ECO-DIRECTED AND SUSTAINABLE PRESCRIBING OF PHARMACEUTICALS IN THE UNITED KINGDOM

Policy Brief

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Eco-directed and Sustainable Prescribing of Pharmaceuticals in the United Kingdom

Policy Brief

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In 2021, the British Government hosted the 26th United Nations Climate Change Conference of the Parties (COP26), where more than 50 countries, including the United Kingdom (UK), signed the historic COP26 Health Programme, the first such agreement that acknowledged the need for a climate resilient and sustainable, low carbon health system [1]. Plans to deliver these commitments are set in NHS England’s Delivering a ‘Net Zero’ NHS report [2] and NHS Scotland’s Climate Emergency and Sustainability Strategy [3]. While these reports provide directions to reduce carbon emissions from pharmaceutical use, NHS England’s net zero strategy in particular offers limited actions on reducing active pharmaceutical ingredients polluting the environment that have impacts on public health, water quality, contribute to the decline of biodiversity, and potentially drive the development of antimicrobial resistance.

In this policy paper, we discuss the issue of pharmaceuticals in the environment and introduce the concept of ‘eco-directed and sustainable pharmaceutical prescribing’ as one of the many solutions to reduce pharmaceutical pollution. We held a series of consultations with representatives from government, industry, academia, and civil society organisations to understand the challenges and opportunities for implementing sustainable pharmaceutical prescribing in the UK. Considering expert advice and experiences of sectoral representatives, we provide a set of contextualised policy measures focusing on public health improvement; promotion of greener and sustainable healthcare; environmental considerations in healthcare decision making; and environmental monitoring of pharmaceuticals.

Through this policy brief, we aim to raise the issue of pharmaceuticals in the environment in the UK Parliament and the wider British political landscape. Pharmaceutical pollution has direct and indirect impacts on human and planetary health. Policymakers in the UK Parliament have a moral obligation to respond to the climate emergency and the biodiversity crisis by creating opportunities for healthy futures for all, through climate-resilient and environmentally sustainable use of healthcare products such as pharmaceuticals.
Researchers have concluded that humans have exceeded our planet's capacity to absorb 'novel entities' - among which plastics, pesticides, and pharmaceuticals are a major part. A threat from human activities that sits alongside the climate emergency, collapse in biodiversity, water stress, and biogeochemical flows as major dangers in the Anthropocene. The environmental impact of pharmaceuticals has been perhaps least noted of those in policy attention and action. This policy document aims to start to address the gap in the UK, recommending policy measures that would allow the British Government to genuinely use the 'world-leading label' and provide ways forward to reducing the global burden of pharmaceuticals in the environment.

It operates within the One Health and Planetary Health paradigms, acknowledging that human, animal, and environmental health are all intimately interrelated. Back in 2014, Prime Minister David Cameron accepted antimicrobial resistance is a threat to the security of us all. We need to recapture the policy focus of that time, as the UK looks to renew its Antimicrobial Resistance National Action Plan, while also acknowledging the need to broaden the focus to other pharmaceuticals, including general pharmaceuticals, endocrine disrupters, and antifungals.

In writing these policy recommendations, we have consulted with academics, industry partners, and other key stakeholders to understand both the state of the current situation, and the realistic and achievable measures we should strive for in order to reduce pharmaceutical pollution in the environment.

Thank you to everyone who has generously given their time and expertise. The outcomes of these discussions are synthesised here, and I look forward to working with all relevant sectors and stakeholders to take this agenda forward.

**Policy Brief: Eco-directed and Sustainable Prescribing of Pharmaceuticals in the United Kingdom**
Pharmaceuticals in the Environment

Pharmaceuticals are one of the cornerstones of modern healthcare and are vital to the promotion and sustenance of human health and wellbeing across the globe. In the UK, the pharmaceutical industry is of huge economic value, with £40.8 billion turnover in 2021 [4].

Figure 1. Medicinal product chain

1. Medicinal product development
2. Registration and market access
3. Product and distribution
4. Consumption (i.e. prescription)
5. Disposal (e.g. bins, human excretion, pharmacy take back scheme)
6. Treatment of waste
7. Fate of medicine residues


While the practical reality of adequate and appropriate doses of pharmaceuticals results in the emission of relatively low concentrations of pharmaceuticals to the environment; the overuse, misuse, and the inappropriate disposal of medicines leads to having more concentrations of active pharmaceutical ingredients (APIs) accumulating in the environment through different emission pathways (Figure 1) [5], which could be reduced or even prevented through upstream interventions.
Recent research conducted in the UK indicates the presence of a wide variety of pharmaceuticals in various environmental matrices. The Chemical Investigations Programme (CIP) from UK Water Industry Research (UKWIR), for example, determined concentrations of priority chemicals entering and leaving approximately 10% of all wastewater treatment plants across the UK, providing an extremely valuable and accessible dataset which could inform regulatory controls and/or improvements to wastewater treatment [6]. Moreover, in 2022, commissioned by Scotland’s Centre for Expertise for Water (CREW), the Water Research Group based at Glasgow Caledonian University (GCU) and the One Health Breakthrough Partnership (OHBP) led the first baseline study on the scale of pharmaceutical pollution in Scotland. The study revealed the presence of sixty pharmaceuticals in Scottish water environments, of which, nine were recommended for further action: antimicrobials (clarithromycin, erythromycin, ciprofloxacin), pain relievers (ibuprofen, diclofenac), contraceptive (ethinylestradiol), antacid (ranitidine), and medicines for heart problems (propranolol) and type 2 diabetes (metformin) [7].

Pharmaceuticals are manufactured to have a biological effect on both humans and animals, even at very small quantities. Therefore, upon entering environmental systems, they will also demonstrate said biological effects. A further concern is that many pharmaceuticals do not rapidly degrade upon entering the environment, and may therefore persist, thus increasing organism exposure to APIs. One of the most established areas of research investigating the negative impacts of pharmaceuticals in the environment (PiE) involves ecotoxicity testing, which has found that API exposure may result in harmful behavioural, physiological and reproductive effects in a wide range of both terrestrial and aquatic species. For example, freshwater fish around the globe have been documented to exhibit altered physiology, sexual development, and behaviour following exposure to endocrine disrupting chemicals [8].

Further to this, an evidence directorate report produced by an integrated catchment science programme at the Environment Agency previously highlighted some of the threats of pharmaceutical pollution in domestic sewage effluent in British rivers to freshwater molluscs [9]. This work investigated the natural oestrogen 17β-estradiol and a mixture of endocrine active chemicals, uncovering that exposure to mixtures of estrogenic chemicals impacts adult reproduction and potentially leads to a predisposition to parasite infection.
In addition to evidence generated from traditional ecotoxicity testing on smaller groups of test organisms, there is also evidence to suggest impacts of PiE on wildlife at the population level. One of the most infamous cases of this was the near-extinction decline of wild vulture populations throughout the Indian subcontinent in the mid-1990s, with some species declining to 0.1% of the original population size [10]. This was due to unintentional poisoning through the natural scavenging nature of vultures, which resulted in exposure to diclofenac from the ingestion of cow carcasses which had been previously treated with the drug. Though a ban on its veterinary use was implemented in 2006 for India, Nepal and Pakistan, and 2010 in Bangladesh, diclofenac is still used in the region, albeit in considerably less quantities, and vulture populations are yet to fully recover [11].

In terms of the impacts of PiE on human health at the population level, much remains understudied and requires further investigation. For example, decades of global research efforts are yet to confirm whether pharmaceutical residues in drinking water supplies pose a risk to human health [12]. However, recent research has begun to identify that the presence of PiE may contribute to the global burden of antimicrobial resistance (AMR), which has been listed by the WHO as one of the top 10 global, public health threats facing humanity, with 4.95 million AMR-related deaths globally in 2019 [13, 14]. Though measured environmental concentrations (MECs) of antimicrobials are found to be relatively low, recent research has revealed that selection for AMR can occur at very low, sub-inhibitory concentrations, comparable to MECs [15, 16]. For example, CIP recently published a report discussing the findings of an investigation lead by the UK Centre for Ecology & Hydrology into the changes to AMR through wastewater and sludge treatment processes [17]. This work detected a range of antibiotics (including ciprofloxacin, clarithromycin, clindamycin, isoniazid, metronidazole and trimethoprim) in wastewater at concentrations above predicted AMR selective thresholds. Thus, it has been postulated that the environment represents an understudied dimension of AMR, potentially responsible for the evolution, spread and presenting an exposure route of AMR microbes to both humans and animals [18, 19].

Crucially, other non-antimicrobial drugs [20] may also be responsible for the emergence of AMR as a result of co-selection: the indirect selection for AMR. Examples of non-antimicrobials that have been evidenced to influence AMR development include chemotherapeutic drugs, antidepressants, nonsteroidal anti-inflammatory drugs, lipid-lowering drugs, beta blockers, and antiepileptics [21, 22, 23, 24]. Therefore, it is essential to both monitor and mitigate the presence and resulting impacts of PiE across all One-Health sectors.
Eco-directed and Sustainable Prescribing of Pharmaceuticals

Eco-directed and sustainable pharmaceutical prescribing has been defined as the combination of measures that aim to reduce pharmaceutical pollution and climate impacts by reducing pharmaceutical consumption through appropriate and improved rational prescribing and by prescribing pharmaceuticals that are known to have less environmental impact based on the medicines' environmental profiles (i.e. biodegradability, bioaccumulation potential, ecotoxicity, and excretion potential) [25, 26, 27].

Cussans and colleagues [28] propose a similar but a more UK-focused definition, taken from the British Medical Association [29]:

"Low carbon prescribing means offering the right people with the right information to help them choose the best treatment. It uses the lowest effective dose for the shortest period of time, selecting medicines that have the smallest carbon and ecological footprint and makes the best use of alternative non-pharmacological interventions."

Considering this UK perspective, the following measures are proposed to make this change in prescribing practices holistic and environmentally sustainable.

- **Non-pharmacologic interventions:** The Royal Pharmaceutical Society [30] proposes in their sustainability policy that 'the most environmentally friendly medicine is the one that is not required and not prescribed'. Non-pharmacologic interventions have an important role to play in reducing the amount of pharmaceuticals prescribed within the NHS. Social prescribing offers a wide range of non-pharmacologic interventions such as prescribing engagement activities with arts, heritage, and the natural environment (e.g. green and blue spaces) [31]. Green and blue prescribing in particular could also help in promoting pro-environmental behaviours among patients and healthcare providers [32, 33].
• **Evidence-based prescribing and medicine optimisation:** Prescription of medicines should always be based on latest evidence and clinical guidelines. While pharmacologic interventions are not the first line for many diseases, clinical decision-making support tools are important guides for appropriate and evidence-based healthcare interventions or treatments. Adherence to these guidelines contributes to optimisation of medicine use and reduction in unnecessary prescribing of pharmaceuticals. In principle, medicine optimisation promotes that the right patients receive the right medicine at the right time [34]. Medicine optimisation is about helping patients take medicines correctly and safely, by avoiding intake of unnecessary pharmaceuticals and by ensuring that the medicines that are prescribed are clinically effective and cost-effective [35]. Although the goal of medicine optimisation is to improve medicine use and patient outcomes, this has co-benefits for the environment since it contributes to the reduction of pharmaceutical consumption and wastage [36].

• **Eco-informed prescribing during patient consultation:** Discussion about the ecological impacts of pharmaceutical consumption should be made as a common practice during patient consultation. This could be tied in when discussing options on healthier and greener non-pharmacological interventions such as fitness activities (e.g. walking, running, cycling) or blue and green prescribing. Discussion on the potential adverse effects of medicines should cover potential impacts on the patients and the environment. Environmental profiles of pharmaceuticals should be taken into consideration when selecting what medicine to prescribe, especially between those that have similar therapeutic effectiveness, without compromising patient choice and safety.

• **Patient-centred and shared decision making:** Patients should be included at the centre of the conversation about the best, greenest, and most appropriate healthcare intervention for their health condition. Discussing non-pharmacologic interventions and/or eco-informed prescription of pharmaceuticals should be co-decided with the patient. The goal of patient-centred and shared decision making is to empower patients in understanding their health condition and in choosing the treatment option for them [28].
Challenges and Opportunities

The implementation of eco-directed and sustainable prescribing of pharmaceuticals is imperative and aligns perfectly with the UK’s net zero and NHS’s sustainability directions (i.e. NHS England, NHS Scotland)\[1, 2, 3, 37\]. While there are opportunities to transform the current pharmaceutical prescribing regime in the UK to a greener and more sustainable one, this transition is also faced with a number of challenges.

Among the number of challenges, the UK Government's lack of commitment to seriously tackle the issue of pharmaceutical pollution remains a major hindrance to realise more sustainable healthcare decision making. While Greener NHS has plans and efforts to decarbonise NHS England, these initiatives only focus on reducing carbon emissions, with limited investment on reducing the concentration of APIs [2]. NHS Scotland is the only one of the four devolved healthcare system to include the environmental impact of medicines in its climate change and sustainability strategy along with the carbon emissions of pharmaceuticals [3]. There are also structural issues within the civil service (i.e. difficulty of knowing who pulls the lever on reducing pharmaceutical pollution) and post-Brexit regulatory environment that creates uncertainty; hindering meaningful engagement with the pharmaceutical industry and international partners (e.g. European Union); and could slow down access to safe and effective medicines.

Awareness and knowledge of policymakers about this issue is scant. There are few policymakers who are sensitised to the issue of One Health, specifically about pharmaceutical pollution and its contributions on AMR. Stakeholders agree that, while the concept of 'One Health' [38] has been used and has been helpful in pushing for sound environmental and health policies and plans in the country (i.e. UK National Action Plan on AMR) [39], the One Health agenda has limited traction among policymakers in the long-term. Particularly, there is little weight on the issue of One Health when discussing the environmental impacts of human medicines, as compared to veterinary medicines. While there are One Health targets in the current UK National Action Plan on AMR [39], stakeholders believe that these targets are not strong enough to make substantial impacts which are aligned with international goals, such as those set by the United Nations (UN), United Nation Environment Programme (UNEP), and the WHO [40, 41, 42].

Health and environment agencies' capacities (i.e. in terms of tools, investment, and technical skills) to conduct robust environmental risk assessment (ERA) of pharmaceuticals in the UK are also inadequate to support greener and more sustainable prescribing.

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The current ERA capacity in the UK is unable to investigate 'cocktail effects' of human and veterinary medicines on the environment and does not account for the selection risk for AMR. Different methods and techniques used to assess environmental risks of pharmaceuticals also result in inconsistent ERA data and challenge harmonisation of environmental profiles of pharmaceuticals that could be used to inform regulatory thresholds for environmental risk. In relation to this, ERA data submitted by pharmaceutical companies during market authorisation are not considered when approving licensing applications for human pharmaceuticals. Although some pharmaceutical companies publish ERA data on their websites, some ERA data submitted by pharmaceutical companies to the government for market authorisation, are not easily and openly accessible to the public aside from making freedom of information requests to respective agencies (i.e. Medicines and Healthcare products Regulatory Agency, MHRA). This could limit the utilisation of the data to inform better and improved pharmaceutical use. Moreover, there is also limited number of individuals who are skilled in analysing big ERA datasets in the UK.

With strong evidence suggesting the link between AMR development at environmentally relevant concentrations, there is appetite within the health sector, pharmaceutical industry, and the public to make the UK health service environmentally sustainable. Key organisations, such as the National Institute of Health and Care Excellence (NICE) and the MHRA, are starting to integrate environmental sustainability (i.e. to reduce greenhouse gas emissions) in their regulatory, licensing, and practice guidelines. Moreover, there is opportunity to integrate impact of pharmaceutical pollution on environmental AMR in the national agenda for AMR through the updating of the UK's National Action Plan on AMR for 2025, spearheaded by the Department of Health and Social Care (DHSC) in England and the Scottish Antimicrobial Prescribing Group (SAPG) in Scotland.

There is consensus among key stakeholders that the public health benefits of pharmaceuticals should take precedence over environmental impacts when making healthcare decisions (i.e. market authorisation, health technology assessment, pharmaceutical prescribing). Public health improvement is a number one motivation among key stakeholders when taking decisions on improving the use of human pharmaceuticals. The UK pharmaceutical industry is motivated to be in line with the UK Government's sustainability measures (e.g. Net Zero, Greener NHS, COP26 Health Programme commitments); however, it needs to be ensured that considering sustainability in healthcare should not compromise patient's health, wellbeing, and access to quality health and social care, including access to life-saving medicines.

While the One Health agenda has been integral in health and environmental policy frameworks in the UK, an emerging concept of 'Planetary Health' (defined as a 'solutions-oriented, transdisciplinary field and social movement focused on analysing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth') [43, 44]; could have more potential in gaining interest and traction among key decisions makers and levers in the UK Government, especially with high-level interest on actions to combat climate change, biodiversity loss, and environmental degradation.

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Eco-directed and sustainable prescribing of pharmaceuticals in the UK would require a broader and well-coordinated systems approach between health and environment agencies, pharmaceutical industry, academia and research institutions, and civil society organisations [45, 46]. The following policy recommendations focus on building the foundations of and removing the barriers for a more environmentally sustainable prescribing regime in the UK through multi-sectoral collaboration.

**Proposed Policy Measures**

Increase investment in health promotion and non-pharmacologic interventions

In 2022, the UK Government spent around £238 billion on healthcare [47]. The majority of the UK's healthcare budget goes directly to the NHS, covering treatment-focused expenses such as primary care and prescribing costs, with the remainder allocated to public health and social care [48, 49]. Reducing the need for pharmacological treatment would require investment in public health and social care infrastructures that would help prevent ill-health across the population.

01 Increase investment in improving the social and ecological determinants of health such as housing, food security, education, access to green and blue spaces, among others.

02 Funnel more resources in building social prescribing infrastructure (e.g. link workers, community-based providers, etc.) and maximise its potential as a mainstreamed, non-pharmacologic intervention.

03 Provide resources to conduct research activities that investigate the social returns of investing in greener, non-pharmacologic interventions.
Develop a comprehensive and integrated communications and advocacy strategy that would help improve knowledge and awareness among healthcare providers and the public about pharmaceutical pollution and ways to reduce its impact.

Create a wider and more inclusive 'sphere of engagement' between representatives from the government, industry, academia, and the public by building on existing networks such as the One Health Breakthrough Partnership in Scotland, the Pharma Pollution Hub at University of Exeter, and the UK's Cross-Government Working Group on Pharmaceuticals in the Environment.

Develop a comprehensive and integrated communications and advocacy strategy that would help improve knowledge and awareness among healthcare providers and the public about pharmaceutical pollution and ways to reduce its impact.

Integrate simple, key messages about the problem and solutions to pharmaceutical pollution in existing health and environmental campaigns (e.g. East Staffordshire's 'The Medicines Matter' campaign, Public Health England's 'Keep Antibiotics Working' campaign, 'Greener NHS' campaign, Thames Water's 'Bin It' campaign, Scottish Water's Nature Calls campaign, etc.).
Integrate environmental and sustainability criteria in healthcare decision making for pharmaceuticals

Currently, there is no established framework to systematically and effectively integrate environmental and sustainability considerations in healthcare decision making processes (i.e. market authorisation, health technology assessment, and pharmaceutical prescribing) [50]. However, this should not limit efforts to develop proofs-of-concept of user-friendly environment-sensitive decision and support aids that could be utilised by healthcare providers when providing healthcare to their patients. For example, the Stockholm Drug Therapeutic Committee in Sweden made environmental profile information (i.e. environmental risk; environmental hazard - persistence, bioaccumulation, toxicity) of essential medicines accessible in their formulary (i.e. Wise List), which now serves as a knowledge support tool for healthcare providers in patient education, consultation, and pharmaceutical procurement [51]. In the UK, NICE developed environment-sensitive decision aids on asthma inhalers [52] and started to ban desflurane (i.e. inhaled anaesthetic) due to its climate impacts [53]. NHS Highland in Scotland is also leading the development of UK’s first framework for eco-directed and sustainable prescribing of pharmaceuticals [54]. CREW also published Scottish-focused recommendations in integrating environmental criteria in healthcare decision making [55] which could be contextualised in other UK nations.

01 Improve adherence of healthcare providers and patients to existing clinical decision aids and programmes that generate co-benefits for the environment (i.e. medicine optimisation, rational prescribing, pharmacy take back scheme).

02 Require pharmaceutical companies to provide comprehensive, transparent, and complete environmental risk assessment data of pharmaceuticals during market authorisation.

03 Include an ecotoxicologist (i.e. expert in assessing environmental risk assessment data of pharmaceuticals) in the market authorisation assessment committee for human medicines.
Develop knowledge support or decision aids for healthcare providers in the NHS where environmental profiles of pharmaceuticals could be used for patient education and communication during consultation.

04

Use environmental risk assessment data submitted during market authorisation to develop an environmental profile database of pharmaceuticals prescribed within the NHS.

05

Make environmental profile information of human pharmaceuticals accessible to healthcare providers in the NHS and the public.

06

Develop knowledge support or decision aids for healthcare providers in the NHS where environmental profiles of pharmaceuticals could be used for patient education and communication during consultation.

07

Invest in projects that aim to develop proofs-of-concept and frameworks for incorporating environmental criteria in healthcare decision making (i.e. market authorisation, health technology assessment, pharmaceutical prescribing).

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Invest in extended environmental risk assessment of human pharmaceuticals

Current challenges in the environmental risk assessment process result in lack of transparency on the environmental risks posed by pharmaceuticals, bioethical concerns, inconsistent data, and unequitable testing burdens on small to medium size pharmaceutical companies. Extended environmental risk assessments described as having robust, comprehensive, transparent, and accessible environmental risk assessment data is integral to the development of environmental profiles of human pharmaceuticals. While environmental risk assessment data are submitted during market authorisation in the UK, accessibility to this information via public assessment reports is limited, insufficient, and not easily comprehensible to 'non-ERA' specialists (i.e. healthcare providers) to support eco-informed pharmaceutical prescribing. From a public health perspective, ERAs do not currently rigorously assess pharmaceuticals, especially antimicrobials, in terms of their AMR selective potential, nor is there a standardised methodology to assess this [56, 57].

01 Broaden information needed for environmental risk assessment of pharmaceuticals by including risk of AMR development, environmental risk of degradation products, and combination effects in addition to environmental risk and hazard (i.e. persistence, bioaccumulation, toxicity).

02 Develop a definitive, enhanced, and open access database of environmental profiles of human pharmaceuticals, by building upon existing work on environmental risk assessment of human pharmaceuticals (i.e. AstraZeneca's EcoPharmacoVigilance dashboard; PREMIER Project - Prioritisation and Risk Evaluation of Medicines in the Environment).

03 Provide sustained investment for regular updating of ERA data of human pharmaceuticals informed by NHS prescribing data (i.e. commonly prescribed or generic medicines).

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Conclusion

Evidence suggests that concentrations of pharmaceuticals in the environment are at levels that pose environmental risk and contribute to the existence of antimicrobial resistant organisms in the environment. Implementing eco-directed and sustainable prescribing of pharmaceuticals in the UK's healthcare system is one of the many upstream and pragmatic approaches that could help reduce pharmaceutical pollution, biodiversity loss, and potential future harm to human health. This sustainable pharmaceutical prescribing practice is in line with NHS net zero and environmental sustainability ambitions and the COP26 Health Programme commitments of the UK.

While there are opportunities to implement this prescribing practice in the UK context, there are challenges that need to be considered and resolved. These include government commitment, regulation, awareness among policymakers, and the capacity of UK’s health and environmental agencies to support the transition to greener and more sustainable prescribing of pharmaceuticals.

By understanding these challenges and opportunities, this policy brief proposes the following themes of policy measures that would help lay the foundations of a greener and more sustainable prescribing practice in the UK.

- **Public health promotion and non-pharmacologic interventions**: Increasing investments in improving the social and ecological determinants of health, building infrastructures for more accessible non-pharmacological interventions with high social returns.

- **Meaningful engagement for the promotion of greener and more sustainable healthcare**: Creating opportunities for wider, inclusive, and meaningful sectoral engagements supported by comprehensive and integrated communications and advocacy strategy.

- **Environmental and sustainability considerations in healthcare decision making**: Incorporating environmental and sustainability information in clinical decision aids for healthcare providers as a tool for patient education.

- **Extended environmental risk assessment of human pharmaceuticals**: Supporting the development of environmental and sustainability information for pharmaceuticals with robust, comprehensive, and transparent environmental risk assessment data.

The adoption and implementation of eco-directed and sustainable pharmaceutical prescribing in the UK would take time to be mainstreamed within the healthcare system as well as in the functions of UK’s environment agencies. These proposed policy measures require long-term investment and collaboration between the government, industry, academia, and civil society organisations. Fidelity to implementing these measures would have positive co-benefits for human and planetary health, without compromising public health and patient safety. Finally, these measures propose research directions to develop and improve our understanding about the impacts of pharmaceuticals on the environment and human health.

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Policy Brief: Eco-directed and Sustainable Prescribing of Pharmaceuticals in the United Kingdom
### Abbreviations

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<td>AMR</td>
<td>Antimicrobial Resistance</td>
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<td>API</td>
<td>Active Pharmaceutical Ingredient</td>
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<td>CIP</td>
<td>Chemical Investigations Programme</td>
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<td>COP</td>
<td>Convention of Parties</td>
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<td>CREW</td>
<td>Centre of Expertise for Waters</td>
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<td>DHSC</td>
<td>Department of Health and Social Care</td>
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<td>ERA</td>
<td>Environmental Risk Assessment</td>
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<td>MEC</td>
<td>Measured Environmental Concentration</td>
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<td>MHRA</td>
<td>Medicines and Healthcare products Regulatory Agency</td>
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<td>NHS</td>
<td>National Health Service</td>
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<td>NICE</td>
<td>National Institute for Health and Care Excellence</td>
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<td>OHBP</td>
<td>One Health Breakthrough Partnership</td>
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<td>PiE</td>
<td>Pharmaceuticals in the Environment</td>
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<td>PREMIER</td>
<td>Prioritisation and Risk Evaluation of Medicines in the Environment</td>
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<td>SAPG</td>
<td>Scottish Antimicrobial Prescribing Group</td>
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<td>UK</td>
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<td>UKWIR</td>
<td>UK Water Industry Research</td>
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<td>World Health Organisation</td>
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