle (e.g., held first ESG supplier capability webinar; published a Sustainable Procurement ESG toolkit) -Sponsor of the ENERGIZE programme
Product eco-design	-Engaged in pre-clinical trials to find an alternative greener propellant for metred-dose inhalers (MDIs), specifically Ventolin, which if successful could reduce impact by at least 90%	-Re-design existing and future products to reduce impact across life cycle -Reducing plastic designed from fossil fuels (e.g., by harnessing waste carbon and hydrogen from energy supply processes)	-Research and development of 'low-carbon inhaler' -Certification of their MDI products with the Carbon Trust -Respiratory care educational series on the global warming impact of inhalers

	-Certified their dry powder inhaler as carbon neutral with the Carbon Trust (remaining emissions from certified inhalers are offset with a reforestation programme in Ghana, equivalent of 1,657 tonnes CO_2e in 2022) -Have a product stewardship programme to embed eco-design principles for all new products -Engage in green chemistry principles by using enzymes that make production 1000 times more efficient	-Four countries they supply to have launched take-back initiatives for insulin pen devices	-Conducting lifecycle assessments on their key products to evaluate the upstream and downstream impact -Reduce product packaging through reducing the weight of packaging and increasing the recycled content (reduces upstream carbon emissions from resource extraction; lowers downstream emissions from less weight per unit of transportation of product and less waste generated by users) -Implementing take-back schemes in the Netherlands for patients to drop off unused medicines at pharmacies
Transport and distribution	-Transitioning from transporting products from airfreight to sea freight where possible -Ensure full container optimisation when transporting products -Engaging in sector peer collaboration to identify common logistic routes and to pilot 'green corridors' for distribution	-Use digital platforms for virtual collaboration where possible to reduce business travel emissions -Entered into agreement with Danish shipping company, Maersk, to transport all products using sustainable biofuels -Entered partnership with SKYNRG (a start-up exploring sustainable aviation fuels) and Kuehne & Nagel with the aim to reduce emissions from product distribution by air freight	-Green Distribution Project which explores sustainable logistics practices (e.g., optimise load, route, and freight mode)
Carbon offsets	-Use carbon offsets for 20% of residual emissions by 2030 and 10% by 2045 -For the 2030 target, they prioritise carbon removal credits through nature investments with subset of carbon avoidance and reductions credits	-Do not use	-Not mentioned

	-For the 2045 target, they aim to only secure carbon removal credits -Member of LEAF Coalition (a public-private initiative designed to halt and reverse tropical deforestation by 2030 and accelerate climate action by mobilising $1 billion for countries wanting to protect their forests) -Carbon offsetting strategy is guided by the Voluntary Carbon Market Integrity Initiative which is working to establish a globally standardised benchmark to guide the use of carbon credits		

Academic output during DPhil

Publications

Booth, A., Breen, L., Wieringa, S., Shaw, S. Planetary health leadership to drive climate action across pharmaceutical supply chains: insights from qualitative research and a call to action. BMJ Leader. http://dx.doi.org/10.1136/leader-2025-001253

Piet, J. **Booth, A.,** Donker, E.M., de Ponti, F., Lunghi, C., et.al. Environmentally sustainable prescribing: recommendations for EU pharmaceutical legislation. The Lancet Planetary Health. 2024. DOI: 10.1016/S2542-5196(24)00230-4

Booth, A., Shaw, S.E. Addressing the Environmental Impact of Pharmaceuticals: A Call to Action. British Journal of Hospital Medicine 2025 86:1, 1-8

Booth, A.; Jager, A.; Faulkner, S.D.; Winchester, C.C.; Shaw, S.E. Pharmaceutical Company Targets and Strategies to Address Climate Change: Content Analysis of Public Reports from 20 Pharmaceutical Companies. Int. J. Environ. Res. Public Health **2023**, 20, 3206.

Booth, A. Carbon footprint modelling of national health systems: Opportunities, challenges and recommendations. The International Journal of Health Planning and Management. 2022; 1-9.

Booth, A., Wester, A. A Multivariate analysis of the contribution of socioeconomic and environmental factors to blood culture E. coli resistant to fluoroquinolones in high-and middle-income countries. BMC Public Health. 2022.

Booth, A., Wester, A., Aga, D. Retrospective analysis of the global antibiotic residues that exceed the predicted no effect concentration for antimicrobial resistance in various environmental matrices. Environmental International. 2020. 141;105796.

Pickard Strange M, **Booth A**, Akiki M, Wieringa S, Shaw SE. The Role of Virtual Consulting in Developing Environmentally Sustainable Health Care: Systematic Literature Review. J Med Internet Res 2023;25:e44823. doi: 10.2196/44823

Booth, A., Omed R.A., Naidoo, M. Analysis of a SARS-CoV-2 daily screening programme for healthcare workers at a district hospital in KwaZulu-Natal, a quality improvement initiative. African Journal of Primary Health Care Family Medicine. 2020. 12(1).

Booth, A., Burger, S., Scott. A., Thomson, D. The International Association of Student Surgical Societies: A brief history from 2014-2017. South African Journal of Surgery. 2017.

Krige JEJ, Jonas E, Beningfield SJ, **Booth A**, Kotze UK, Bernon M, Burmeister S. Resection of benign liver tumours: an analysis of 62 consecutive cases treated in an academic referral centre. S Afr J Surg. 2017 Sep;55(3):27-34. PMID: 28876562.

Booth, A. Identifying host candidate genes to use as drug targets against tuberculosis. UCT Open Access Research Page. 2015.

Veen, M. **Booth, A**., Jacobse, S. Varpio, L. Our Diffusion of Innovation Problem: The Climate Crisis. International Clinical Educators. 2023.

Booth, A. Is green social prescribing the future of health? The Oxford Scientist. 2022.

Pending publications:

Booth, A., Chowaniec, M., Goyal, S., Faulkner, S.D., Shaw, S.E. The carbon footprints of single-use and reusable medical devices: A systematic review. BMJ Open (pending review)

Book chapter. Making sense of Personal Protective Equipment: An autoethnographic exploration of intervention, context, and health care change. In Healthcare Innovation, Implementation and Change - A Sensemaking Perspective

Co-authoring a forthcoming book on sustainable health care published by Taylor & Francis.

Conference presentations

28 March 2025 — Panellist, Climate Working Group Session, Royal College of Paediatrics and Child Health Annual Conference, University of Glasgow.

26 November 2024 — Presenter, Climate and Sustainability Showcase, House of Commons, Westminster, British Parliament.

14 September 2024 — Invited Speaker, European Society for Medical Oncology Conference, Barcelona.

22 May 2024 — Keynote Speaker, One Health Lecture Seminar, University of Edinburgh.

14 February 2024 — Guest Interviewee, BBC Focus on Africa, Spotify.

18 September 2023 — Plenary Speaker, 25th Annual Conference of Family Physicians, Johannesburg, South Africa.

8 June 2023 — Panellist, Sustainable Pharmaceutical Procurement Session, Climate Action Accelerator, online.

25 May 2023 — Panellist, The Sustainable Clinician Think Tank, The Future of Medicine, UK.

24 April 2023 — Podcast Guest, Episode 53: Reducing Greenhouse Gas Emissions in Healthcare, The Sustainable Healthcare Podcast, Spotify.

18 April 2023 — Panellist, Sustainable Medicines Optimisation Session, Health Services Research and Pharmacy Practice Conference, Bradford, UK.

5 November 2022 — Keynote Speaker, Environmental Seminar Series, European Medical Writers Association, Riga, Latvia.

4–5 October 2022 — Presenter, Berlin University Alliance 7th Student Conference, Berlin, Germany (Abstract selected with university scholarship).

29 June–1 July 2022 — Presenter, World Organisation of Family Doctors Conference: Innovating Family Medicines for a Sustainable Future, London, UK.

20 June 2022 — Delegate, Climate Risk and Resilience Forum, Said Business School, Oxford, UK (contributing to COP27 guidelines).

9–11 May 2022 — Plenary Speaker, International Society of Medical Publication Professionals Conference, Washington DC, USA.

5 May 2022 — Presenter, Health Systems and Net Zero Targets Seminar, Net Zero Tracker, Oxford, UK.

24 March 2022 — Invited Speaker, First, Do No Harm – To Patients and the Planet, University of Kwa-Zulu Natal, South Africa.

Teaching

Throughout my doctoral studies and professional roles, I have gained extensive teaching experience at the Universities of Cape Town, Kwa-Zulu Natal, and Oxford. I co-designed and currently co-lead the Sustainable Health Care module for the MSc in Translational Health Sciences, and support teaching on climate science, ESG, and sustainable transitions for the MSc in Sustainability, Enterprise, and the Environment. I regularly deliver lectures and workshops for mid-career researchers and professionals, focusing on sustainability and health care.

I have designed and delivered lectures on the following topics:

1. Sustainability and sustainable health care
2. History of climate change: the global North and South
3. What is carbon footprinting and why use it in health care?
4. Globalisation, localisation, and pharmaceutical supply chains
5. Sustainable leadership
6. Climate change and global health
7. Communicating and teaching sustainability

In addition, I have provided teaching support, hosting discussion groups on the following topics:

1. Physics of climate change
2. Natural capital, markets and society
3. Sustainable enterprise
4. Socio-technical interventions and sustainable law
5. Water, inequalities, and social enterprise
6. Qualitative methods and theory