Advocating for planetary health and environmentally conscious practice– the evolving role of pharmacy

13th May 2026

Stephen James Walsh, Aisling O'Leary, Matthew Lynch

Overview of session

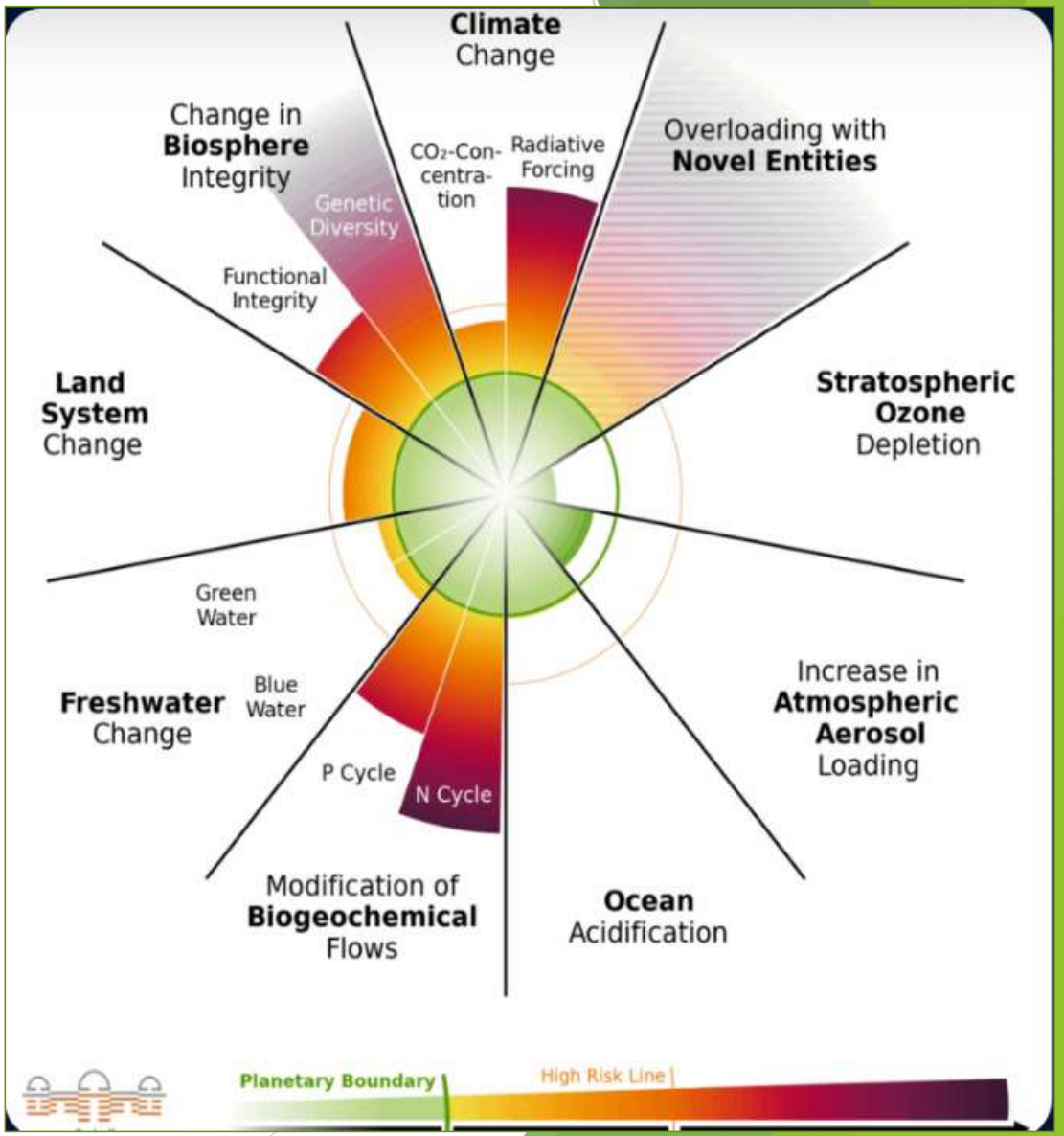
- Introduction
- Findings from recent research
- Results of a waste medicines audit in community pharmacy
- Summary

Planetary Health Boundaries Framework

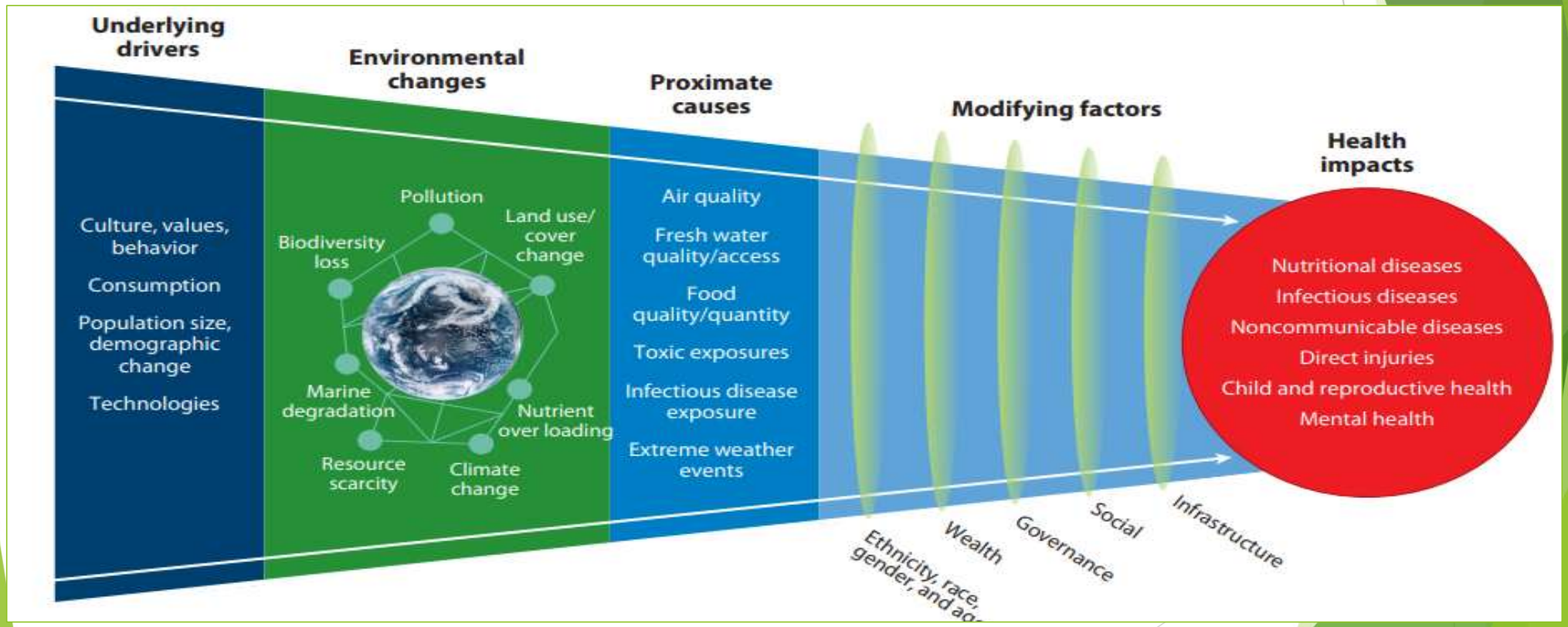
- Anthropogenic activities have perturbed earth system boundaries

- Planetary Health report 2025
- Seven boundaries now breached

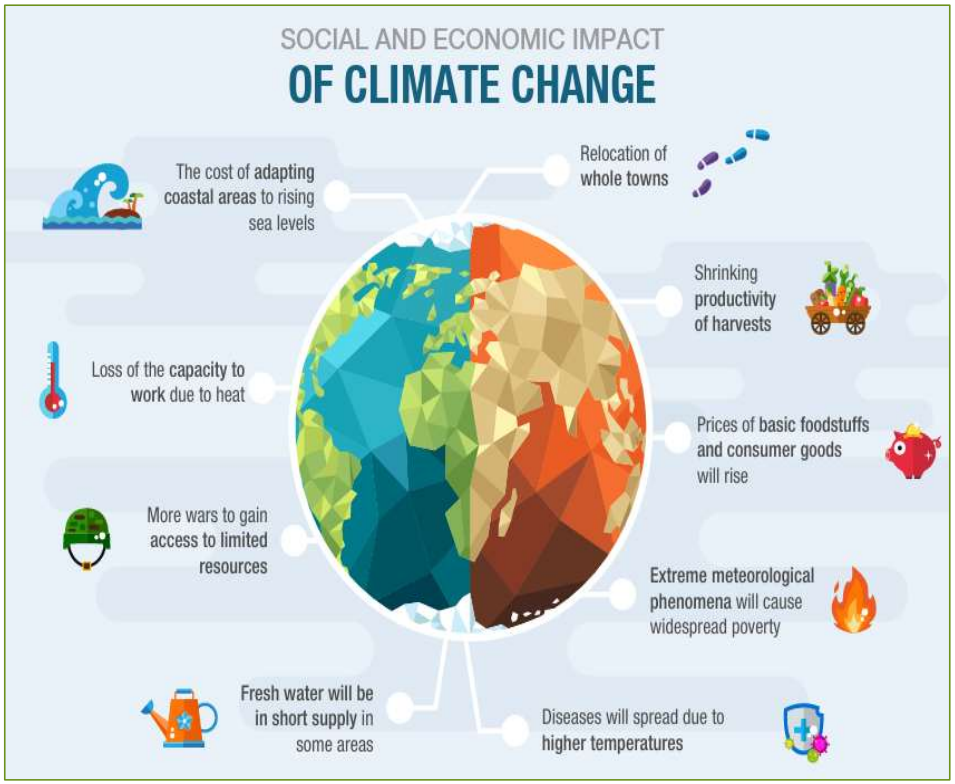
https://www.planetaryhealthcheck.org/wp-content/uploads/PlanetaryHealthCheck2025_ExecutiveSummary.pdf



Planetary health & human health are inextricably linked



https://dx.doi.org/10.1016/S0140-6736(17)32846-5
Guzman et al https://doi.org/10.1146/annurev-environ-111523-102309



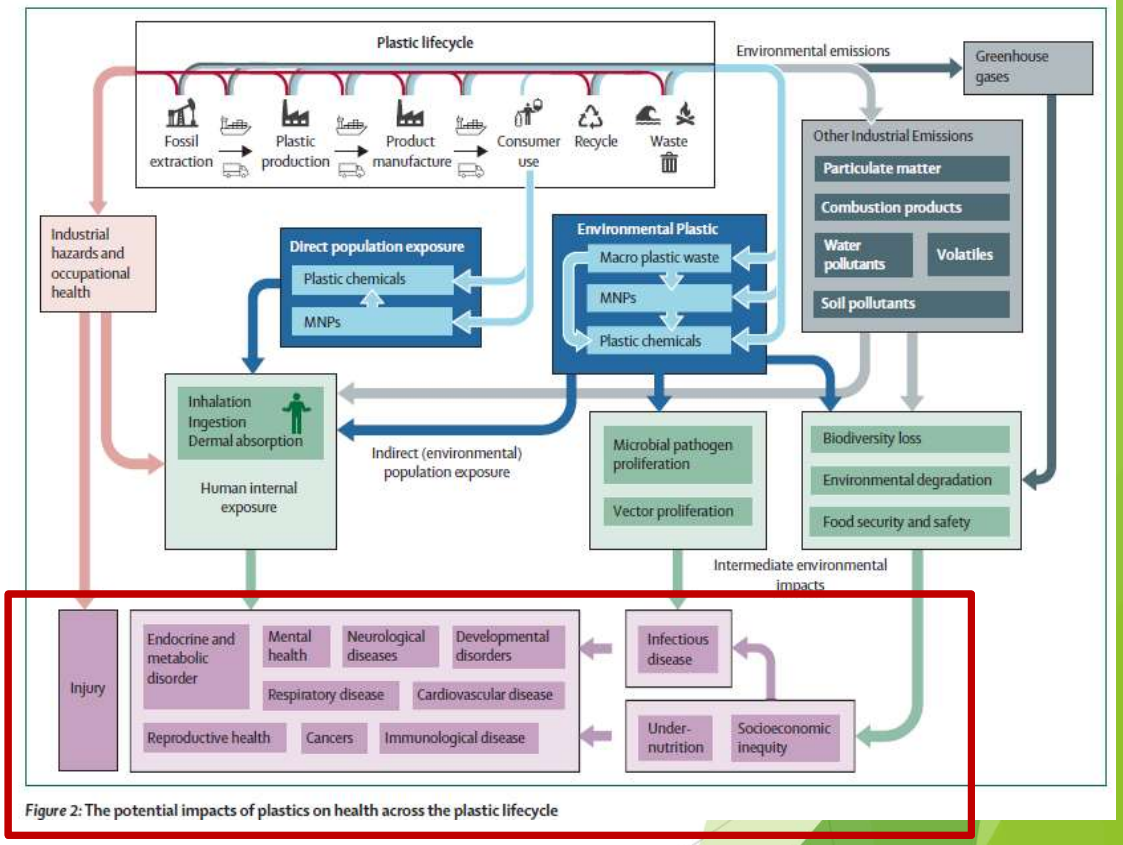
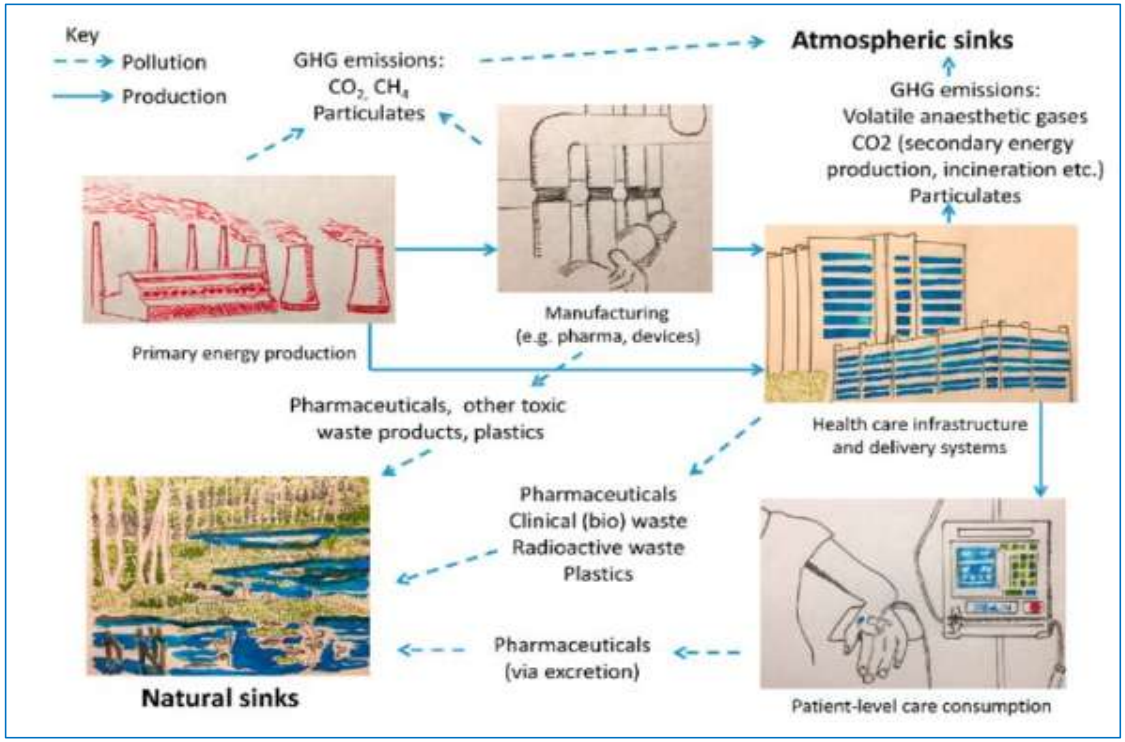


Figure 2: The potential impacts of plastics on health across the plastic lifecycle

The most vulnerable in the world most impacted – climate inequalities

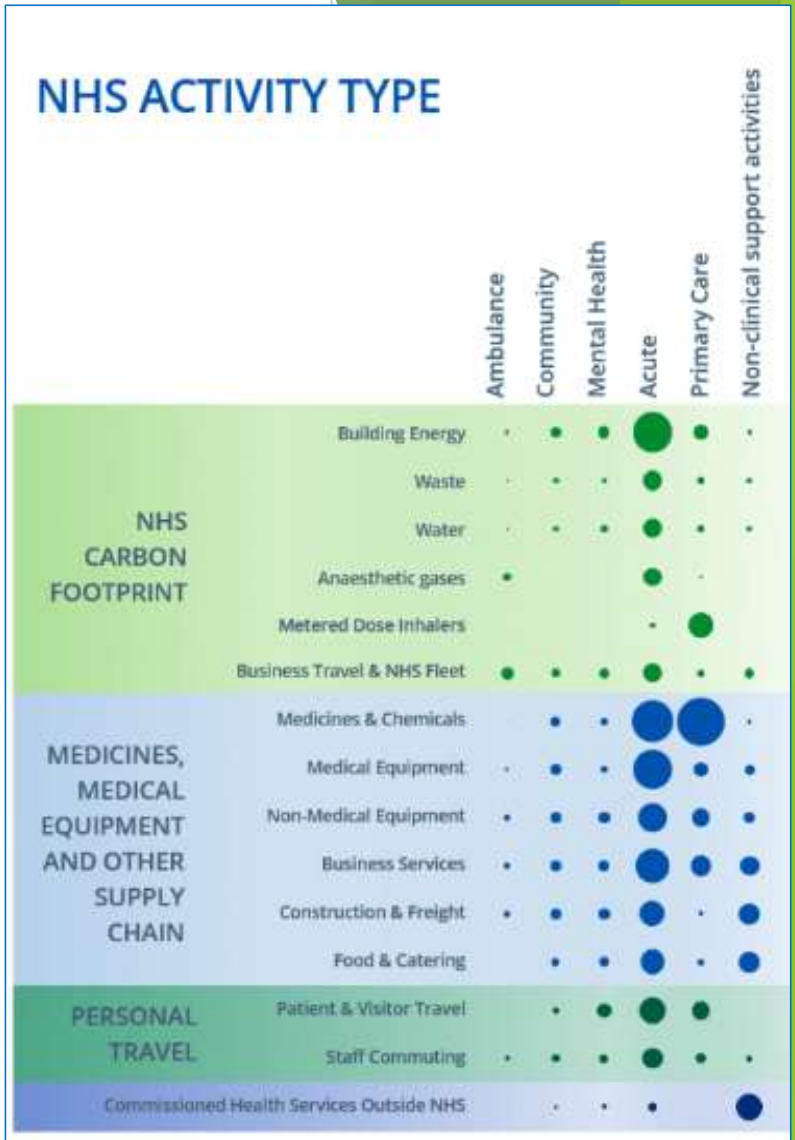
Hess NEJM 2025 https://10.1056/NEJMicm2413012
Landrigan et al 2025 https://doi.org/10.1016/S0140-6736(25)01447-3

Contribution of healthcare



Weight loss drug waste: what happens to the Ozempic pens?

Pharmaceutical companies facing increasing demand for GLP-1 agonist receptors are struggling to minimise their impact on the environment. **Mahima Adey** reports



Henshar et al 2020 https://doi.org/10.1016/j.socscimed.2020.113420
Asey A 2026 http://doi.org/10.1136/bmj.r2495
https://www.england.nhs.uk/wp-content/uploads/2025/09/item-9i-five-years-of-a-greener-nhs.pdf

What needs to be done?

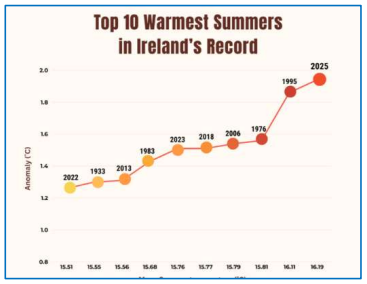
Mitigation strategies

- Actions or changes to reduce impacts on planetary health & prevent further transgressions of planetary boundaries

Adaptation strategies

- Actions to reduce or compensate for or adapt to the adverse impacts arising from planetary boundary transgressions

Case scenario
Heat-sensitive illness



Heat	Risk to human health (physical and mental health) due to extreme heat	Health				
	Risk to human health due to increases in average temperature (e.g., increased aeroallergen levels, higher rates of skin cancer, and decreased indoor air quality)	Health				

- Sean is an 82-year-old man living alone in an apartment block in Dublin city centre who has a history of heart failure, type 2 diabetes, and early-stage vascular dementia. In July 2025 when temperatures hit 27^{0}C for several consecutive days, his niece visited him and found him confused, lethargic, and complaining of "dizziness".
- Prescribed medicines
  - Enalapril
  - Metformin
  - Empagliflozin
  - Fluoxetine
  - Bisoprolol
  - Digoxin
- What are the risks for this patient associated with his prescribed medicines in extreme heat episodes and how should pharmacists **adapt** to ensure patient care optimised?
- ….discussion to follow

Advocating for planetary health and environmentally conscious practice - The evolving role of pharmacy

Stephen James Walsh

Dr Aisling O'Leary

Dr Matthew Lynch

RCSI UNIVERSITY OF MEDICINE AND HEALTH SCIENCES

Research focus – sustainable healthcare

Background

- Community pharmacist
- M.Sc. Health Policy
- Keen interest in sustainability

PhD aim & objectives

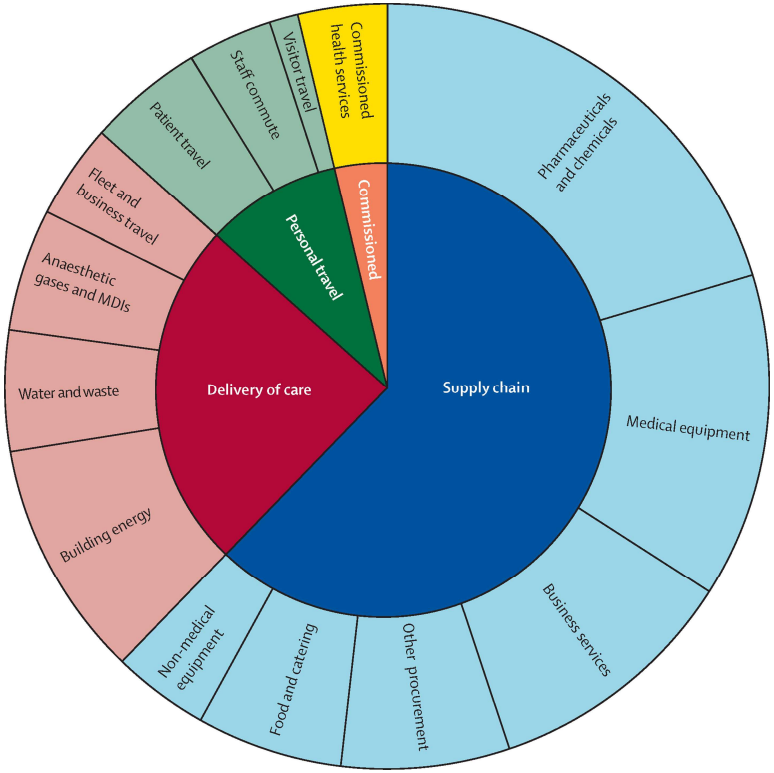
- Develop and translate evidence into practical sustainable actions

This presentation

- ➢ Outline the impact of healthcare
- ➢ Important role of primary care
- ➢ Role of pharmacists

Environmental impact of healthcare

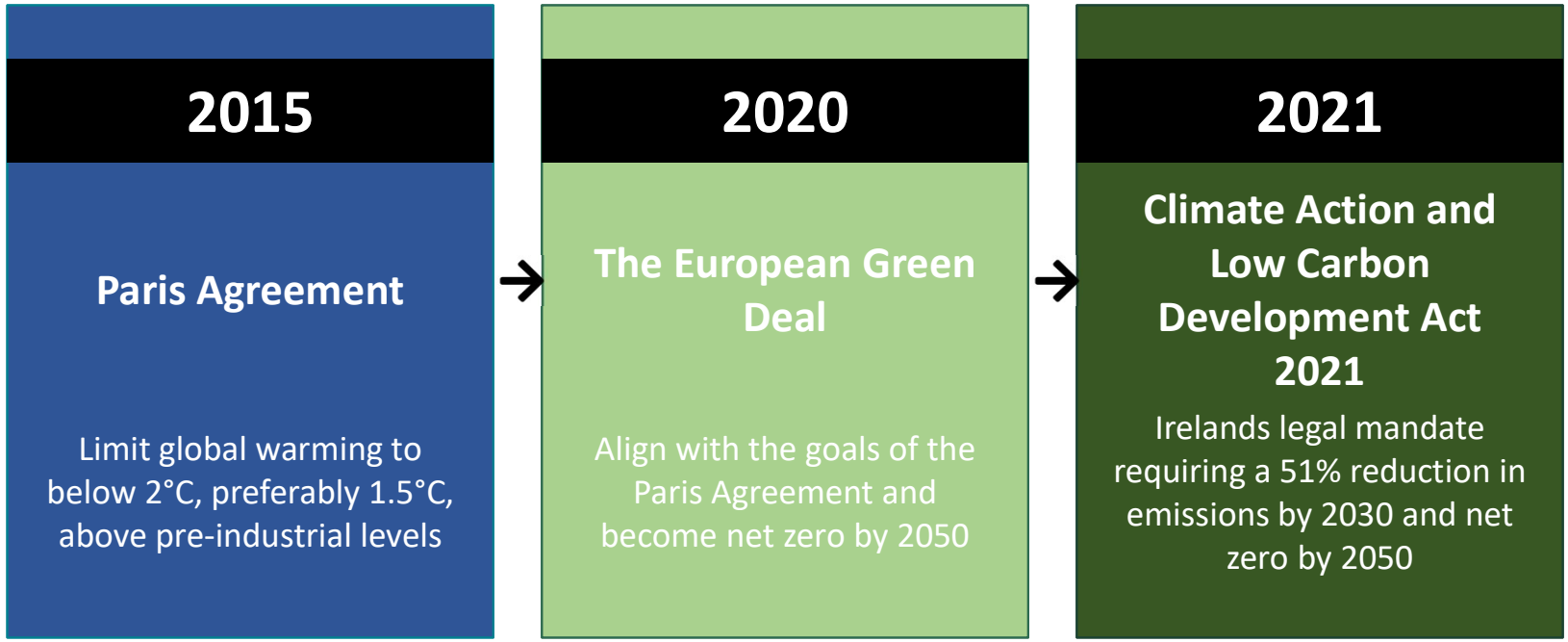
- Healthcare accounts ~5% of global emissions[1]
- Hospitals – energy and resource intensive
- Primary care estimated to account for 25%[1]



Tennison et al. 2021 - Contribution of different sectors to the greenhouse gas emissions of the NHS England, 2019

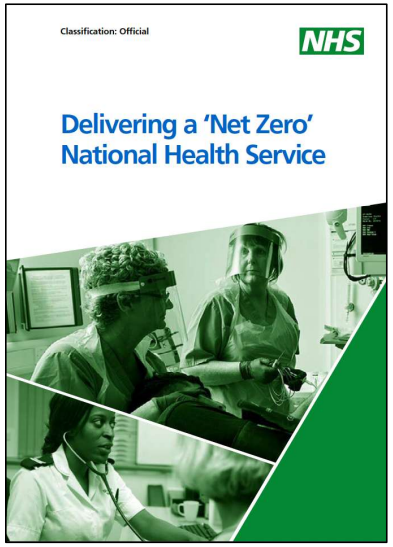
1. Tennison, I., Roschnik, S., Ashby, B., Boyd, R., Hamilton, I., Oreszczyn, T., Owen, A., Romanello, M., Ruyssevelt, P., Sherman, J.D., Smith, A.Z.P., Steele, K., Watts, N., Eckelman, M.J., 2021. Health care's response to climate change: a carbon footprint assessment of the NHS in England. Lancet Planet. Health 5, e84–e92. https://doi.org/10.1016/S2542-5196(20)30271-0

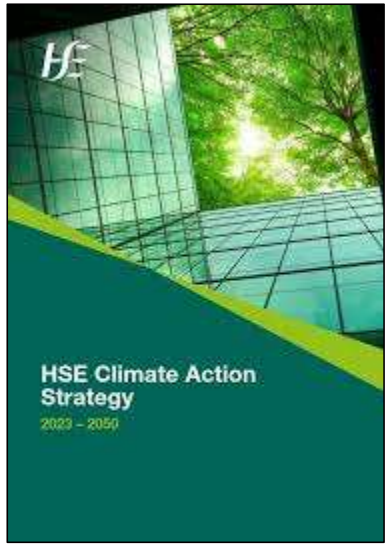
Legal context



Net zero emission healthcare

- 2022 Delivering a ‘Net Zero’ NHS
  - 80% reduction in emissions by 2032
  - Net zero by 2040
  - Net zero supply chain by 2045
  - ➢ https://www.england.nhs.uk/greenernhs/wp-content/uploads/sites/51/2022/07/B1728-delivering-a-net-zero-nhs-july-2022.pdf





- HSE Climate Action Strategy 2023-2050
  - 51% reduction in emissions by 2030
  - Net zero by 2050

Importance of primary care

- WHO estimates ~90% of healthcare needs can be met via primary care[1]

➢Accessible

➢Improved health outcomes

➢Cost effective

25%

of healthcare's total environmental impact comes from primary care

Tennison et al., Lancet Planet Health 2021

1. Rao, M., Pilot, E., 2014. The missing link – the role of primary care in global health. Glob. Health Action 7, 23693. https://doi.org/10.3402/gha.v7.23693

The primary care gap

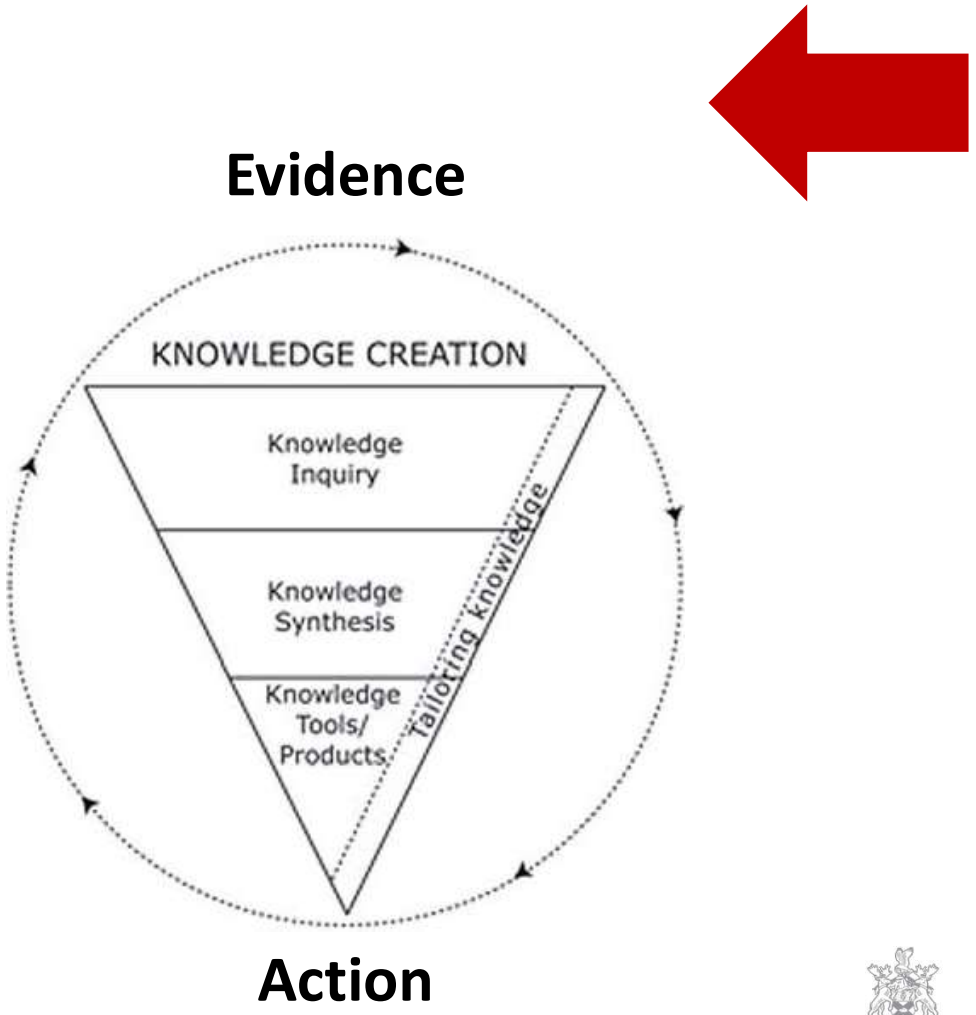
A complex system made up of many different services and providers

[Operation Zero: Health Service Executive (Ireland) Roadmap for Healthcare Decarbonisation Report 2025]

Evidence into action

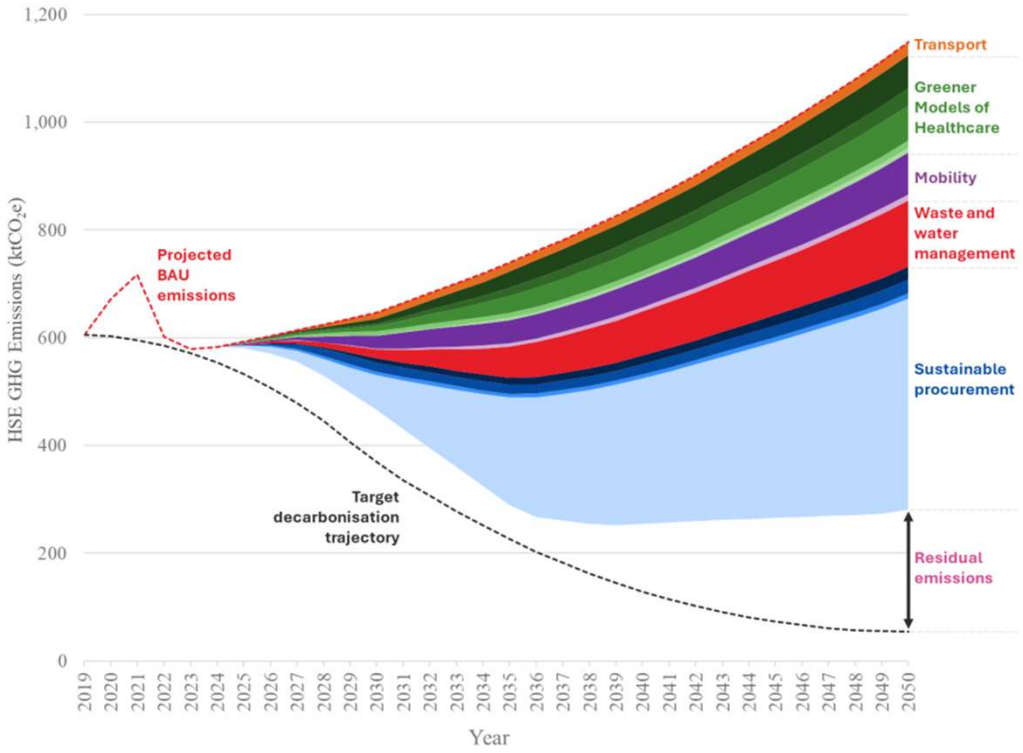
- Tailor evidence and translate it into specific achievable sustainability actions for primary care

Graham, I.D., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W., Robinson, N., 2006. Lost in knowledge translation: Time for a map? Journal of Continuing Education in the Health Professions 26.



Graham et al. 2006 – Knowledge to action process: phase 1 knowledge creation

HSE decarbonisation roadmap



Research focus – sustainable primary care

- PhD timeline – funding for 3 years
- Establish a baseline of what is known about sustainability in primary care
- Focus on the Irish setting
- Identify opportunity for action

Gather existing evidence

Scoping review

- Initial search:
  - 246 published articles
  - 25 reports, toolkits, guidelines & frameworks

- Included in the final review:
  - 39 articles
  - 12 reports, toolkits, guidelines & frameworks

Walsh, S.J., O'Leary, A., Bergin, C., Lee, S., Varley, Á., Lynch, M., 2024. Primary healthcare's carbon footprint and sustainable strategies to mitigate its contribution: a scoping review. BMC Health Serv. Res. 24, 1630. https://doi.org/10.1186/s12913-024-12068-8

Walsh et al. BMC Health Services Research (2024) 24:1630
https://doi.org/10.1186/s12913-024-12068-8

BMC Health Services Research

SYSTEMATIC REVIEW Open Access

Primary healthcare's carbon footprint and sustainable strategies to mitigate its contribution: a scoping review

Stephen James Walsh[1*], Aisling O'Leary[1,2], Colm Bergin[3], Sadhbh Lee[5,4], Áine Varley[6,4] and Matthew Lynch[1]

Abstract

Background The escalating climate crisis poses a significant threat to global public health. The healthcare sector, designed to protect human health is a major contributor to greenhouse gas emissions, and thus, a key driver of climate degradation. This paradox endangers both planetary and human health, making the decarbonization of healthcare, including primary care, critical. However, research on primary care's contribution to emissions and strategies for mitigation remains limited.

Aim This scoping review aimed to map how primary care contributes to healthcare's environmental footprint and determine contributing factors. Additionally, it sought to identify existing and innovative strategies to reduce the carbon footprint of primary healthcare.

Methods A comprehensive strategy was developed to systematically search both published databases and grey literature. Key terms were identified and employed in the exploration of relevant databases and internet search engines.

Results An initial search yielded 246 published articles and 25 grey literature sources. 14 additional articles were included following forward and backward searching of prominent authors and key articles. After screening and full-text review, 39 articles and 12 reports/toolkits were included. The majority of sources were opinion pieces, with limited quantitative, observational, or qualitative studies.

Primary care's carbon footprint can be classified into clinical and non-clinical sources, with significant impacts from pharmaceuticals and inhaler propellant gases. Contributing factors include limited knowledge of emission sources, lack of awareness of sustainable practices, low prioritization of sustainability, barriers including ethical concerns and over-medicalization.

Identified strategies to reduce emissions include decarbonization of patient care, increasing education and awareness, implementing non-clinical decarbonization efforts, and conducting more research to support sustainable initiatives. Developing metrics to track progress and securing policy supports to improve adoption and implementation were also highlighted as critical.

Conclusion The identification of sources of carbon hotspots in primary care is an essential precursor to enable the development of targeted decarbonization strategies. Decarbonizing primary care requires a multifaceted approach that addresses the underlying factors driving unsustainable practices. This would allow healthcare

*Correspondence:
Stephen James Walsh
stephenjwalsh@rcsi.ie
Full list of author information is available at the end of the article

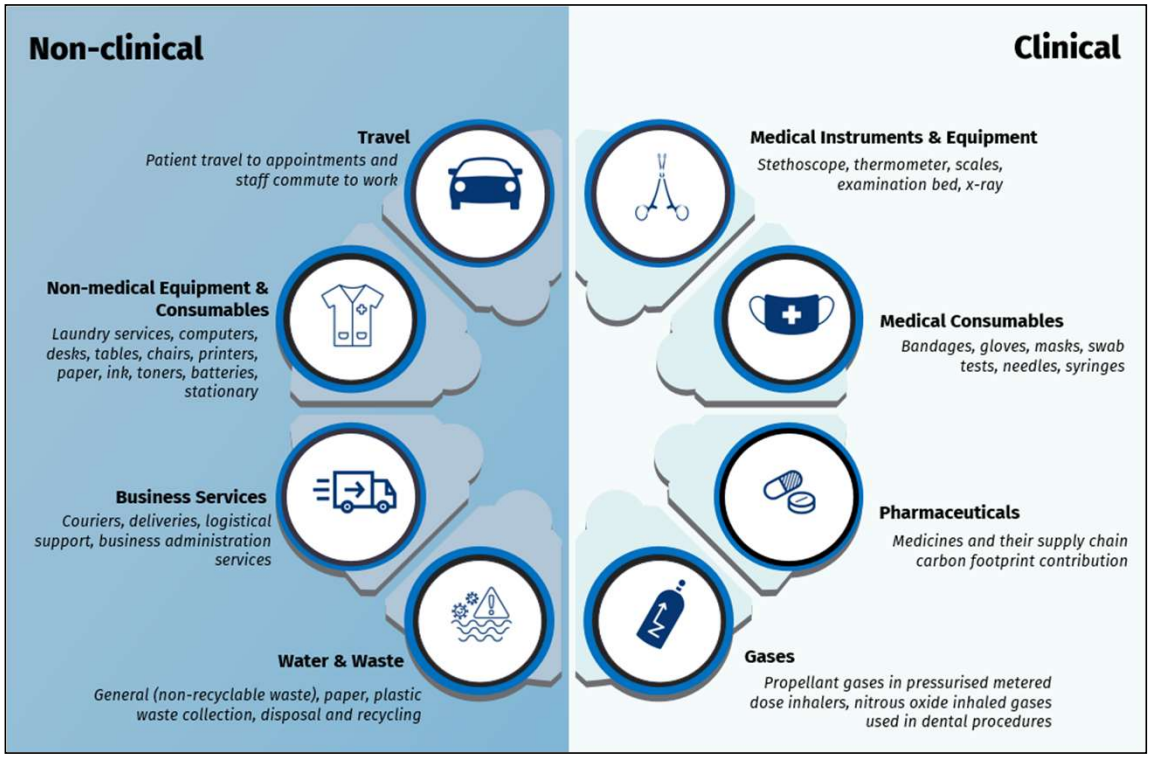
Scoping review findings

Sources of primary care's carbon footprint

- Clinical
- Non-clinical

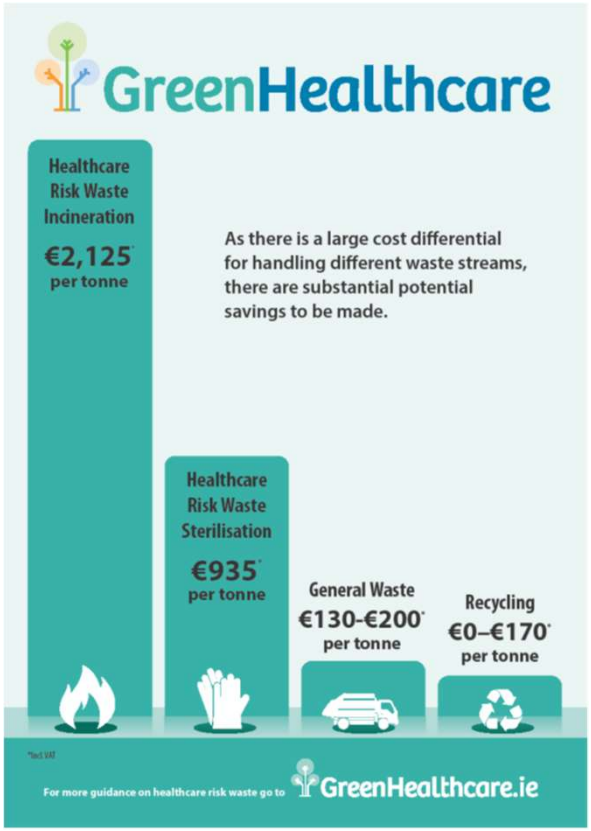
Hotspots

- Pharmaceuticals & Gases
- Business services & deliveries
- Consumables



Waste in healthcare

- Clinical & non-clinical
- Little to no guidance
- Often conflicting, complicated, or out-dated advice



Scoping review findings

Key Barriers Identified

Knowledge gap	Limited awareness of primary care's carbon footprint
Ethical tension	Perceived conflict between sustainability & patient care
Over-medicalisation	Excessive low-value interventions with no clear benefit
Lack of leadership	No clear guidance, metrics or incentives in place
Financial barriers	Business case for greener alternatives

Mitigation Strategies

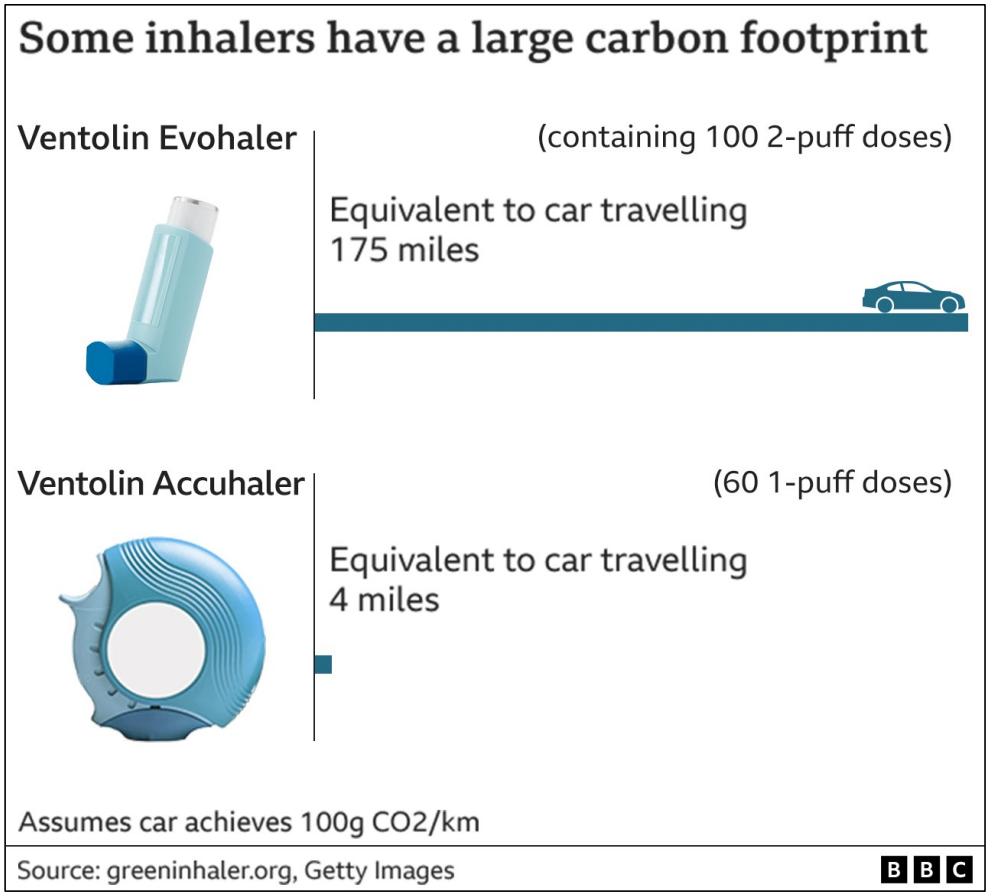
Education	Empowering patients and upskilling healthcare professionals through targeted, sustainability-focused education and training
Enhanced patient care	Shifting towards prevention-first approaches & reducing unnecessary medicines use and deliver higher-quality care
Leaner service delivery	Minimising waste, improve efficiency, and embed environmentally responsible practices across all workflows
Audit & research	Identify inefficiencies, measure environmental impact, and drive continuous improvement in sustainable practice
Supportive policy & guidance	Align stakeholders, incentivise green practices, and embed sustainability as a standard across the healthcare system

Conclusion: *Decarbonising primary care requires a multifaceted approach targeting clinical hotspots, education, policy and infrastructure*

Example opportunity for inhaler eco-optimisation

- Ventolin Evohaler® = 28kg CO_2eq

- Kanwal et al. 2022
  - 54.2% of all inhalers dispensed were metered dose inhalers (MDIs)
  - 70% of all MDIs dispensed were short-acting β2-agonists
  - MDI's accounted for 95-96% of inhaler related emissions
  - 2022 = 37.6 kt CO_2eq



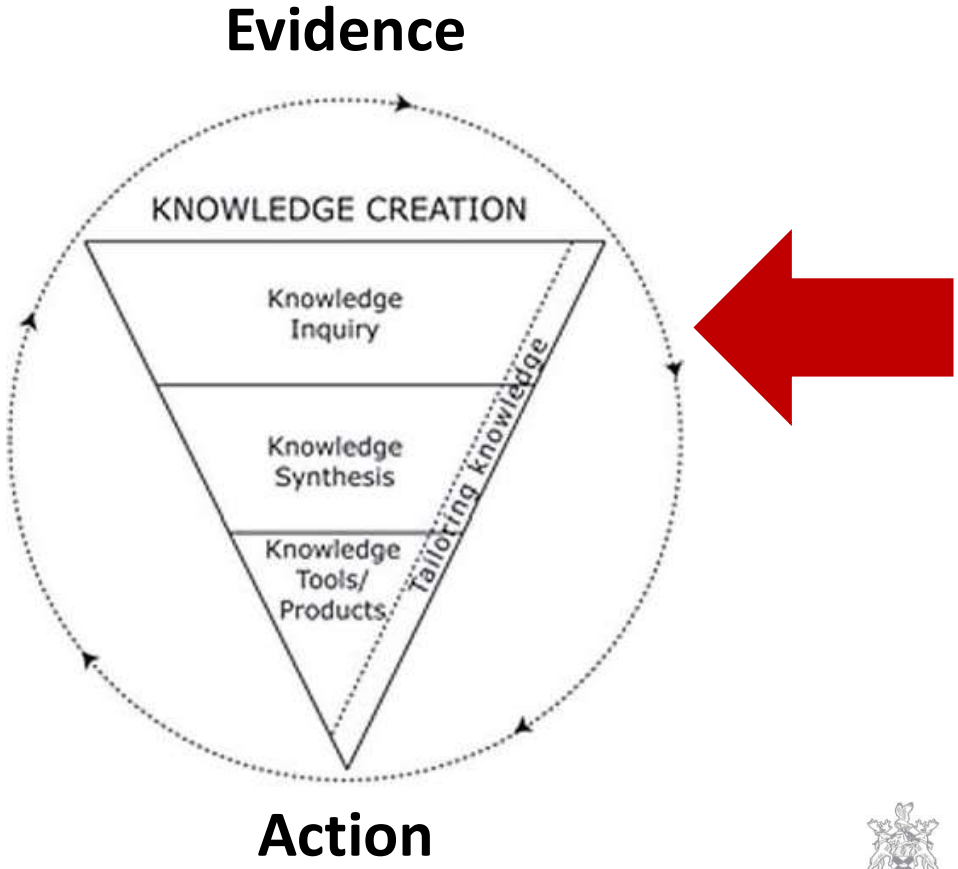
Owens, S., Morris, K., Hurley, E., O'Reilly, K., O'Callaghan, J., Allman, J., Linehan, D., McDonald, M., Green, S., 2023. Estimating the national carbon footprint of inhalers in healthcare. Ir. J. Med. Sci. 192, 2251–2253. https://doi.org/10.1007/s11845-022-03234-0

Kanwal, H., Umm-E-Kalsoom, Khan, A., Ryan, T., Quinn, J., Ryan, C., 2025. Estimation of carbon emissions from inhaled respiratory medicines in Ireland: a cross-sectional study from a national pharmacy claims database from 2020 to 2022. International Journal of Clinical Pharmacy. https://doi.org/10.1007/s11096-025-02039-2

Insights from primary healthcare professionals in Ireland

- Qualitative interviews with:
  - Community pharmacists, General practitioners, Dentists, & Practice nurses

- Important to ground future action in evidence from those working in practice

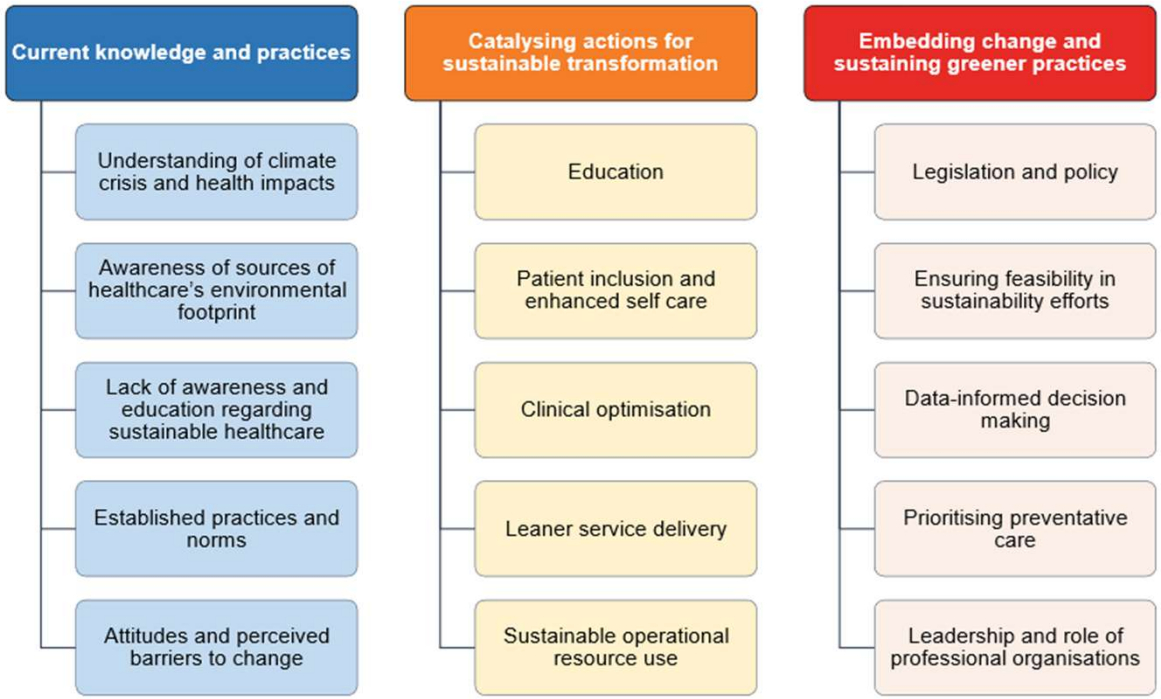


Graham et al. 2006 – Knowledge to action process: phase 1 knowledge creation

Walsh, S.J., O'Leary, A., Lynch, M., 2025. Planetary health and environmentally sustainable healthcare: perceptions of primary care practitioners in Ireland - a qualitative study. BMJ Open Quality 14, e003827. https://doi.org/10.1136/bmjoq-2025-003827

What did primary healthcare professionals say?

- **Aware but unable to act**
  - HCPs recognised the urgency of climate change but lacked the tools, training and system support to translate concern into practice
- **Practical opportunities exist**
  - greener prescribing, telemedicine, paperless systems and reduced packaging waste were identified as workable starting points
- **Structural barriers dominate**
  - the fee-for-service model financially rewards over-treatment, making sustainable practice economically risky without systemic reform



Walsh et al. 2025 - Breakdown of higher order categories and associated categories.

Interview insights

“I think you can put education out there… Education shouldn't just tell us what to do, but also explain why it matters and the difference it makes.” [PN1]

“In Ireland, especially with the older generations, there's this tendency to rely heavily on tablets. There's this idea of *"a pill for every ill,"* and they prefer to take a tablet to solve everything.” [GP5]

“Our hands are tied in what we can do without legislation changes to support us.” [CP5]

“If [interchangeable generic lists] promoted the greenest generic alternative instead of the cheapest.” [CP1]

“The principal sets the tone for the whole practice. If they're on board with sustainability, it filters down to everyone else.” [DT1]

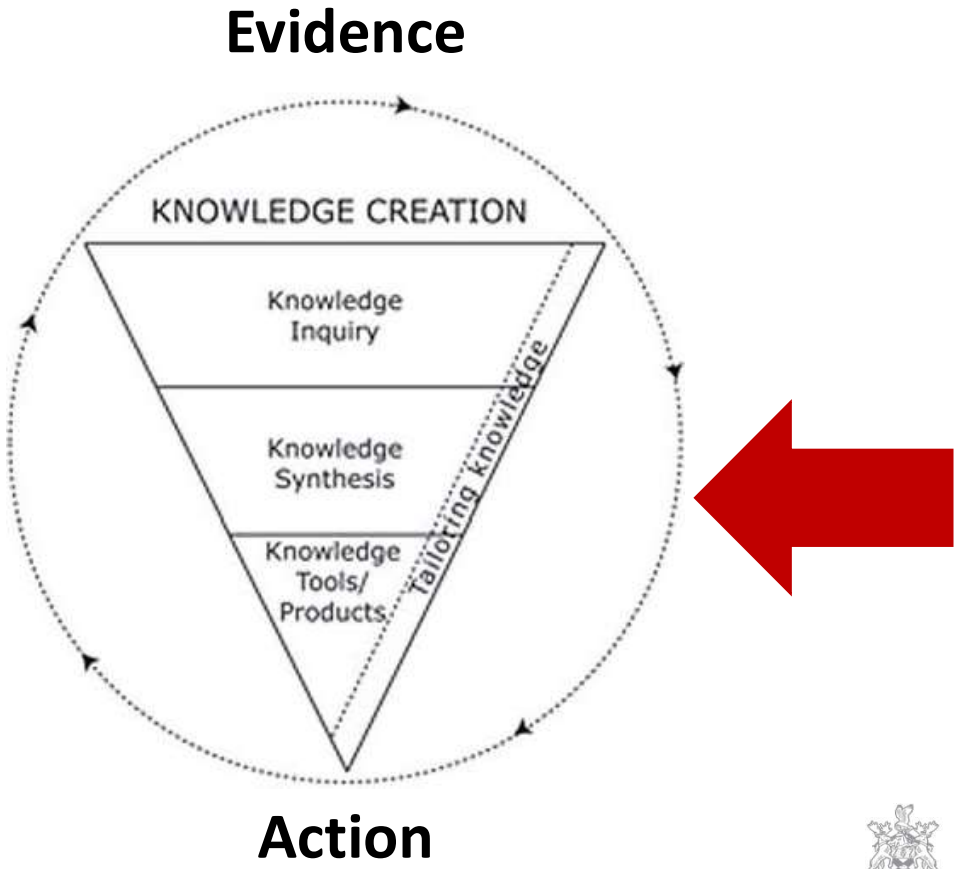
The opportunity

- Pharmacists are uniquely positioned
  - frequent patient contact and direct influence over medicines use, the single greatest source of healthcare's environmental footprint
- The gap
  - while GPs have the GLAS Toolkit, Irish pharmacists have no equivalent guidance or framework to act on sustainability
- An opportunity
  - pharmacists are an untapped lever for sustainable healthcare change, yet remain unsupported and undirected

Focus on community pharmacy

- A national survey of community pharmacists to capture real-world attitudes, barriers and readiness to act on sustainability

- **Evidence must drive action**
  - without understanding what pharmacists know, feel and face daily, any guidance or intervention risks missing the mark



Graham et al. 2006 – Knowledge to action process: phase 1 knowledge creation

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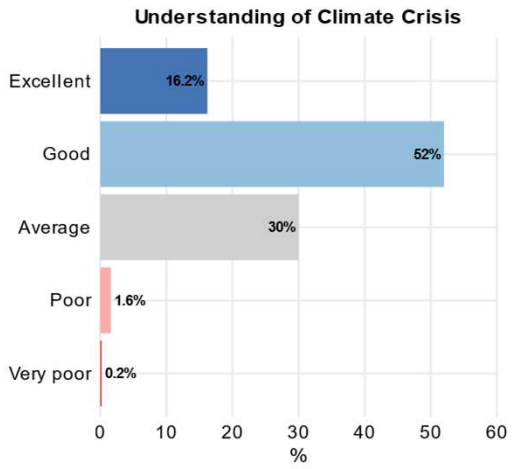
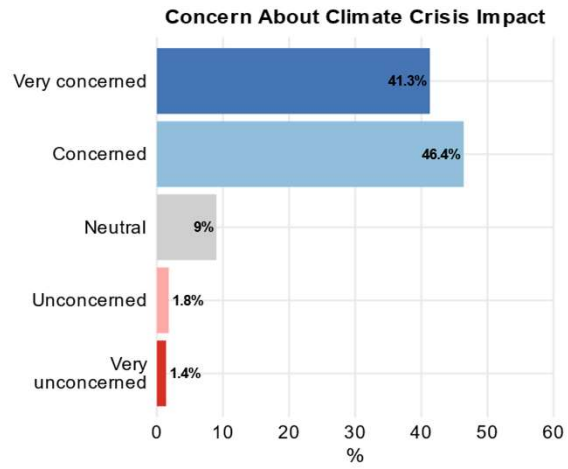
Survey Results

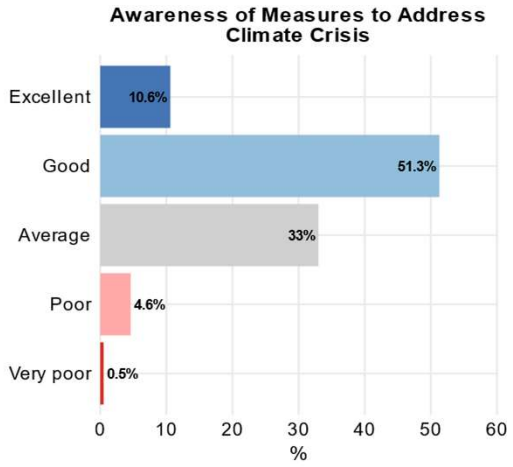
433 responses

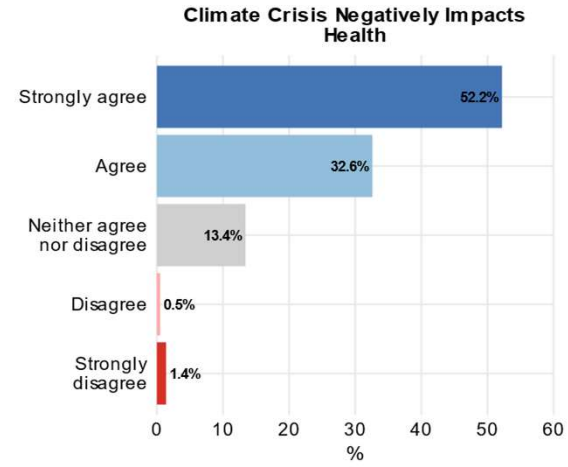
Pharmacist role

- Employee – 265 (61.2%)
- Employer – 106 (24.5)
- Locum – 62 (14.3)









Walsh et al. 2026 - Community Pharmacists' Awareness and Understanding of the Climate Crisis

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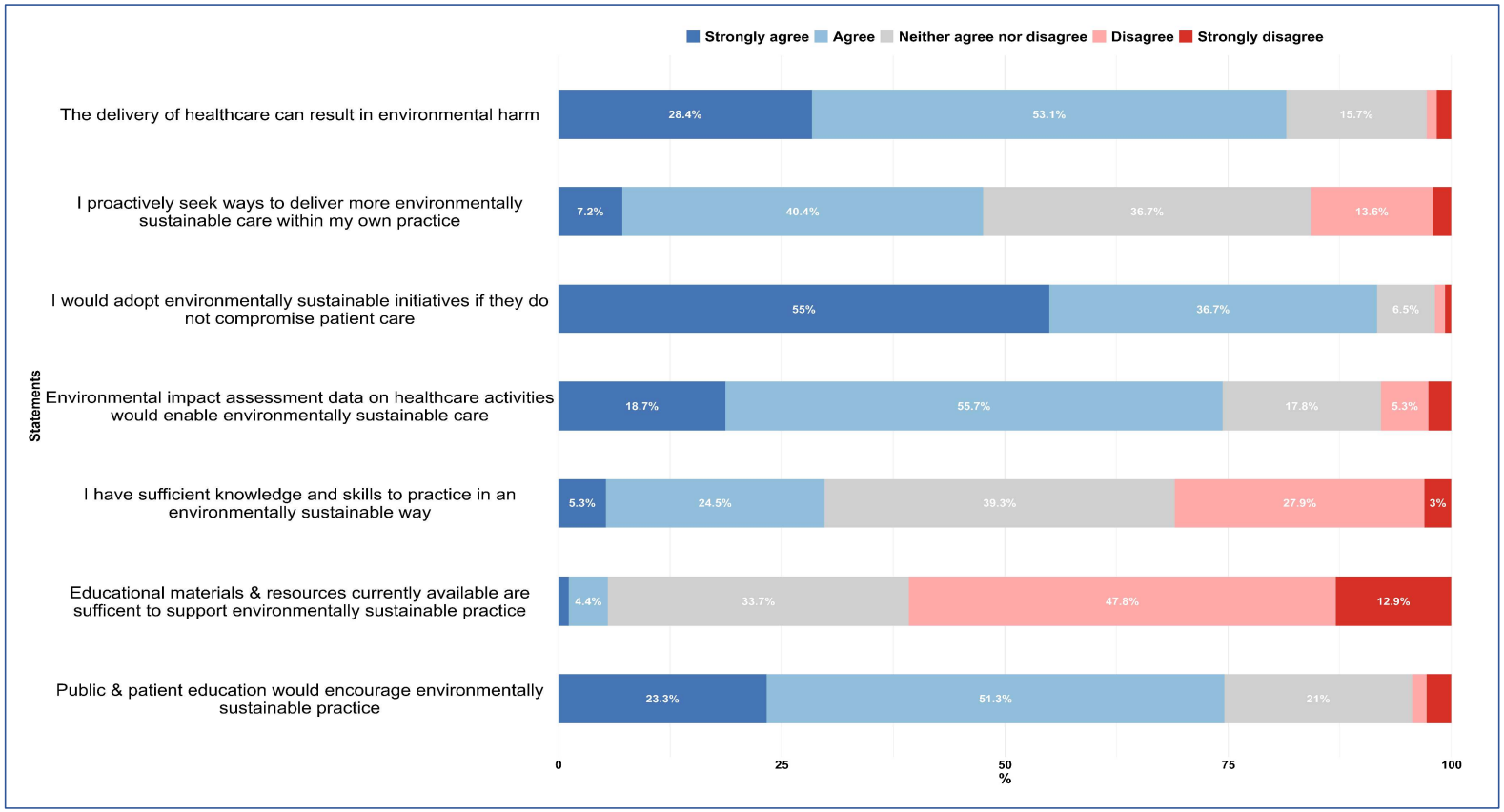
Survey results



Walsh et al. 2026 - Community Pharmacists' Practice Behaviours and Utilisation of Educational Supports for Sustainable Healthcare

Survey of community pharmacists

- "Waste is widely accepted and tolerated"
- "I try to encourage the rational use of medicine so as to avoid waste, making sure patient requires a specific medication and doesn't have adequate supply at home"
- "Pay a realistic non-dispensing fee without a quibble to encourage ensuring patients don't get medication they don't need"
- "I would often think about change but not be equipped to make the change… I wish I could implement change but unsure how to go about this"
- "Stop producing tonnes and tonnes of 'informational and promotional' paper, and public health leaflets, remove need/requirement for 'paper trails'"

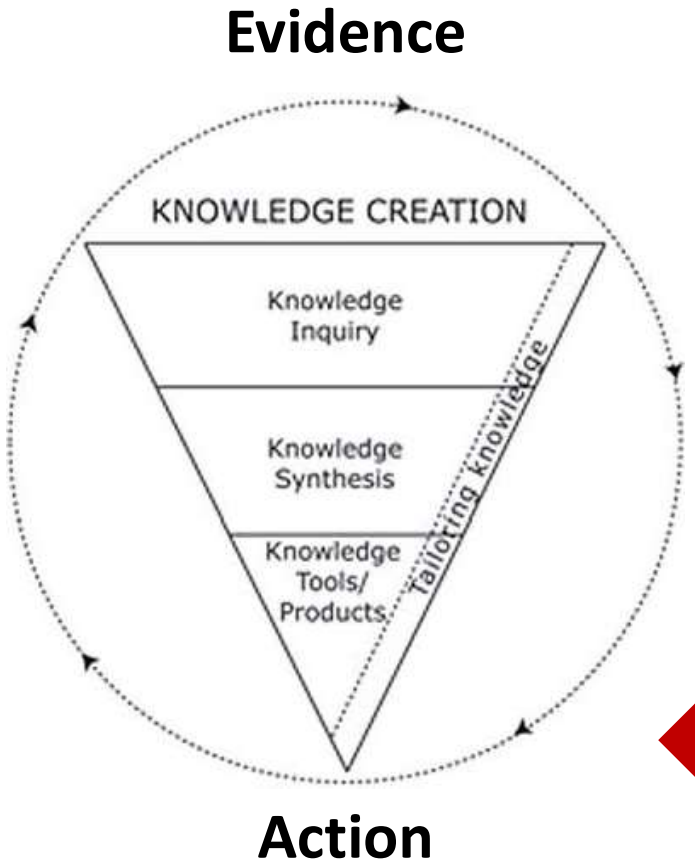
Develop & test tools for action

- Developed environmental sustainability guidance with step by step actions for community pharmacists to take

- Focused on:
  - Non-clinical activities
    - Energy
    - Waste
    - Deliveries
  - Repeat medicines management
  - Respiratory care optimisation

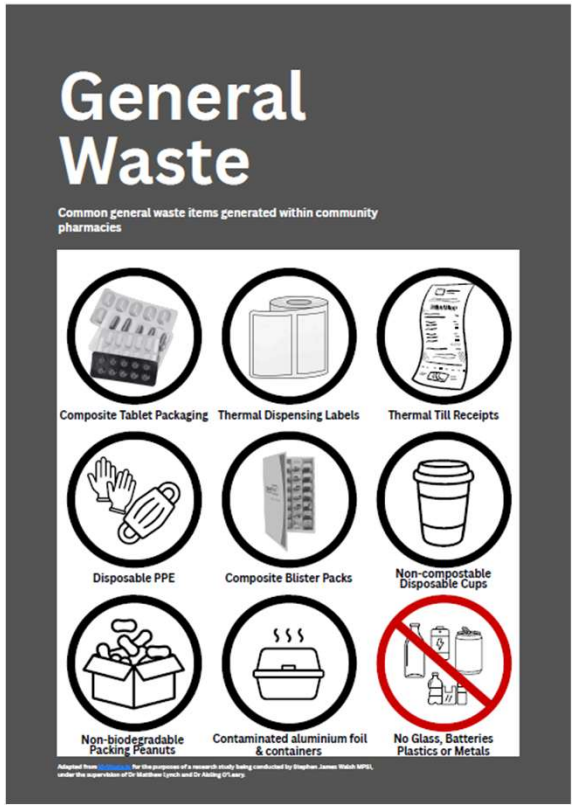
- Tailored to the unique context of community pharmacy practice in Ireland

- Piloted in a number of community pharmacies across Ireland



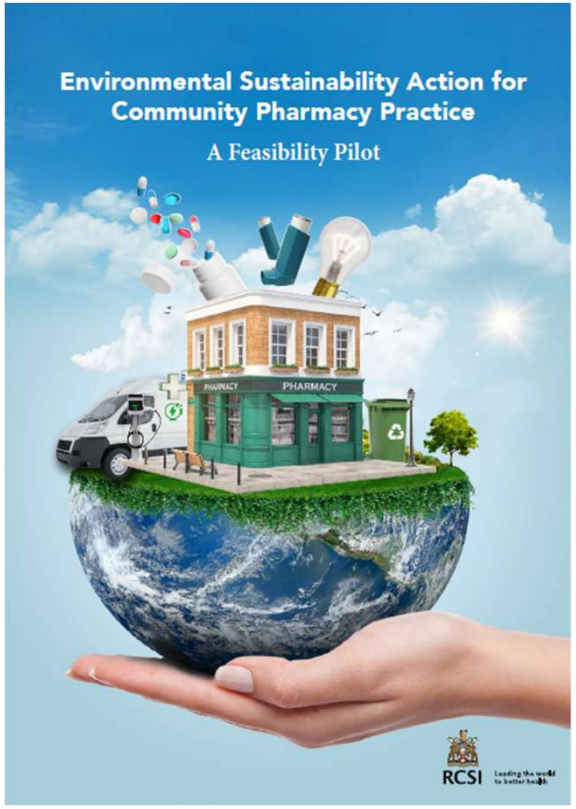
Graham et al. 2006 – Knowledge to action process: phase 1 knowledge creation

Tailored waste posters developed



Preliminary results

- 15 pharmacies participated
- Good engagement with each activity
- Barriers emerging
  - Time pressures
  - Patient engagement
  - Dispensing practices around healthmail



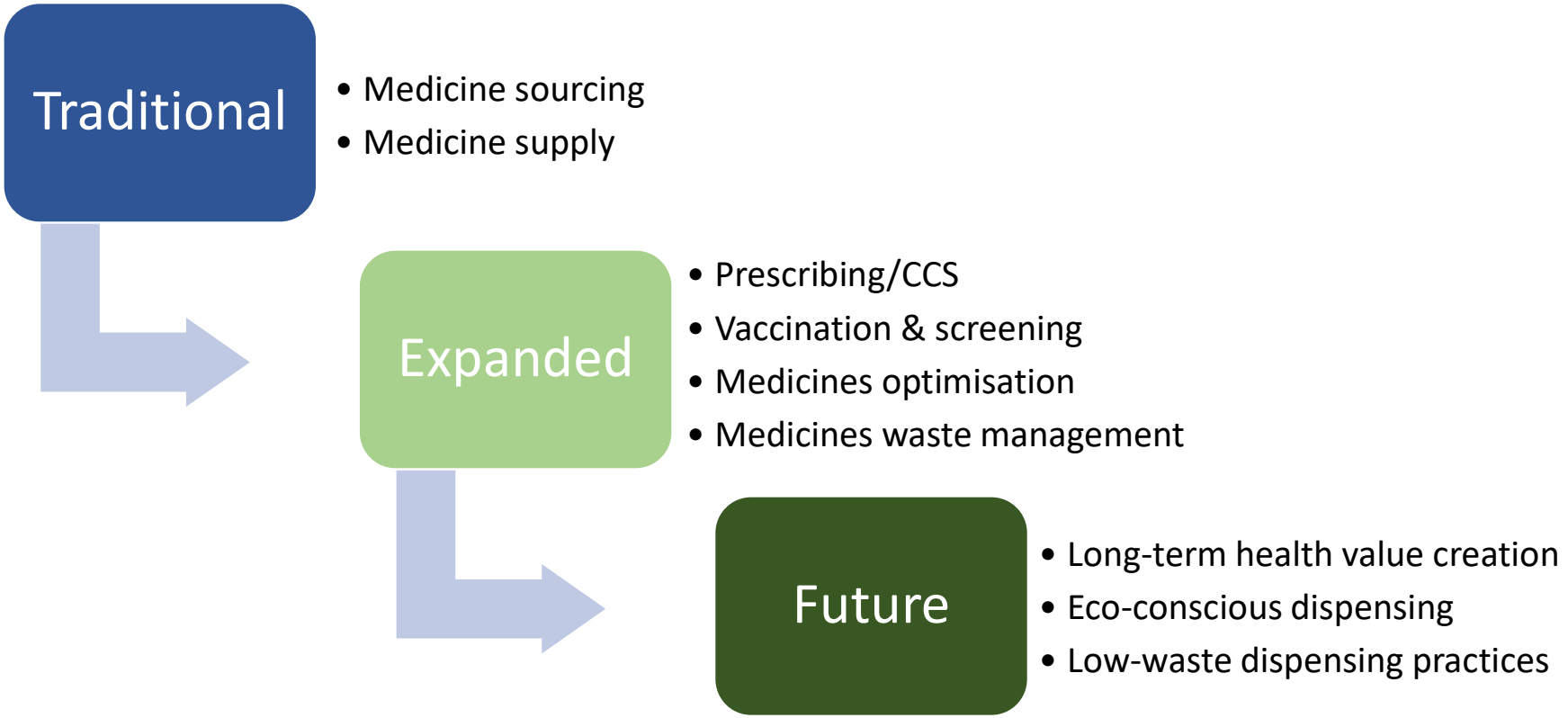
How can pharmacists practice sustainably?

- Rational use of medicines
- Identify and highlight overuse of salbutamol inhalers with patients and prescribers
- Eco-substitute salbutamol inhalers where appropriate
- Patient education & awareness
- Leaner service delivery
  - Deliveries, Energy & Waste practices

Resources

- Waste
  - https://mywaste.ie/
- Energy
  - www.seai.ie/reduceyouruse/business
- Healthcare
  - https://greenhealthcare.ie/
- Sustainability in Quality Improvement
  - https://www.susqi.org/

The evolving role of pharmacists

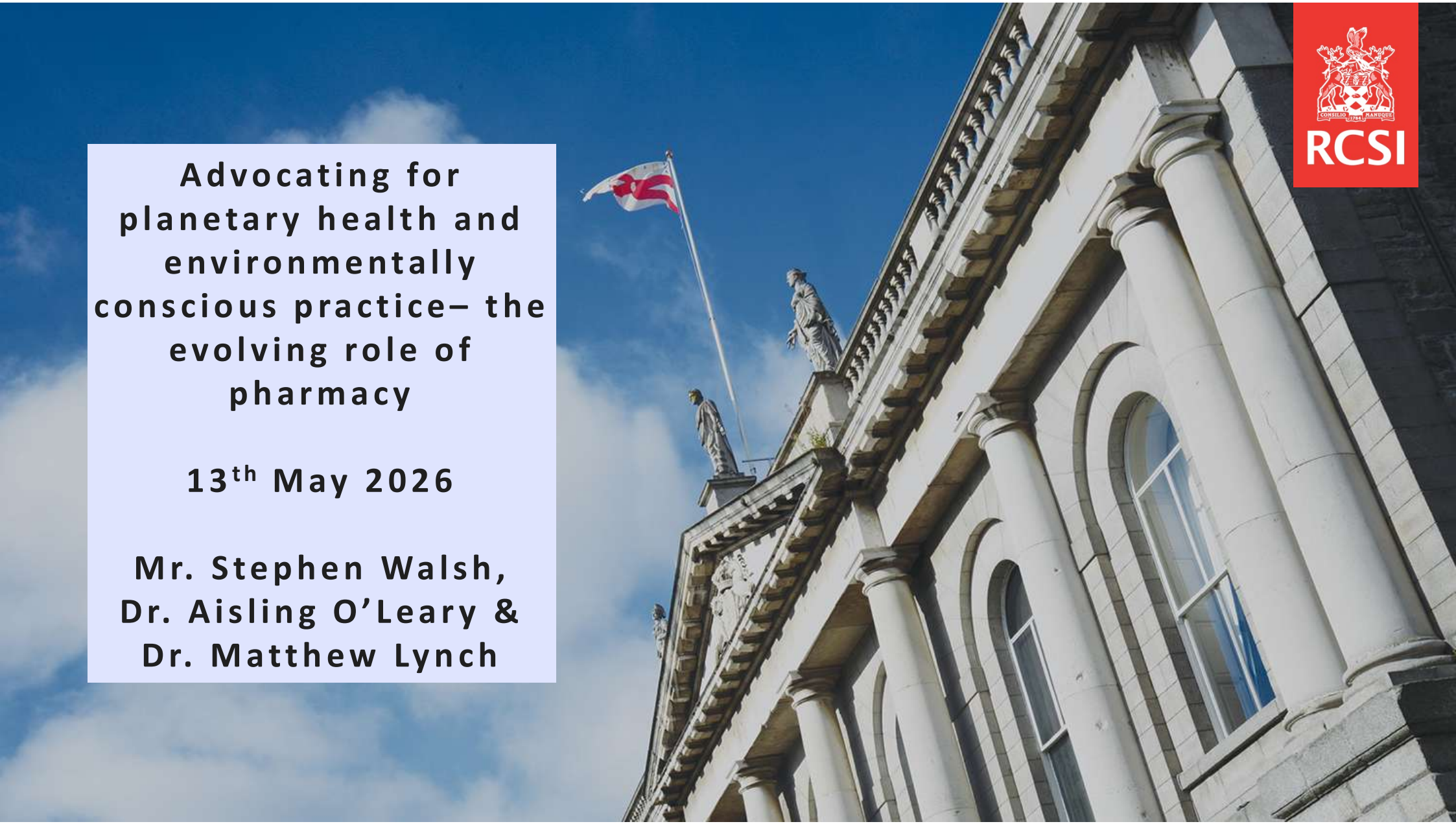


Thank you

Special thank you to the pharmacists who participated in interview, survey, and pilot studies

Email: stephenjwalsh@rcsi.ie

Supervisors:
Dr Aisling O'Leary & Dr Matthew Lynch



Advocating for planetary health and environmentally conscious practice– the evolving role of pharmacy

13th May 2026

Mr. Stephen Walsh,
Dr. Aisling O'Leary &
Dr. Matthew Lynch

Medicines Waste

- Defined as any pharmaceutical product that remains unused or is not fully consumed during the entire pharmaceutical supply chain
- Medicines waste, is both a waste of finite financial resources but also an avoidable environmental burden
- According to global estimates, between 3 and 50% of medicines remain unused with about 40% of this being preventable
- It is estimated by the Environmental Protection Agency (EPA) that approximately 29,000kg of medicines remain unused or expire annually in Ireland

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Clinical Waste Audit in Community Pharmacy

- MPharm Year 5 Research project in 24/25
- Clinical Waste audit conducted in four community pharmacies
- Study aim was to systematically characterise and quantify medicines waste generated in those pharmacies over a four week period and to explore the underlying causes and potential economic impacts
- Study objectives
  - To quantify the amount of patient-returned medicines and pharmacy generated medicines waste
  - To identify the primary therapeutic classes, stated reasons contributing to medicines waste and estimated value of the waste generated.

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Method

- A bespoke waste medicines audit tool was developed
- It captured data on
  - Type, form quantity, ATC code, source and reason given for waste medicines return or generated
- Data was collected in the four pharmacies over a four week period
- The value of waste medicines was calculated based on the wholesaler list price

Source of medicines waste

Source	Number of items	Total no. of units	% of total items
Patient-generated	216	6451	72%
Pharmacy-generated	83	2035	28%
Total	299	8486	100%

Of the total medication waste recorded, 90% were prescription medicines and 10% were OTC products.

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Reasons for medicines waste

- The primary reasons for patient returns were
  - patient death (20.8%)
  - treatment discontinued by the patient (13.4%), and
  - general non-adherence resulting in medication accumulation (12.5%)
- For pharmacy-generated waste, the most common reasons for disposal were
  - blister pack amendments following treatment changes (31.3%)
  - expired medicines (26.5%) and
  - medicines left uncollected by patients (15.7%)

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Economic value of medicines waste

Source	Number of items	% of total items	Total units	Total value (€)	% of total value
Patient returns	216	72%	6451	4928.39	81.5%
Pharmacy-generated	83	28%	2035	1121.48	18.5%
Total	299	100%	8486	6049.87	100%

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National economic impact - extrapolation

- Based on this short four-week audit in four community pharmacies, the mean value of medication waste generated per pharmacy of €1,512.47 over a four-week period
- This extrapolates to an estimated value per pharmacy of €19,662.11 annually (52 weeks)
- Based on the available data at the time of analysis, there were 1,908 community pharmacies registered in Ireland(Pharmaceutical Society of Ireland, 2025)
- Applying the estimated annual value generated in this audit to all community pharmacies, the annualised average value of medicines waste per pharmacy equates to an economic value in the region of €37.52 million

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Limitations

- Data collection occurred over a relatively short period, which may not capture seasonal variations in prescribing patterns, patient behaviours, or waste generation.
- The audit was also confined to four pharmacies, potentially limiting generalisability to other geographic settings with different dispensing volumes and patient demographics.
- The value of medicines waste may be overestimated by the use of list prices that do not include discount rates negotiated by pharmacies for the purchase of those medicines

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Key messages

- Notwithstanding its limitations, this audit provides valuable insights into the volume, nature, and drivers of medication waste in community pharmacy practice together with the potential scale of both its economic and environmental cost
- Further research drawing on a larger and more diverse sample of community pharmacies is required to better understand its scale and underlying causes. Similar research is also required in the hospital sector to assess medicines waste there
- Such evidence would inform the development of targeted prevention strategies for key stakeholders across the medicines' lifecycle, without compromising patient safety or quality of care
- Adopting a more sustainable framework for medicines use would not only reduce environmental harm, but also enhance resource efficiency and improve patient care
- Findings support the need to expedite the introduction of the proposed nationally funded scheme for waste medicine disposal

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Full study Findings

- O'Leary, A.C., Gerasimova, Z., Devlin, N. et al. Unused and expired medicines waste in Ireland – an audit of medicines returned to and generated in community pharmacies. Ir J Med Sci (2026).

- Available at https://doi.org/10.1007/s11845-026-04436-6

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Acknowledgements & References

- MPharm Students - Zlata Gerasimova, Neil Devlin, Arun Katheri & John Syjo
- Pharmacists and staff of participating pharmacies

- Bekker, CL, Van Den Bemt BJF, Egberts ACG et al (2018) Patient and medication factors associated with preventable medication waste and possibilities for redispensing. Int J Clin Pharm 40:704– 711. https://10.1007/s11096-018-0642-8
- Environmental Protection Agency (2021) National Hazardous Waste Management Plan 2021–2027

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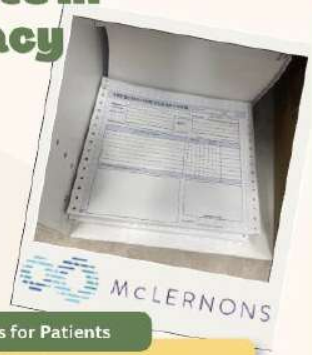
Reducing Paper Waste In Community Pharmacy

Project Concept

- Medical waste is a huge issue and hazard to the environment
- Where can we reduce waste on small scales to make a big impact?
- Can I help to reduce paper waste in the community pharmacy I work in by reducing the volume of prescription receipts printed?



Benefits for Patients

- Reduced waiting times while prescriptions are prepared
- Less burden to keep track of all medication receipts throughout the year- less paperwork!
- Yearly DPS or medical expense tax report is a condensed version of expenses paid and is much simpler to interpret for tax return purposes
- Yearly expense reports (DPS, Medical Expense reports) are more confidential than prescription claim receipts as they do not detail prescribed medications dispensed

Benefits for the Pharmacy

- Easier dispensing process- in particular when a patient has multiple items dispensed on a variety of schemes eg DPS, LTI, HT
- Less chance of errors and GDPR violations- eg patient getting a receipt for another patient
- Reduced staff stress levels- technical issues with dispensary printers are common!

Benefits for the Environment

- Huge reduction in paper waste! Therefore reducing our carbon footprint, one piece of paper at a time
- Less ink used to print receipts
- Less electricity required to have printers constantly running- even in standby mode

Action Plan

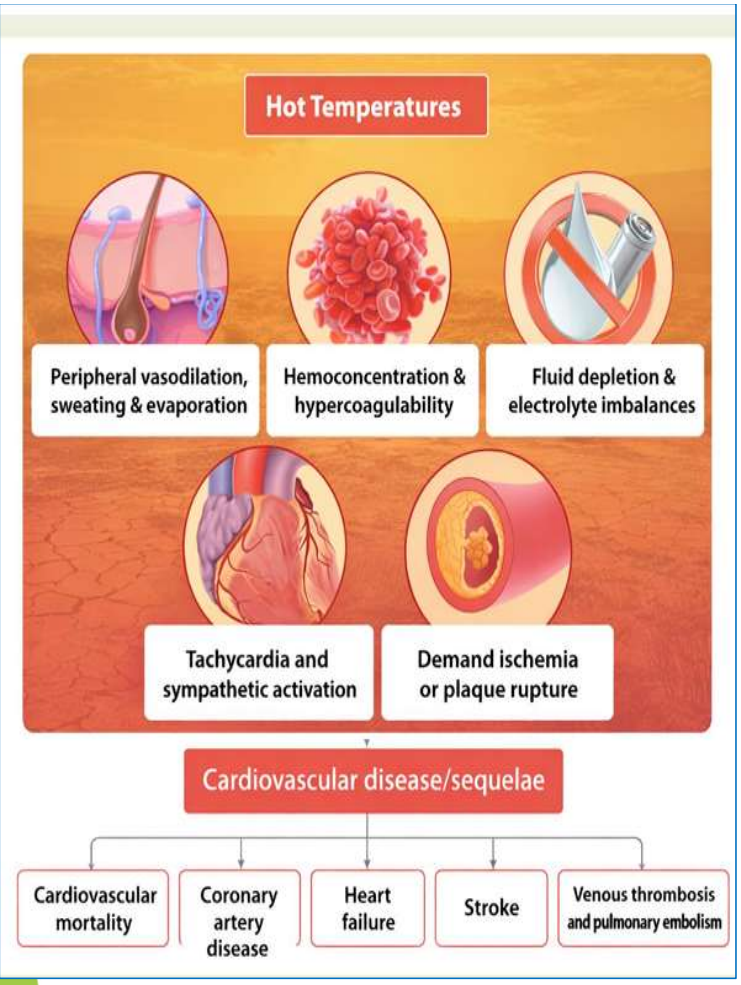
- The PSI states that pharmacies must keep a detailed record of all items dispensed in a pharmacy, *however* there is no specific requirements on providing patients with a itemised receipt at the time of dispensing. They must however be able to reproduce documentation of any dispensings or transactions *upon request*.
- This led to my proposed idea for this action based project- to reduce prescription claim form ("blue receipts") printing in my place of work favour of printing annual medical expense receipts.
- The first step was to discuss this plan with supervising my pharmacist. This conversation was very productive as I had laid out the advantages of this plan for patients, for our dispensary team and for the environment. We then worked together alongside store management to bring this plan to reality.
- Step 1-Disable automatic receipt printing function on dispensary software- MPS McLernon's
- Step 2-Sent a text message to all regular patients through MPS to let them know of this trial period of not printing prescription receipt claim forms
- Step 3-Generate generic stickers to attach to prescription bags stating receipts are only being printed on request in an attempt to go green! (While stickers are still waste they are considerably less wasteful than long paper receipts)
- Step 4- Display new receipt procedure at dispensary tills

My colleague Donna and I

Outcomes

- We have officially retired one of 3 receipt printers! It is still left in the dispensary, but we have been able to unplug it fully from the wall where the other printers are left in an eco-standby mode.
- Colleagues have reported reduced instances of having to order and replace printer paper!
- Some patients prefer to have their printed "blue receipt" for tax or insurance purposes and if this is the case we will record this as a prompted message on their MPS file for future reference
- Overall there was a huge degree of support from our patients on this new process
- Knowledge - many patients were unaware that we are able to reprint receipts for the past 4 years!

Niamh Gibbons MPharm Y3 student assignment 2025-2026



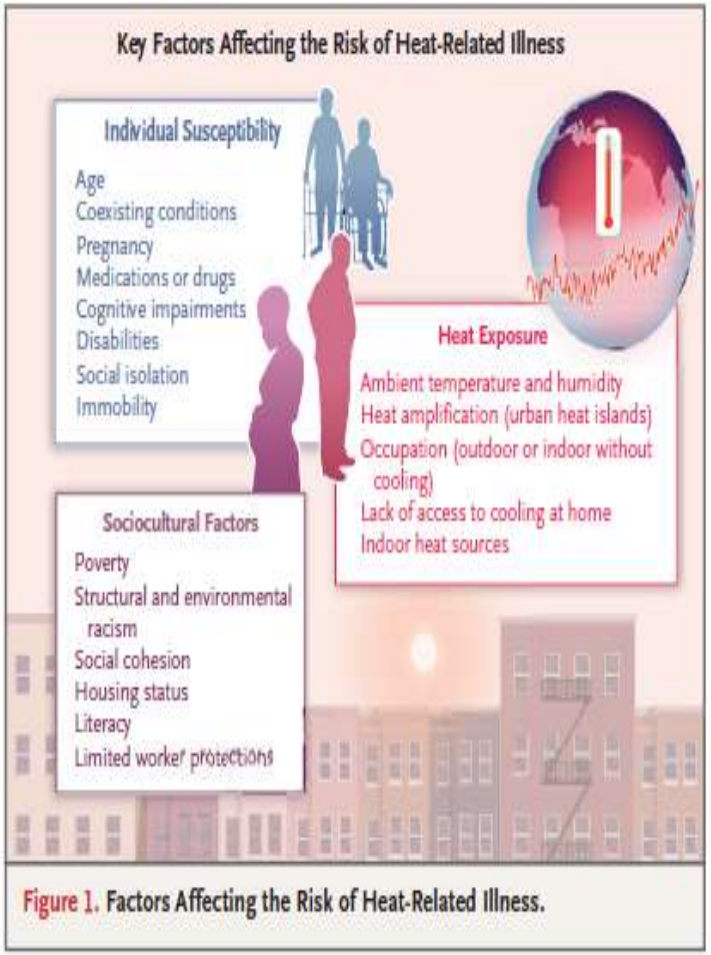


Figure 1. Factors Affecting the Risk of Heat-Related Illness.

- Enalapril
- Metformin
- Empagliflozin
- Fluoxetine
- Bisoprolol
- Digoxin

- ➢ Need for action/adaptation plans
- ➢ Medicines storage considerations
- ➢ Medicines supply considerations

ESC European Society of Cardiology
European Heart Journal (2025) 00, 1–9
https://doi.org/10.1093/eurheartj/ehaf326
SPECIAL ARTICLE
Epidemiology, prevention, and health care policies

Heat extremes and cardiovascular diseases:

ESC European Heart Journal (2026) 00, 1–25
https://doi.org/10.1093/eurheartj/ehag270
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A clinical consensus statement of the European Society of Cardiology

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November 2025

https://www.fip.org/file/6423

4 Knowledge & skills for sustainable pharmacy practice

Knowledge, skills and attitudes for sustainable pharmacy practice[4, 24-30]	
Core	
Mitigation*	Adaptation**
Knowledge • Recognise the environmental impacts across the full medicine lifecycle, from manufacturing and distribution through patient use and disposal, including emissions, energy use, and pharmaceutical waste. • Apply eco-friendly procurement methods, regulatory standards, and international guidelines that promote pollution prevention, resource efficiency, and sustainable supply chains. • Recognise how technology choices impact the environment and implement sustainable digital practices, such as minimising unnecessary data usage and choosing energy-efficient tools. • Understand how different medication formulations (such as dry powder inhalers versus metered-dose inhalers, and cold-chain liquid versus tablets) or routes of administrations (IV vs oral) affect environmental outcomes throughout the medicine lifecycle.	Knowledge • Understand how climate change directly impacts medicine effectiveness, availability, and patient behaviour. • Understand how disease patterns and prevalence evolve over time and help to guide effective climate adaptation measures, enabling health systems to anticipate and respond to climate-related health risks. • Recognise how certain groups face greater risks from climate-related medication disruptions and environmental health threats. • Identify weak points in pharmaceutical supply chains and healthcare delivery systems that are vulnerable to environmental disruptions. • Interpret air quality data and incorporate it into patient counselling and education. • Engage with public health by understanding socioeconomic factors that influence health at both population and individual levels. • Remain informed on public health campaigns, risk communication strategies, and local environmental health initiatives such as pharmacy-based vaccination programmes. • Recognise the contribution of non-adherence to prescribed regimens to medicines waste.
Skills • Discuss environmental responsibility with patients, colleagues, students and stakeholders, including guidance on sustainable medication choices and proper disposal practices. • Implement smart supply chain strategies using automation and demand forecasting strategies to prevent overstocking and reduce waste. • Manage pharmacy operations to maximise energy efficiency through different initiatives such as LED lighting, proper insulation, smart climate control, and efficient equipment usage.	Skills • Adapt medicine sourcing, distribution, and storage practices during environmental emergencies such as extreme weather events or natural disasters. • Provide targeted guidance to help patients minimise air pollution exposure through strategies such as optimised inhaler use, protective masks, and proper ventilation. • Inform patients about heat-related risks (such as dehydration, heat exhaustion, and physical exertion), and practical preventive measures.

Conclusion

- Pharmacists can be true advocates for environmentally conscious care
- Translating intent into action will require support but willingness is more than apparent
- Every single action counts, no matter how small as cumulative actions can create cascades of change
- *“The world is changed by your example, not by your opinion.” (Paulo Coelho)*

Botanic Gardens Dublin

Thank you for attending