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Research article

Interventions to Reduce the Environmental Impact of Medicines: A UK perspective☆

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ABSTRACT

Many doctors are taking steps to reduce their personal carbon footprints, but few know how to tackle the high environmental impact of the care they provide at work. In particular, many are unaware of the wider impacts of medications we prescribe. Health and care services produce around 5% of the United Kingdom's total CO2 and the largest part of this comes from its supply chain - medicines and equipment. In addition to carrying a significant carbon footprint, pharmaceuticals have wide-ranging environmental impacts. Effluents from production and usage have been shown to have a damaging effect on wildlife and contribute to antimicrobial resistance. This article examines the ways in which healthcare professionals can intervene to reduce pharmaceutical pollution.

Introduction

Many doctors are taking steps to reduce their personal carbon footprints, but few know how to tackle the high environmental impact of the care they provide at work. In particular, many are unaware of the wider impacts of medications we prescribe. United Kingdom (UK) health and care services produce around 5% of the country's total CO2 and the largest part of this comes from its supply chain - medicines and equipment [1]. The National Health Service (NHS) has produced estimates of the carbon cost of the different healthcare specialties. This identifies 'hotspots' for our initial interventions. One of these hotspots is medicines prescribed in primary care, estimated as 3619 ktCO2e in 2015 or 65% of the total emissions related to primary care [2]. In addition to carrying a significant carbon footprint, pharmaceuticals have wide-ranging environmental impacts. Effluents from production and usage have been shown to have a damaging effect on wildlife and contribute to antimicrobial resistance [3]. There is evidence of widespread damage to wildlife from fluoxetine, oxazepam and oestradiol in the aquatic environment [4]. Veterinary treatment of cattle with diclofenac has decimated vulture populations in India [5]. Around 600 different medicines can be found in wastewater and effluent and little is known about their effects on the natural world and ultimately on human health [6].

Pharmaceutical companies must address the environmental impact of their products, including manufacture, sterilization, packaging, waste production and transport. Governments and regulatory authorities also have a role in identifying and responding to ecological damage. As a large purchaser of pharmaceuticals, the NHS can drive markets towards the most sustainable products by preferentially purchasing from manufacturers making the best progress towards reaching net zero and minimizing their environmental impact. Finally, prescribers and patients have a role to play; this article focuses on ways in which prescribers can reduce pharmaceutical

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pollution. This perspective is from UK mental health and primary care prescribers but we believe the principles apply generally and have included examples and references from other specialities where relevant.

Low carbon prescribing means offering the right people the right information to help them to choose the best treatment. It then uses the lowest effective dose for the shortest period of time, selecting drugs that have the smallest carbon and ecological footprint and makes the best use of alternatives such as psychotherapy, social prescribing and green care [2].

Evidence-based prescribing

About one eighth of all prescribing in primary care in the UK is related to mental health issues; it therefore offers an appropriate setting to look at the extent to which we are using evidence, involving patients and prescribing effectively. Drug treatments in mental health disorders are clearly effective and life saving for many but the clinical benefit of commonly used medications is often small (number needed to treat (NNT) ≥6). The National Institute for Health and Care Excellence (NICE) acknowledges this in its guidelines and for many common disorders, medications are not first line. In their information for patients, the Royal College of Psychiatrists say that many people taking antidepressants get little benefit and some even get worse [7]. Between a quarter and a third of people with psychosis will relapse even when fully concordant with medication [8]. Frequently used pharmacological strategies in severe mental illness often have limited evidence for their effectiveness. In one study, antidepressants used in bipolar affective disorder had little correlation with mood symptoms [9].

Individuals, practices and regions vary greatly in prescribing rates for common conditions. Such variation points to factors other than optimal patient care which, if addressed, could reduce the use of many medicines. Clinical decision support systems are potentially useful tools for ensuring the most evidence-based treatments are offered and hence for reducing ineffective and environmentally damaging prescribing [10]. Surveys have shown that many doctors overestimate the benefits and underestimate the harms of medicines in the management of long-term conditions, so accurate, easily available information is needed [11]. The inclusion of data on effectiveness into decision-making systems that help clinicians more accurately assess the benefits of different medications is likely to help reduce the carbon footprint of prescribing.

Medicines optimization

Medicines optimization [12] aims to reduce prescribed items and can therefore save carbon and reduce other environmental harms [13]. Medicines reconciliation avoids unnecessary prescribing and reduces errors. A 2021 review estimated that at least 10% of the total number of prescription items in UK primary care were unnecessary [14]. The 2019 Public Health England (PHE) review of prescribed medicines highlighted the scale of long term, potentially addictive medication prescribing in the UK [15]. In the year 2017 to 2018, 1 in 4 adults were prescribed benzodiazepines, zopiclone and zolpidem, gabapentinoids, opioids for chronic non-cancer pain or antidepressants. The report also found that longer term prescribing is widespread and both the rate of prescribing and the duration of use was associated with dependence. Suggested ways to reduce this included improving clinical guidance on prescribing potentially addictive medications, encouraging compliance with this and providing information for patients and carers to support shared decision making and informed choices.

Reducing over-prescribing does not reduce treatment effectiveness and can have many benefits for patients, the environment and wider society. For example, reducing polypharmacy has been shown to be noninferior to usual care in management of hypertension in the elderly [16]. Likewise, opioid overprescribing has had serious adverse effects on society but a reduction in prescribing can be achieved [17].

A focus on unwarranted variation is part of the NHS Long Term Plan. Choose Wisely in England [18] and Realistic Medicine in Scotland [19] and Less is More in the US are all campaigns intended to reduce over-prescribing and low value interventions. Their use in sustainable prescribing should be examined and barriers challenged [20].

In UK primary care, the Network Contract Directed Enhanced Service recommends medication optimization through Structured Medication Reviews (SMR) and has produced recent guidance [21]. SMRs are a NICE approved, clinical intervention designed to include a comprehensive clinical review of a patient's medications. These are conversations aimed at ensuring that patients' medication is working well for them, and are underpinned by shared decision-making principles. In this process patients are supported to make the best decisions about which medicines they should or should not take. The final decision to prescribe or de-prescribe must be based equally on the clinical evidence, the prescriber's experience and the patient's values, experience and wishes.

Patient involvement in the prescribing process

Shared decision making (SDM) can make a big difference in preference-sensitive treatment choices [22]. SDM aims to support patients to articulate their understanding of their condition and of what they hope treatment (or self-management support) will achieve. A shared understanding of these treatment goals may reduce the chances that a medication solution is chosen. It aims to inform patients about their condition, about the treatment or support options available, and about the benefits and risks of each and to ensure that patients and clinicians arrive at a decision based on mutual understanding of this information. There is evidence that SDM can be effective in changing management plans and reducing financial cost which is a good proxy for carbon intensity [23]. However, SDM can be a challenge and training is necessary to make it effective. Adequate training and open and honest conversations between clinicians and service users are needed to overcome barriers, for example in its use in psychosis [24] and in ophthalmology [25]. Refining practice around shared decision making could help make it a more effective tool [26].

Overuse of low value health care interventions can be harmful to patients as well as to the environment [27]. It is likely that many people given these low value interventions were not fully informed of the risk-benefit ratios. If we are knowledgeable, accurate and candid about the benefits and harms then service users can make fully informed choices about what they want. Sometimes the outcomes most valued by service users are not the same as those used in the efficacy research studies [28]. Patient Decision Aids (PDAs) are tools to put evidence in the context of patient preferences and can be effective if linked to locally and rapidly available resources. PDAs minimise waste and therefore environmental damage by identifying patient preferences and values which may be different from those of the prescriber.

Self-management is another established practice which if used more widely has potential to reduce the environmental footprint of pharmaceuticals. Self-management involves a number of elements, including educating patients about a condition and its treatment, collaboratively creating individualized treatment plans, and helping people develop skills and strategies to support self-monitoring and adherence to treatment. Self-management is one of the central tenets of sustainable healthcare. It can reduce healthcare resource use and improve concordance and hence reduce prescribing and waste. Empowering service users to self-manage long term conditions including asthma, diabetes, hypertension, depression and other

mental health conditions can reduce their use of services and prevent relapses [29].

Deferred prescriptions is a method whereby doctors give patients a prescription for use at a later date, if their symptoms do not improve. A Cochrane review found that delayed prescribing significantly decreases antibiotic use, whilst there were no differences between clinical outcomes [30]. This method should be researched to see whether it can safely be expanded beyond its occasional use for antibiotics to include other self-limiting conditions such as anxiety and mild to moderate depression.

Waste and disposal

We must also address what happens to prescription medications once they are collected by patients. Half of all prescriptions are not taken as directed [31]. This creates enormous amounts of waste. Packets of medicine returned unopened cannot, under current UK regulations, be reused. There are a myriad of reasons why patients are non-compliant. Physicians can address some of these by encouraging true collaborative shared care [32]. This may involve deeper discussion about the patient's expectations and understanding of the benefits and harms of treatment options. In many instances it may be possible that non-pharmacological options are the patient's preferred choice. Patient-led care improves medication adherence and reduces waste [31].

Many patients with long term mental health conditions find the benefits of continuing medication is outweighed by the harms. In this situation, SDM and individualised treatment plans may lead to patient and doctor agreeing to a strategy of not providing medication, so-called managed non-concordance. This is preferable to what happens too commonly in the UK and likely elsewhere, which is that the patient accepts the prescription at the doctor's insistence but does not take the tablets. There will therefore be environmental costs from production and distribution of these drugs but no clinical benefit; and risks related to improper disposal.

Healthcare professionals and pharmacists can provide patients with information about appropriate disposal of medications. Most patients will be unaware of the potentially polluting effects of their discarded medications. Disposing of medications appropriately can keep pharmaceuticals from polluting water systems and prevent release of potent greenhouse gases from partially used metered dose inhalers [33]. Healthcare organisations can sign up to environmental stewardship strategies. Wastewater treatment is an area which requires ongoing advancements as at present, high concentrations continue to be found downstream of sewage treatment plants [34]. Tackling this issue will require collaboration between pharmaceutical and environmental services [35].

Lastly, there is the issue of expiration dates; one study showed that all the expired drugs tested were still active past their recommended expiration dates, even when storage was not optimal [36]. This raises the question of how expiration dates are determined and how much they contribute to unnecessary waste. This area requires further exploration.

Non-pharmacological interventions (NPIs)

There is an increasing evidence base for NPIs including green, blue and social prescribing [37]. Green prescribing involves nature-based interventions and activities [38]. Blue prescribing follows the same premise but specifically refers to water environments, such as rivers, coastlines and wetlands [39]. Social prescribing involves referral to non-clinical services such as community groups or statutory services for practical and emotional support [40].

A wide range of physical, group and social activities have been associated with better physical and mental health [41]. Prescribing a structured exercise program for osteoarthritis of the knee can reduce symptoms and improve function to a degree comparable with drugs [42]. There is also evidence that NPIs can be as effective as medications in a number of areas of mental health. Indeed, the Royal College of Psychiatrists has recently published a position statement jointly with the Royal College of Occupational Therapists advocating for social prescribing [40]. The World Health Organisation says 'Green spaces are important to mental health. Having access to green spaces can reduce health inequalities, improve well-being, and aid in treatment of mental illness. Furthermore, physical activity in a natural environment may help remedy mild depression and reduce physiological stress indicators' [43]. NPIs can reduce the use of medication and hence environmental harms. For example, many people are on chronic long-term antidepressants whereas cognitive therapy could enable discontinuation of the medication without adverse effects [44]. Practical guidance is available on how to implement NPIs and deprescribe medication for insomnia [45]. There is also evidence that exercise can reduce the pathological changes associated with Alzheimers [46], although clinical effects are lacking [47].

Even in serious psychotic mental health disorders NPIs can make a significant difference; for these patients, there is evidence that combined psychological and pharmacological interventions produce the best outcomes [48]. NPIs for major mental illness include volunteer support delivered through a dedicated 'befriending' programme [49], cognitive behavioural therapy, strategies to normalise symptoms, reduce stigma, and explain triggers to hallucinations. Keeping a diary of voices can also reduce anger, sadness, shame and anxiety. The teaching of coping strategies such as distraction and mindfulness are effectively used in practice and could be made universal.

NICE recommends that psychological support is the first line treatment for most common mental problems, yet the availability of psychological therapy and other NPIs is often poor. Social prescribing has promise but more research is needed to prove its effectiveness in reducing pharmacological prescribing [50]. Education and resources are needed to improve prescribers' knowledge of and access to NPIs including psychotherapy, social prescribing and green/blue prescribing. The appropriate use of NPIs can reduce or sometimes replace drug treatments, decreasing the total use and thus environmental impact of pharmaceuticals.

Talking about green prescribing in the consultation

Optimally, discussing environmental issues with patients should become more commonplace and accepted as a valid use of clinical time by service providers and regulators. This empowers patients to make choices that are better for their health and for the planet. Many clinical encounters bypass important environmental factors, despite advocation from NICE in their guidance [51] and from the UK Royal College of Paediatrics and Child Health [52]. Asthma reviews, for example, are an opportune time to discuss the harmful effects of air pollution. Patients can be encouraged to reduce their exposure to emissions, for example walking or cycling rather than driving, which may also improve their fitness. Metered dose inhalers contain hydrofluorocarbon propellants which are potent greenhouse gases, meaning they contribute to global warming dramatically more than dry powder inhalers [50]; clinicians should consider educating their patients on the difference and where appropriate, offering them a lower carbon alternative. Clinicians may encounter eco-distress during these conversations, and understanding how to respond to this is necessary.

Conclusion

Healthcare systems need to adapt in order to optimise care provision whilst remaining within planetary boundaries - addressing the environmental consequences of prescribing is a critical part of this. Healthcare relies heavily on the use of pharmaceuticals and

healthcare professionals can play a role in reducing the significant environmental impact of our prescribing. This paper has identified multiple areas where interventions are proposed; clinicians can reduce the impact of their prescriptions by medicines optimization, patient-centred care, and the appropriate use of non-pharmacological interventions. The urgency with which we respond to the climate and ecological emergency is growing and so all these strategies warrant our attention.

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