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Healthcare sobriety and pollution awareness for a green healthcare sector: a Belgian qualitative study

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**Healthcare sobriety and pollution awareness for a green healthcare sector:
a Belgian qualitative study**

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Keywords

Stakeholders' perception; Healthcare pollution; Healthcare Sobriety ; Facilitators; Barriers.

Abstract

The healthcare sector’s contribution to climate change and pollution more broadly is now widely recognised as problematic. Not only does it disrupt the ecosystems and the living environment, but it also paradoxically affects human health. In recent years, an increasing number of countries have committed to reducing the ecological footprint, or in other words, the ‘environmental cost’ of their healthcare system. Achieving a responsible transition toward a greener healthcare sector requires considering the perspectives and potential roles of various actors and stakeholders within the field. Thus far, very few studies have investigated the perspectives of (potential) healthcare consumers on challenges, ethical issues and social tensions that could arise during the transition to a greener healthcare system. To address this gap, we carried out five group interviews, exploring the views of 28 participants on climate change, healthcare pollution, and their sense of engagement in reducing healthcare pollution.

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Data were collected, coded and analysed using an inductive process. While most participants perceived climate change as a serious threat to human health, many were unaware of the healthcare sector's significant contribution to it. Pharmaceutical waste and plastic pollution were identified as the main problems. Two promising avenues for reducing healthcare pollution emerged from the findings: promoting *healthcare sobriety* and improving education for actors and stakeholders on the sector's contribution to global pollution. Participants defined healthcare sobriety through four key elements: adequate care, collective responsibility, ecological finance, and prevention. Regarding education, they underline that it should be done at the right time, by the right person and in an effective manner. Two important barriers to achieving these goals were identified: participants are less willing to accept trade-offs when it is health-related; and ethical concerns were raised about mobilizing vulnerable populations to achieve carbon neutrality in the healthcare sector.

Introduction

According to the World Health Organization (2021), climate change is "*the single biggest health threat facing humanity*". The healthcare sector bears the negative impact of pollution on human health, but it is also a major contributor to climate change. Between 2000 and 2015, the sector increased its greenhouse gas (GHG) emissions by 29%, reflecting the doubling of global expenditures on healthcare during the same period (Lenzen et al., 2020). The 2022 *Lancet Countdown* report highlighted that the healthcare sector accounts for 5.2% of the global GHG emissions (Romanello et al., 2022). As the healthcare sector does "*not only protect people from negative health impacts of climate change, but also contributes to worsening them*" (Luo et al., 2023), many countries committed to move toward climate-resilient and/or sustainable low carbon health systems at the 2021 UN Climate Change Conference (COP26) in Glasgow, UK (World Health Organization, 2022). F

The transition to a sustainable healthcare sector should involve all actors and stakeholders (Littlejohns et al., 2019); including healthcare workers, policymakers, healthcare consumers, as well as healthcare manufacturers and companies. Each of these groups can play a role in promoting "*climate-safe and healthy models of care, [protect] resources and natural assets, and [adopt] sustainable procurement practices*" (Lenzen et al., 2020). In recent years, research has explored the perceptions and views of healthcare professionals and/or students regarding sustainable healthcare (Gasciauskaite et al., 2023, Zaw et al., 2023, Luo et al., 2023, Luo et al., 2024, Hammer et al., 2024, Álvarez-Nieto et al., 2022, López-Medina et al., 2022). While most participants in these studies were motivated to achieve sustainable goals, they identified

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barriers such as a lack of knowledge on sustainable practices (Gasciauskaite et al., 2023, Zaw et al., 2023) and limited environmental awareness (López-Medina et al., 2022). Luo et al. (2023) argued that healthcare professionals were well positioned to facilitate and promote sustainable and local changes (Luo et al., 2023), however healthcare consumers also play a critical role. In particular, *"understanding how patients feel about sustainable healthcare is important to help plan for the future"* (Knagg et al., 2024). Still, research on patients' perspective has been limited (Knagg et al., 2024, Quitmann et al., 2023, Cameron et al., 2021). Moreover, stakeholders must anticipate, discuss, and address the potential challenges, ethical issues and social tensions that could arise during this transition (de Maack et al., 2024).

Bioethics scholars have recently started engaging with the ethical challenges posed by the ecological transition of healthcare systems. Richie (2019) advocates for "green bioethics", which promotes principles of distributive justice, resource conservation, simplicity, and ethical economics as cornerstone of ethical decision-making in this context. Resnik (2009) highlighted the inherent conflict between the human health benefits of some policies and their environmental harm, proposing an ethical decision-making approach to help policymakers balance human health promotion with environmental protection. Similarly, Capps (2022) introduced a "One Health Ethics" framework underlining the interconnectedness of human, animal, and environmental health, and envisioning a natural moral community that bridges cultural and natural worlds to support all forms of life. This emerging theoretical discussion underscores the complexity and urgency of addressing the ethical considerations in the intersection of health and environmental sustainability (Ten Have and Gordijn, 2023, de Maack et al., 2024). According to Gurevich (2020), the healthcare sector was slow to adopt sustainable and environmental changes because *"traditional bioethics only considers patient and doctor as the stakeholders"*. He argued, however, that *"the first tenet [of the four principles] is 'do no harm,' and as such, most efforts are directed toward the welfare of the patient"* (Gurevich, 2020). Richie (2024) further notes that the ecological transition of healthcare must avoid exacerbating social inequalities and health disparities. Those least equipped to reduce their environmental impact often lacks the *autonomy* to make sustainable choices, deepening the divide between themselves and more advantaged groups. This not only limits their ability to act but paradoxically increases their contribution to pollution despite their efforts (Ehigiamusoe et al., 2022). Environmental factors such as air and water quality, access to healthy food, housing safety, and working conditions directly affect the physical and mental health of populations (Santana et al., 2020, Brulle and Pellow, 2006, Kruize et al., 2014). At the same

time, social inequalities—such as unequal access to healthcare, education, and economic opportunities—exacerbate disparities in individual health outcomes (Wagstaff, 2002, Dickman et al., 2017, Thomson et al., 2017, Smith et al., 2022). This vicious cycle worsens climate change, as the most disadvantaged people are disproportionately affected by its impact (Faist, 2018, Paavola, 2017), and so, in need of more healthcare, which in turn increases pollution. This underscores the importance of *responsibility*, not only in mitigating the effects of climate change but also in ensuring that the ecological transition does not disadvantage the most vulnerable.

Given the growing commitment to green healthcare objectives, the development of low-carbon health systems, the scarce literature on the perspective of key main actors and stakeholders' on transitioning to green healthcare and the ethical issues introduced by this transition, this paper aims to map healthcare consumers' perceptions in three key areas: (1) their views on climate change, (2) their awareness of healthcare pollution, and (3) their sense of engagement in reducing healthcare pollution.

Belgium was selected as a case-study. Healthcare spending in Belgium represents 10.3% of the gross domestic product (GDP) and 5.5% of the national GHG emissions are attributable to its healthcare system (Karliner et al., 2021). Furthermore, Belgium has committed to the two major engagements of the COP26 regarding health systems (World Health Organization, 2022).

Methods

We conducted a qualitative study based on five group interviews involving a total of 28 participants.

Participants

The study aimed to collect the views of (potential) healthcare consumers, encompassing the perspectives of the general public. As everyone has been (or is likely to be) a healthcare consumer at some point, whether through undergoing a medical test, taking medication, or visiting a healthcare professional, we did not apply any stringent exclusion criteria. This approach acknowledges that different groups of healthcare consumers may have differing views on this topic and analysing these differences is beyond the scope of this paper. Participants were required to be at least 18 years old, able to speak French, and willing to participate. We used a purposive sampling to ensure variation in participants' age, gender and activity status (student, worker, pensioner), thereby increasing the diversity of perspectives on

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our research questions. Recruitment and interviews were conducted between January and March 2024 using snowball sampling. Participants were recruited through our network in hospitals and universities, and information about the study was provided via email. Participants were invited to express their consent and willingness to participate via email. A 25€ voucher was offered as a compensation for participation in the study.

Data collection

All group interviews were conducted in French and in person by the same investigator (Desterbecq), using a standardised interview guide (Appendix 1). The guide was collaboratively developed by Desterbecq and TUBEUF and structured to address three main themes: (1) participants’ self-assessment of their responsibility in tackling climate change, (2) their understanding of the healthcare sector’s contribution to climate change, and (3) their identification of barriers and facilitators to reducing this contribution. No information on healthcare pollution was provided to participants prior to the interviews. Such information was only shared subsequently when none of the participant in the group showed awareness of the issue or mentioned it up during the initial stages of the discussion. Individual socio-demographic data were collected after the interviews via an online questionnaire using Qualtrics.XM (<https://www.qualtrics.com/>). Recruitment and data collection stopped once no new themes emerged and thus, thematic saturation was reached. No repeat interviews were conducted.

Data analysis

Interviews were audio-recorded with the consent of each participant and transcribed into verbatim. Data were analysed following an inductive process and based on the framework approach, widely used in qualitative analysis (Hackett and Strickland, 2018, Smith and Firth, 2011). The framework approach comprises five stages: (1) familiarisation with the data by reading the transcript; (2) construction of a preliminary thematic framework which emerged during the interview and during the reading phase; (3) qualitative data indexing and sorting (= coding) using the software 'MAXQDA'; (4) data synthesis and display through data charting; and (5) mapping and interpretation of emerging themes and sub-themes. The coding stage was not influenced by the three pre-determined themes, but the interpretation stage was aligned to these themes. Stages 1 to 3 were carried out by Desterbecq, while all co-authors participated in stages 4 and 5. Socio-demographic characteristics were analysed using IBM SPSS statistics 27.

Results and discussion

Sample description

We conducted five group interviews (GI1: n=11; GI2: n=2; GI3: n=2; GI4: n=5 and GI5: n=8). The interviews lasted an average of 85 minutes (min: 52.0 ; max: 114.5). Table 1 provides an overview of participants involved in this study.

Table 1 - Participant characteristics

	Total	GI1	GI2	GI3	GI4	GI5
Number of participants	28	11	2	2	5	8
Sex						
Male	8	1	0	1	3	3
Female	20	10	2	1	2	5
Employment						
Student	8			2	5	1
Full-time employee	15	8			0	7
Part-time employee	3	3				
Unfit to work	1		1			
Pensioner	1		1			
Education						
High School	6	1		2	2	1
Bachelor degree	4	1	1		1	1
Master degree	13	7			2	4
PhD	4	2				2
Other	1		1			
Age (years)						
Mean	33.7	40.2	62.0	20.5	21.6	28.5
(Min; Max)	(18;73)	(33;52)	(51;73)	(20;21)	(18;24)	(21;42)
Interview duration (minutes)						
Total;	425.0;	110.1	114.5	52.0	72.2	76.5
Mean	84.8					
(Min; Max)	(52.0;114.5)					

The atmosphere of all the interviews was calm and relax with no tension perceived between participants. As a moderator, it is challenging to ascertain if each participant fully expressed their views. The group setting may have introduced a "*self-censoring and conforming influence*", a behaviour more common in group interviews than in individual interviews (Powell and Single, 1996). However, a wide range of opinions was shared and discussed during the interviews. This sometimes led participants to agree with ideas or remarks they had not initially considered. In this context, interactions proved to be a valuable resource as they "*allowed the participants to clarify individual opinions and to compare their positions*" thereby stimulating participation through a "*sharing and comparing process*" (Acocella, 2012).

Perception of climate change

All participants were aware of climate change. When discussing climate change, participants framed their responses in two different ways: either in terms of its impact on the environment, or the changes in behaviour they had adopted in response to it.

Impact on the environment

Most participants reported that climate change, particularly heat waves, negatively impacted their physical health. For instance, by causing allergies, exhaustion, heatstroke, skin diseases or sleep disorders: "*Because in summer, it's very, very hot. As a result, I'm in a situation where I feel exhausted. It's too hot. At some point, it takes a lot of energy.*" (P19)

They also reported that their mental health was affected by climate change through emotions such as "*bad mood*" (P19) and anxiety about the future consequences for human health, and living conditions more broadly. These negative effects of climate change on mental health have already been explored. For example, in 2022, extreme weather was associated with a record 0.53 percentage point reduction in online positive sentiment expression during heatwaves, and a 0.31 percentage point reduction in positive sentiment expression during extreme precipitation days (Hersbach, 2023). In their literature review, Cianconi et al. (2020) identified studies which highlighted that climate change events affect population's mental health through "*mood disorders such as depression, anxiety, increased suicide rate and substance use, as well as increased aggressive behaviour*".

Interestingly, many participants reported being concerned not only for themselves, but even more importantly, for others. They expressed worries about the impact of climate change already has and will likely increasingly have on vulnerable people, such as the elderly, future generations, and people living in low- and middle-income countries (LMICs): "*I'm more afraid for others, in other parts of the world (...) or in future generations, than for myself directly.*" (P27). Scientists have already studied the disproportionate impact of climate change on vulnerable populations and emphasized the need for preventive measures to protect these groups: "*It is imperative that clinicians and policymakers confront the issue of climate change and natural disasters, developing relief efforts and preventative measures to secure the well-being of underserved groups who may not have many resources at their disposal*" (Benevolenza and DeRigne, 2019). In the 2024 Europe report of the *Lancet Countdown* on health and climate change, van Daalen et al. (2024) recognized that variations in exposure, sensitivity, and adaptive capacity – often shaped by interconnected patterns of socioeconomic development, marginalization, and persistent inequities, lead to unequal distribution of the health impacts of climate change among populations.

Most participants agreed that climate change impacts biodiversity, particularly wildlife such as insects and plant life: "*The problem [season changes] is that it disrupts the whole biodiversity ecosystem.*" (P9)

Many participants viewed media coverage of climate issues as inadequate, reporting that they did not feel sufficiently informed about the crisis and the associated extreme events: *"I don't get the impression that there was much media coverage on the topic."* (P21). The 2024 report of the *Lancet Countdown* on health and climate change highlighted that media engagement is low but stable (van Daalen et al., 2024). However, increased media coverage could enhance awareness and knowledge of climate issues and thus influence *"public perceptions and government agendas"* (Schmidt et al., 2013, van Daalen et al., 2024).

Adaptation process to climate change

For most participants, their knowledge and concerns about climate change have prompted them to adopt environmentally friendly behaviour(s). For example, they prefer walking or using public transport as their primary mode of travel, and they actively sort their waste. They also reported their desire to preserve the environment and the planet for future generations is a key motivation for behavioural change. According to van Daalen et al. (2024), individual engagement with climate change remains low in Europe. However, the participants' behavioural changes can be attributed to their high level of awareness about the issues and their willingness to act for mitigating the adverse effects of climate change.

A few participants (n=3) expressed a feeling of injustice when making such changes. They reported wanting to change their behaviour to address the climate crisis, but at the same time, they felt constrained and even blamed by the government in their initiatives: *"I find that the theme of injustice is very predominant, because as another participant said, we're [understood as the government] mainly going to blame the public. Among the public, there are many people who can't afford to pay I don't know how many to go somewhere by train, or who can't afford to buy clothes that are eco-responsible. We say to these people, yes, you have to change your habits, but we don't give them the means."* (P22). It appears that citizens want to be part of the solution to tackle climate change but they do not feel sufficiently considered by politicians. In any democracy, the viewpoint of the population should be reflected in policy decisions (Dahl, 1956, Kinnunen, 2021). However, a lack of congruence between citizens' opinions and policy support could reduce democratic performance and participatory engagement. Accordingly, Albarracín et al. (2024) identified social-structural determinants such as descriptive norms, material incentives, social support and access as promising to support individual behavioural changes, specifically in the health and environmental domains.

Perception of healthcare pollution

For most participants, the pollution of the healthcare sector came from three sources: waste, resource use and building.

Waste

Waste is a broad theme that encompasses both pharmaceutical pollution and plastic pollution. According to the participants, **pharmaceutical pollution** refers to environmental consequences associated with drug production, such as the *"destruction of local ecosystems and small towns with drinking water problems"* (P1). It also includes drug residues in wastewater following drug consumption. Water pollution by chemical pollutant is a topic of great concern with increasing worldwide scientific evidence (Thornber et al., 2022, O'Flynn et al., 2021, Wilkinson et al., 2022, Ortúzar et al., 2022, Freitas and Radis-Baptista, 2021, Richie, 2022, Belkhir and Elmeligi, 2019, De Soete et al., 2017). Hence the European Commission has defined contaminants of emerging concern (CECs) as *"substances that have the potential to enter the environment and cause adverse ecological and human health effects, but are still largely unregulated and whose fate and potential effects are poorly understood"* (O'Flynn et al., 2021). Future research could explore the extent to which drugs consumers feel responsible for pharmaceutical pollution and whether they would be willing to change behaviour.

Additionally, participants highlighted overproduction and overuse of drugs as sources of pharmaceutical pollution: *"It's also something that makes me think about the overuse of drugs. Sometimes I'm surprised by the adverts, I have the impression that before I didn't see so many of them, I wasn't paying attention. Sometimes I say to myself that it's a bit strange because in fact you should take this if you're ill, it's a doctor who tells you what you have to do."* (P22) Some participants (n=3) recommended reducing pharmaceutical pollution by limiting the drugs production to what is strictly necessary and avoiding a multiplicity of brands for the same molecule. Ethical and economic concerns accompanying such solutions include the potential risk of giving a single pharmaceutical company too much power to corner the market, which could drive up drug prices and the costs of other health technologies. This, in turn, would increase the financial burden on already strained public healthcare systems and consumers.

Plastic pollution primarily refers to single-use drug and food packaging. Waste management issues are associated with products that cannot be recycled or have passed their use-by date. In their study on stakeholders' perception in a German hospital, Quitmann et al. (2023) identified waste, including packaging waste, as being perceived as the most harmful for nature because of its *"tangibility, visibility and increase in daily hospital life"*(Quitmann et al., 2023).

A participant suggested that, to reduce drug packaging, pharmacists should dispense only the quantity of drugs needed according to the prescription, rather than providing an entire box. This approach is already used in the UK NHS for controlled drugs, which are defined as "*drugs sufficiently dangerous or otherwise harmful, with the potential for diversion and misuse*" (McCann, 2014). In line with this practice, the prescription should indicate the total quantity of medication and be limited to 30-day supply or less (McCann, 2014). However, this is a complex issue, where tensions appear between continuing with original pack dispensing and returning to pharmacist, which may reduce patients' compliance.

Resource use and building

Resource use, such as water and energy, in healthcare technology production and service delivery was seen as an important source of pollution: "*But what's even more worrying is the amount of resources - energy, materials, drugs, everything - used by the hospital sector, which you don't necessarily realise if you're not a doctor or don't work there. As a patient, you don't actually see much. And behind that, in fact, is a huge industry with impacts at all levels.*" (P25)

Adequate resource use is key to insure environmentally sustainable health systems. The World Health Organization (2020) defines "environmentally sustainable health systems" as those which "*improve, maintain or restore health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, for the benefit of the health and well-being of current and future generation*". Hence, healthcare facilities have to optimize resource consumption and find the right balance between maintaining care and avoiding waste and resource depletion (Corvalan et al., 2020).

Furthermore, medical infrastructures such as hospitals are perceived as aging and not adapted to tackle climate change and its environmental consequences, nor to reduce healthcare pollution: "*We have buildings that are so old and depending on the time of year, I can tell you, which unit is going to have a problem. [...] The infrastructures are big and often very old.*" (P9). Building environmentally sustainable health system thus requires changes in healthcare infrastructures including better insulation and the use of clean and renewable energy sources (Corvalan et al., 2020).

Perception of a non-polluting healthcare sector

Some participants (n=3) appeared to be surprised by how healthcare systems can be polluting: "*Quite frankly, I don't really see how healthcare can be environmentally polluting.*" (P12). Given that most people are not sufficiently and precisely informed about healthcare pollution,

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the call to transition toward sustainable and greener healthcare practices is not obvious to them. However, the healthcare environmental footprint is "*only smaller than the energy, transport, and construction sectors in many countries*", highlighting the need for changes in the sector (Or and Seppänen, 2024, Pichler et al., 2019). One solution to increase citizens' awareness of the issue might be to provide proactively information. However, this must be accompanied with socio-structural determinants including material support, concrete alternatives, and guidance to be effective (Albarracín et al., 2024, Cordero et al., 2020, Kollmuss and Agyeman, 2002, Bray and Cridge, 2013).

Priorities for reducing healthcare pollution

Healthcare sobriety and education were identified as two promising facilitators for reducing healthcare pollution while individual interests and ethical issues were seen as the two main barriers.

Healthcare sobriety

Healthcare sobriety can be understood as the rational use of healthcare system by each individual as part of a collective approach. This concept is similar to the concept of 'digital sobriety' which "*advocates for reduced technology usage to create a more sustainable society*" (Pérrea et al., 2023). Four elements are key to healthcare sobriety: adequate care, collective responsibility, ecological finance, and prevention.

Adequate care relates to the engagement of healthcare professionals and addresses whether "*the care provided [is] reasonable and appropriate*" (P11). This may be influenced by the procedures and technologies used in diagnosis or treatment. To ensure adequate care, some participants expressed the need for a holistic approach to health, considering individuals as part of a social environment, and recognising their continuous evolution within this context. According to the participants, aiming for adequate care implies avoiding overuse of medicines and healthcare products, reducing reliance on healthcare technologies, and limiting the over-specialisation of care. Inappropriate care practices can not only harm patients but also leads to unnecessary healthcare expenditures and generates avoidable pollution (Hensher, 2023, Or and Seppänen, 2024, MacNeill et al., 2021). Promoting healthcare sobriety could therefore potentially transform healthcare practices and significantly reduce their environmental footprint (Karlsson and Öhman, 2005).

Collective responsibility implies that everyone must be actively involved in the change because it is the sum of individual changes that will lead to an effective and responsible transition. Some

participants (n=6) reported the best way to achieve this is to consider reduction of healthcare pollution as a “*common good*” or “*common goal*”. However, State intervention may be necessary to regulate and ensure behavioural change. Thaler and Sunstein (2009) argued that “*private and public organisations should intervene more often than they currently do to alter people’s behaviour*”. They suggest that governments select and shape available options, to some extent, while individuals preserve their freedom to choose their preferred option, as much as possible. Marteau et al. (2008) also support that governments should prioritize and orientate collective efforts that individuals are encouraged to endorse upon reflection and for solidarity reasons, rather than by being imposed the change. The views highlight interdependence between socio-structural interventions and the promotion of individual autonomy (Albarracín et al., 2024).

Ecological finance was identified as a mean to encourage individual and organisational changes, and to ensure the reduction of healthcare pollution. It may be implemented at two levels: the micro level -related to healthcare consumers- and the macro which is related to healthcare infrastructures. At the micro level, it appears important to determine whether environmental-friendly practices lead to increased costs for consumers or the health insurance. According to six participants, they supposed that if the increased cost affects health insurance, healthcare consumers will be more willing to consider environmentally-responsible options. However, if the increase directly affects consumers’ finances, they may be less willing to adopt these options because money is seen as “*the sinews of war*” (P28). However, Trivedi et al. (2015) highlighted that the willingness-to-pay for green products is also influenced by pro-environmental behaviours and their locus-of-control, which refers to how strongly they believe they have control over life events and situations with their actions. At the macro level, two options were expressed to encourage behavioural changes; “*encouraging [by giving rewards/ healthcare activities or hospitals that are environmentally responsible]*” (P19) and exhibiting the price of healthcare goods to increase awareness, rationalise their use and avoid overproduction by pharmaceutical industries or overconsumption by healthcare professionals. According to Ellen et al. (2018), “*the biggest barrier [to address overuse] may be the complex interplay between the societal culture of ‘more is better,’ the competing priorities among different actors in the system, and the willingness of policy-makers to make politically difficult decisions*”. In our study, none of the participants spontaneously suggested the use of a financial sanction to limit overuse of healthcare goods by professionals. As a matter of fact, it would be difficult to identify which professionals tend to overuse healthcare goods.

Prevention is the last component of healthcare sobriety and it was seen by participants (n=5) as a promising avenue to be prioritise to reduce healthcare pollution for two reasons. First, greater investment in preventive rather than curative care could help improve population health and well-being, and reduce drug consumption. One participant suggested forest baths as a preventive care that could be more effective for health than prescribed medicines, while another suggested educating people on what should be done to prevent over-screening; for example, having a screening mammography every year when it is recommended every 2 years for women over 50 with no risk factors. Some authors have recommended better financing of preventive care to reduce healthcare pollution, as well as the associated disease burden and healthcare costs (Eckelman et al., 2020, Maciosek et al., 2010). Second, concrete preventive actions such as smoking less or eating less meat could be voluntarily adopted by some people, for ecological reasons, if they were better informed, ahead of time, of the environmental costs of treating the associated diseases: *"For example, if we tell not only to cancer patients but also to the general population that curing cancer means killing x thousands of fish. Some people, for ecological reasons, would be more convinced to take preventive actions, such as eating less meat, smoking less or drinking less alcohol to avoid those damages."* (P23)

Education

Providing information about healthcare pollution is seen as important and *"a big step"* (P28) in raising awareness among healthcare consumers and practitioners. Some participants also suggested that educating patients about the environmental implications of their treatments empowers them to make informed choices about the care they want: *"Increasingly, patients are involved in choosing their own care. Getting treatment or not. Yes, an advice is given, but it is only an advice. If, after having given information on environmental issues, a patient decides well no, I am not going to treat myself, that's perfectly within his rights."* (P25)

This observation refers to the principle of informed choice for improving decision making. According to Knagg et al. (2024) *"patients would be supportive of sustainable healthcare, where this does not affect the quality of healthcare, patient safety and equity of access [if they were educated and engaged] regarding healthcare sustainability"*. Integrating information into healthcare decisions, however, could be seen as intruding into patients' preferences and affecting lifestyle choices (Ang, 2019). In a recent paper, Richie (2023) notably advocates for a shift in the informed consent process towards "green informed consent", which involves disclosing climate-related information to patients, presenting low carbon healthcare options, and respecting patients' rights to refuse treatment because of a significant carbon footprint.

If patients are accustomed to a particular type of treatment and are resistant to changes, even if an alternative could have a lower environmental impact, this resistance could compromise their *autonomy* in choosing their treatment. Conversely, if the information is not given at all, it could thus compromise the trust relationship between healthcare practitioners and users, increasing the asymmetry of information in their relationship and reducing patients' *autonomy*. While a majority of healthcare consumers value information and are educated on green healthcare options, not all are willing to decide on this matter (Woolf et al., 2005). Some patients are more inclined to delegate authority and decision to healthcare professionals or the government. Additionally, physicians and healthcare professionals should recognize that the health literacy of healthcare consumers is sometimes limited, and that this can compromise their ability to obtain, comprehend, evaluate, and use health information to make informed decisions and choices about healthcare, disease prevention, and health promotion (Sørensen et al., 2012).

According to participants, information should be adapted using words or images that are easily understandable. They also recommended using "*shocking*" (P6) representations to ensure a better understanding of environmental issues. Some authors believe that emulating negative emotions to trigger behavioural change is not effective. Some studies have suggested that negative messages are more likely to reinforce inaction or self-protection, and therefore are counterproductive (Baek and Reid, 2013, Brennan and Binney, 2010); while, others suggest that negative messages can lead to prosocial action because of "*defence reflexes, corrective or compensatory actions, militant involvement*" (Albouy, 2017). Further research is needed to determine how to best communicate information about the environmental cost of healthcare technologies and services.

A few participants expressed concerns related to such communication, highlighting a tension between the need to provide information, and making sure care remains the top priority, especially in contexts of uncertainty regarding evidence and when patients are in situations of vulnerability. Some participants suggested that information should be shared at the appropriate moment to avoid unnecessary stress or anxiety: "*I'd say you really have to choose the moment. Let's say you've just had some bad news about your health, you've got cancer or something. And on top of that, you're told, yes, afterwards, there's the climate, there's this, there's the environment, you have to do this. In short, it generates much more stress and so, you really have to choose the best moments to share information.*" (P26)

Knagg et al. (2024) also expressed a similar recommendation: "*information should be accessible at a time and place convenient to the patient, and presented without pressure to*

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3 *accept a form of healthcare which may compromise quality or safety*". If it is communicated at
4 the wrong time or in an inappropriate manner, it could also undermine the effectiveness of the
5 communication and the patient's ability to make informed decisions (Zuckerman and Silcox,
6 2016). From healthcare professionals' perspective, their *autonomy* may also be called into
7 question if they do not feel comfortable communicating such information or struggle with how
8 to present it in a way that is understandable by the patient and this feeling can be increased if
9 their healthcare environmental literacy is low.

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16 A majority of the participants suggested to inform patients about the environmental impact of
17 their treatment by a knowledgeable and trustworthy healthcare professional, such as a physician
18 rather than a pharmaceutical companies representant, whose messages could be distorted
19 because of conflicts of interests. However, healthcare professionals rarely communicate the
20 environmental impact of treatments or medications to patients and this is because such
21 information is not widely available nor integrated into standard medical guidelines (Marsh et
22 al., 2016, Gallina et al., 2016, Drummond et al., 2022, McAlister et al., 2022). A few
23 participants also added that, if the duty to inform patients falls on healthcare professionals, it
24 is crucial to be mindful of the time this may take on their already busy schedules. They
25 emphasised the need to get the appropriate resources to support such new task. Integrating
26 lectures on sustainable healthcare systems within the curriculum of healthcare professionals
27 could also help address this issue. This approach is already encouraged by professional bodies
28 such as the International Council of Nurses and the General Medical Council and has already
29 been the subject of several studies (Huss et al., 2020, Brand et al., 2021, Tun, 2019, Roden and
30 Lewis, 2021).

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There are also ethical issues to consider when aiming to reduce the environmental
consequences of healthcare (Mortimer et al., 2018, Kponee-Shovein et al., 2022). Participants
identified several ethical challenges. For example, they underscored that it is not the
responsibility of the healthcare sector to address pollution and climate change concerns, as its
primary focus is to take care of human patients: *"That's because it's health at any price. And
so it's health, because without care, there's nothing else. It's really, really important to neglect
it."* (P13)

However, they consider that reducing healthcare pollution could raise complex dilemmas that
are less apparent in other sectors. For example, healthcare professionals *"take care of somebody*

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3 *at a given moment and the associated environmental consequences are in the distant future"*
4 (P19). This raises the ethical question of prioritising "*the life of an individual against that of*
5 *the planet*" (P28). It is thus crucial to explore shared responsibility, which is linked to an
6 understanding of interconnectedness and interdependence among individuals and
7 communities. Sustainable care aims to benefit all actors and stakeholders involved in the care
8 process, as climate change affects healthcare professionals in their work and lives as well
9 (Nicholas and Breakey, 2017). This underscores the importance of questioning healthcare
10 professionals on their role in this transition (Kotcher et al., 2021), and their willingness to take
11 on this role as some data show a gap between personal and professional actions towards
12 environmental sustainability (Dunphy, 2014). Establishing a framework of shared
13 responsibility that enhances both individual and collective health, and providing professional
14 support, seem essential for transitioning to environmentally responsible standards of practices
15 in the health care sector (Dunphy, 2014).

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17 Another ethical issue that could compromise people's engagement is individual interests. When
18 participants were asked about their preferences for a more environmentally-friendly in cases
19 where this would diminish at least to some extent the treatment's effectiveness, most
20 participants acknowledged that everyone has to change their behaviour to address the issue and
21 contribute to the transition toward a greener healthcare sector. However, many participants
22 admitted they would consider environmentally-friendly options only for mild illnesses, such as
23 a cold but not for severe illnesses, such as a cancer. A study in the US and another one in
24 Sweden (Dohle et al., 2013, Håkonsen et al., 2023) investigated whether "*information about*
25 *environmental harm would affect people's medicine choices*" and "*support of environmental*
26 *policies to reduce pharmaceutical pollution*" would influence patients' treatment choices.
27 Participants were presented with hypothetical choice scenarios for two health conditions
28 differing in terms of symptoms severity; the studies found similar results: the willingness to
29 accept environment-friendly drugs and policies was higher for mild diseases than severe.

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31 Another example of individual preferences is related to chronic illness where people want to
32 enjoy a healthy life as long as possible: "*There are many more chronic illnesses than before,*
33 *which means that people aged 40-50 still have a much longer life expectancy, a woman lives*
34 *to 80 and men to almost 80. It is clear that people will choose to treat themselves and live as*
35 *long as possible.*" (P21). However, to tackle the climate crisis and to protect future generations,
36 most participants expressed that they adopted (pro)environmental behaviours. Yet, when it
37 comes to health, a majority are less willing to accept trade-offs. They justify their choice by
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arguing that they could be considered as "selfish" (P15) and "individualistic" (P20), prioritising their "own well-being" (P22) and their desire to be treated. This expression of individualism may be seen as problematic considering that the individuals receiving medication or undergoing a medical exam are not necessarily bearing the environmental consequences associated with their treatment. In their study, Malik et al. (2021) asked patients to choose between an effective but less expensive drug and a more effective and more expensive drug. They found *"altruism as the strongest factor associated with a patient's decision to select a less effective but more cost-effective medicine for their own health care"* (Malik et al., 2021). In their commentary of this study, Moshiri and Moshiri (2021) argued that being altruistic was (perhaps) a decision that many individuals are willing to make or a burden they are willing to face and asked the following questions: *"Should patients be allowed to decide whether they accept the risk of slightly lower quality care for the sake of society as a whole? And if so, should the scarcity of medical resources be a burden carried solely by those who choose the treatment, or is there another way to distribute the load more equitably?"*. These concerns are applied to the transition to sustainable healthcare systems: can we blame healthcare consumers who want to preserve their own health and want to choose the most effective medicine to the detriment of this transition? Further research is needed to determine whether altruistic mindset support adoption of green medicines and healthcare practices.

Strengths and limitations

This study is one of the first to identify healthcare stakeholders' perceptions on climate change and engagement for a greener healthcare sector. Despite the sample size is small, this exploratory study included participants with diverse profiles and viewpoints, allowing us to identify a range of considerations on this emerging question. However, because of the recruitment method, our results are not generalizable and representative of the entire population. The sample may show a selection bias as even if we offered a 25€ voucher as a compensation, only people, mainly female with an interest on climate change, and many individuals from the healthcare sector participated. Furthermore, we did not consider previous experience within as healthcare consumer but this can also be a source of bias. We cannot also exclude the possibility of social desirability bias in participants' answers and discussion during the group interviews. Finally, the small size of some groups can be considered as a limitation but we were confronted with participants refusing to take part and/or limited availability.

Conclusion and policy recommendations

By studying the perception of climate change, healthcare pollution and sense of engagement in reducing healthcare pollution, this study is one of the first that highlights a variety of considerations among healthcare consumers. While all participants recognised climate change as an environmental and human threat, and adapted their behaviour accordingly, they were not all aware of the environmental pollution of the healthcare sector. Waste, resource use and building were expressed as the main sources of healthcare pollution. A first promising avenue is healthcare sobriety, which requires four essential elements: adequate care, collective responsibility, ecological finance, and prevention. Developing guidelines on these four elements appears to be required. Guidelines should emphasise the need to consider the individual in his social environment, to consider the individual as a member of healthcare community, in order to promote their involvement in the transition, to use financial incentives as an asset to change individual and organisational behaviour, and to stress the importance of preventive rather than curative care. A second promising avenue is educating healthcare consumers, specifically by sharing information. However, this information must be provided by an expert and in a specific and adequate context. Policymakers should support sustainable healthcare education, specifically for healthcare professionals as part of medical education as well as continuous professional training. Two barriers were also mentioned: individual interests and ethical issues. To ensure effective and responsible transition towards sustainable healthcare systems, additional research is needed, particularly regarding how responsibility should be appropriately shared between actors and stakeholders, and how to encourage empower altruistic motives that support change.

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Author contributions

DESTERBECQ: conceptualization. DESTERBECQ, DUPRAS, De MAACK and TUBEUF: literature search, data analysis, original draft preparation and critical revision of the work. All authors contributed to the article and approved the submitted version.

Conflict of interest

Authors reported no conflict of interest.

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Data availability statement

The data cannot be made publicly available upon publication because they are not available in a format that is sufficiently accessible or reusable by other researchers. The data that support the findings of this study are available upon reasonable request from the authors.

Ethical statement

The approbation of the Ethics Committee of Louvain Catholic University Hospital was requested (project number: 2024/26MAR/162) but its opinion is not restrictive as the study does not fall within the scope of the Belgian law of 07.05.2004 on human experimentation.

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