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Including environmental and social sustainability in the planning process of healthcare services: A case study of cancer screening programs in an inner area in Italy

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ABSTRACT

Healthcare systems plan their activities to achieve efficiency and effectiveness, without addressing environmental and social sustainability. This paper describes a new approach adopted in Italy to plan and deliver health prevention services in an inner area of the Tuscany region (in Italy) to guarantee proximity of care and environmental and social sustainability. The project examines the design and delivery of cancer screening programmes using a mobile screening unit to maximise social benefits while minimising environmental waste. A cost analysis was developed to estimate the difference in CO_2 equivalent emissions, travel costs, and productivity losses, comparing the current screening programmes against the introduction of a comprehensive full-service mobile screening unit. The results indicate that the new service model reduces direct non-medical costs incurred by the population and improves environmental sustainability. This alternative can reduce, annually, over 95,000 euros in terms of travel costs and productivity losses, as well as 35 tons of CO_2-equivalent travel emissions for a population of 59,000 inhabitants in a mountainous area with around 6000 people involved in the screening programme. The study supports the need to adopt a new planning methodology that considers environmental, social, and financial sustainability jointly in the provision of public health services in rural areas.

1. Introduction

Health systems, particularly those with universal coverage and financed through general taxation, orientate their action towards promoting, restoring, and improving public health for all the population. Throughout the years, their mission has been focused on three main goals: clinical outcome, equity and financial sustainability [1]. Recently, public health systems are gradually adopting a broader approach, considering the concept of *One Health* [2], which regards human and animal health as interdependent and linked to the health of the ecosystems in which they are situated. This novel approach endures and withstands new challenges that the healthcare system needs to face, such as environmental threats. Thus, in line with the purpose of the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development [3,4], health systems should progressively broaden their perspective by integrating environmental and social sustainability to clinical outcome, equity and financial sustainability issues. In particular, this new holistic approach should be included in the planning process of healthcare systems and health programmes. Indeed, as clearly underlined by the WHO [5], health and environmental protection goals should go hand in hand [6], by putting in place a win-win strategy based on integrated actions able to promote the equilibrium of the ecosystem.

The issue of environmental and social sustainability of health systems is not new in the literature. In the last years, various studies have focused on environmental sustainability within health systems [7]. These studies are focused on specific issues, mainly in the field of waste management within the clinical practices and aim at advocating for a full-cost accounting of environmental emissions in the health care sector to protect public health [8–11]. Other research has focused on management techniques and strategies that minimise the environmental impact in terms of GHG emissions of anaesthetic gases in the operating theatre [12–17].

On the debate about social sustainability [18–20] in healthcare, this is often considered in terms of equal (non-discriminatory) access to care for the entire population- a nested concept of universal health coverage

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systems- and high engagement and participation of the population in health-related decisions, promotion, and prevention initiatives. Especially in the context of preventive care, the emphasis on the population's role and collective action takes centre stage. This involves empowering and enabling the community to take responsibility for its health and ecosystem, making it a key aspect in the planning of healthcare services [21].

However, so far, both in the literature and in practice, health planning still lacks an integrative view on environmental and social sustainability goals.

This study aims to contribute to closing this gap by proposing a new methodological approach able to ensure, especially for health systems with universal health coverage, greater synergy and coherence between health, environmental and social goals through the planning process. The paper opens with an overview of the current state of the integrated planning process in Italy, focusing on the incorporation of environmental sustainability measures. In the subsequent sections, a case study on the planning of oncological screening activities in a health district of Tuscany region (Italy) is presented. The case is used to illustrate how environmental and social sustainability can be incorporated into the health service planning process, with the aim of improving population accessibility. Results from the case study are then discussed primarily considering the potential benefits of integrating sustainability into the healthcare planning process.

2. Background

2.1. Environmental sustainability in the healthcare strategic planning of the Italian regions

Italy's health care system is a regionally based national health service that provides universal coverage largely free of charge at the point of delivery. The regions, through Local Health Authorities (LHAs), are in charge of financing, planning, and provision of services at the local level. The planning at regional level follows the national strategic plan and national programmes addressing specific health challenges. Specifically, the national document that provides the health agenda is the National Health Plan (NHP) [22], while the Health Pact (Patto per la Salute) is the financial and programmatic agreement between the central government and the Regions regarding the spending and planning of the NHS. Both documents last three years. The last Health Pact was signed in December 2019 and emphasised that the NHS should respond more effectively to the needs of citizens [23]. In addition, health reforms are often put forward by Ministerial Decrees such as the hospital reform (Ministerial Decree 70) [24] and community health reform (Ministerial Decree 77) [25,26], which define hospital and community care standards, emphasising quality, technology, and sustainability.

Traditionally, according to the aforementioned documents, healthcare planning is articulated around three main concerns: ensuring clinical outcome, equity and financial sustainability. The last Health Pact [23] marks a significant difference from the previous as it makes explicit reference to the issue of territorial pollution and refers to the *One Health* approach, emphasising the need for inter-sectoral collaboration to achieve improved public health outcomes. While Ministerial Decree no. 70 specifies the need for Regions to focus on applying energy-saving strategies to public health facilities, Ministerial Decree no. 77 puts greater emphasis on environmental considerations: in addition to addressing the concept of *One Health* and the interconnectedness between health and the environment, this decree also incorporates the SDGs and emphasises the necessity of integrating them into the realm of health prevention and promotion. Accordingly, it requires a strict collaboration with local communities and competent agencies to achieve health goals in a sustainable manner.

Has this approach been adopted by regions in their current Regional Health Plans (RHPs)? We run a documentary analysis to understand the frequency and the degree of inclusion of environmental sustainability in the formal planning process at regional level and the availability of performance measures to assess these aspects. Specifically, the RHPs of five regions were analysed: Veneto, Lombardy, Emilia-Romagna, Tuscany and Campania. The regions have been selected amongst the one with the largest resident populations and with the RHP issued no later than 2016 corresponding to the year when the 17 SDGs came into force [3,4]. Not included in the sample are Lazio, Sicily, Piedmont, and Apulia region, which, despite being amongst the largest Italian regions in terms of population, have not formally issued a RHP during the past six years - i.e., from 2016 onwards.

The identified strategic plans were compared through a content analysis [27]. We created a metric text system to identify pertinent "observation units" as "sustainability" and "environment*". These units were counted with a word processor software. We assessed their contextual relevance to environmental sustainability and their distribution in the text. Then, we undertook a comprehensive document analysis, with the aim to identify explicit environmental sustainability goals, their measurable indicators, and tangible actions. See Table 1 for the key findings.

In terms of environmental sustainability, the Veneto region aims to support the protection of soil, water, and noise pollution within its RHP. It plans to enhance systematic control over hazardous industrial production and implement measures to contain and reduce pollutants [28]. Within the framework of health and environmental initiatives, the region intends to ensure effective monitoring activities in collaboration with the Regional Agency for Environmental Prevention and Protection (ARPAV). However, the Plan does not provide any specific indicators for measuring environmental sustainability.

While the latest RHP of Lombardy acknowledges the significance of preserving the environment in individuals' living spaces, as well as the protection of the environment in food chains and water intended for human consumption [29], it does not provide any indications concerning environmental sustainability within the organisation of the healthcare system.

The RHP of Emilia Romagna does not include any specific provisions or indications regarding environmental sustainability [30].

In the most recent RHP of the Tuscany Region [31], environmental sustainability is given significant importance in the definition of strategic objectives. The Plan emphasises the need for healthcare systems to recognize pollution as a factor influencing human health, thereby highlighting the importance of prevention [32]. To address this, a regional coordinating body was established in 2017 to promote prevention, research, and training activities concerning environmental and health issues. The RHP of Tuscany also presents the concept of environmental sustainability by highlighting the regional-level development and transition towards a circular economy (green waste management, increased utilisation of green energy sources, implementation of Green Public Procurement practices).

To conclude, the RHP issued by the Campania region underlines the need for continuous epidemiological surveillance of environmental risks throughout the region [33]. Additionally, the region intends to integrate data on cancer incidence, mortality rates, hospital admissions, malformations, and birth defects with environmental data at the municipal level, thus establishing a link between health outcomes and environmental factors.

All the documents analysed lack of a holistic approach to sustainability issues. Indeed, specific strategies, concrete actions, measurement, and assessment methods that could be integrated with clinical outcome, equity, and financial sustainability goals of the planning process are not mentioned.

When examining the planning process at the sub-regional level, such as health districts, the importance of environmental sustainability becomes even more critical for districts classified as inner areas, e.g. mountainous regions or low-population-density islands. These areas face specific challenges, as public services are scattered, leading to reduced population coverage and increased travel costs, which in turn

Table 1
Synthesis of the documentary analysis of the RHPs.

Region	Year of last RHP	N. of pages RHP	N. of instances "sustainability"	N. of instances "environment*"	Main use of the word sustainability	Main use of the word environment
Veneto	2019–2023	194	40	52	Financial, Environmental	Surrounding conditions
Lombardy	2019–2023	55	7	21	Financial	Surrounding conditions
Emilia-Romagna	2017–2019	97	1	8	Financial	Surrounding conditions
Tuscany	2018–2020	241	39	90	Financial, Environmental, Social	Surrounding conditions, natural environnement
Campania	2019–2021	182	9	42	Financial	Surrounding conditions, natural environnement

have a negative impact on the environment. Consequently, these districts often experience a downward spiral characterised by a significant outflow of young people, resulting in reduced attractiveness and limited employment opportunities that contribute to the area's impoverishment [34,35]. Studies have described the effectiveness of innovative programmes in health within these areas – e.g. the introduction of family and community nurses that visit the elderly in mountain areas to plan the necessary interventions [36,37]. However, as these studies underline the economic sustainability of the programmes, they do not consider the possible benefits on the environment and the population. Hence, the significance of tackling environmental sustainability challenges in these regions cannot be overstated, as it plays a pivotal role in not only mitigating adverse environmental effects but also enhancing the general well-being and health outcomes of the population. A new healthcare planning approach including environmental sustainability was tested in an inner area of Tuscany, facilitated by active collaboration amongst various stakeholders, including health professionals, municipalities, and non-profit organisations. Indeed, the theme of environmental sustainability is undoubtedly a comprehensive objective for the entire population and not just limited to healthcare services, necessitating the involvement of all stakeholders. As an example, the case of oncological screening services is presented. The approach is planned to be replicated in other similar areas within the region of Tuscany.

3. Materials and methods

3.1. Environmental and social sustainability in the healthcare strategic planning at the local level

In the following section, we describe the implementation of a novel planning approach within the oncological screening programme, which is a relevant strategic objective aimed at ultimately lowering cancer mortality rates. Starting from the current organisational model for delivering screenings, the research team's approach evaluates healthcare's environmental impact while addressing population health needs. The pilot area, Tuscany's Valle del Serchio health district, spans 390.68 km^2 with 19 municipalities in the Province of Lucca. With around 59,000 residents, this area has Tuscany's highest cancer mortality (276/100.000 inhabitants), surpassing the region's 2020 average (245/100.000 inhabitants) [38,39]. This rate increases annually.

3.2. Italy's current organisation of oncological screening programmes

In Italy, population-based screening programmes for breast, cervical, and colorectal cancer are detailed in the National Public Health and Prevention Plan [40] and are included in the Essential Level of Services provided to the population by Local Health Authorities (LHAs). The prevention programmes are operated at the district level and organised following regional quality standards. In addition, results and performance are reported and coordinated by the LHAs [41]. Systematic cancer screening campaigns have been organised according to the type of tumour. Women between the ages of 50 and 70 receive a written invitation bi-annually to attend a mammographic screening and another invitation every three years for the Pap or HPV test for cervical screening. Finally, both men and women between the ages of 50 and 70 receive an invitation bi-annually for colorectal screening. The immuno-chemical faecal occult blood test (iFOBT or FIT) is used for colorectal screening.

To date, the organisation of population-based screening campaigns has followed a provider perspective, in which the delivery model has been defined according to the needs of the provider, without fully considering the population perspective and the connected and environmental aspects of the geographical area. The targeted citizens receive a single invitation for each screening programme, i.e., mammography, cervical screening, and colorectal screening and are invited to attend each of the three screening services on different dates, with significant discomfort, costs, and loss of time for patients.

In the Tuscany region, the screening programmes recorded approximately 70% attendance for breast cancer, 56% for cervical cancer, and only 40% for colorectal cancer in 2020 [38] with high variability amongst local health districts, particularly for the population living in inner areas. The Valle del Serchio health district registers a low screening attendance, which could be due to several factors, one of these being the presence of higher private costs for the inhabitants of inner areas [42], which make it more difficult to access health services, including preventive medicine. Indeed, the different morphologic variations and landscape features across health districts may affect the financial capabilities (e.g., travel time and costs) of the population of inner areas for seeking health services: as illustrated by a recent study [43], health risk increases with the spatial distance from health facilities. The proposed new approach primarily focuses on conducting an analysis of the environmental impact associated with the travel distance of individuals invited to participate in the oncological screening programme within the inner Valle Del Serchio area.

3.3. Design: data collection and cost estimates

Semi-structured interviews with the management department responsible for the regional screening programmes of the Institute for Study, Prevention and Oncological Network of Tuscany region (ISPRO) and healthcare personnel of the LHA were conducted to identify all the key elements related to the current organisational model. From these interviews, distinct screening process stages were identified: invitation management as per protocols, letter delivery, invitee's travel itineraries to screening points, screening visit, medical reporting, and result notification. Our attention was subsequently directed towards identifying the impact of each phase in terms of environmental and social sustainability. Amongst these phases, given the availability of data and information, the initial estimate related to environmental and social impact focused on computing the distance travelled by invitees to undertake screening activities. To quantify the effect of this variable in terms of pollution, for each screening type, the CO_2-eq emissions per kilometre driven from the municipality of residence to the closest screening location were computed. The source of these emission factors was the Department for Environment, Food and Rural Affairs (DEFRA) 2021 [44]. Considering the Greenhouse Gas Protocol [45], only direct

emissions were considered. Moreover, in terms of social costs - i.e., direct non-medical costs that the population incurs to attend the screening services offered by the Tuscany region - we considered the expenses measured as transportation costs (cost per km, capital share, fuel, tyres, and maintenance) and working days dedicated by the community (travel time to the closest screening facility and the days of work dedicated to the attendance at screening campaigns). Productivity losses due to absenteeism were estimated using the "lost wages method", the most frequently used method to measure productivity loss [46]. From a population perspective, these costs, if consistently high, may hamper people's willingness to undergo screening [47]. Detailed data and information related to environmental costs can be found in Appendix A.

4. Results

4.1. CO_2 emissions and social cost of Italy's current oncological screening programmes

In terms of travel emissions, the breast-cancer screening programme was linked to the most polluting service (Table 2), given by the high number of invitees - i.e. 3398 women - and the distance travelled to the only hospital dedicated to this screening service for the 19 municipalities of the Valle del Serchio district. This observation highlighted that the presence of a fixed screening centre led some women to travel a significant distance, as they did not have a closer alternative. For the 2020 cervical-screening programme, approximately 3000 women were invited to participate. Given the possibility to choose amongst different health facilities to undertake the HPV or Pap test, emissions were lower, compared with those of the breast-cancer screening programme. Moreover, if the emission of virtually 6000 women and men invited to colorectal screening in 2020 were added to the aforementioned environmental costs, about 36 tons of CO2-equivalent were estimated to have been produced.

In terms of transportation costs and days of work dedicated to screening by the community, as each woman is likely to attend each screening examination on different working days, the direct non-medical costs increase. Table 3 shows social costs linked to travel expenses and working days dedicated by the community for screening activities incurred by invitees. The total costs per year for the Valle del Serchio district population amounts to almost 170 thousand euros/year.

The results led the research team to develop a new planning approach for a more environmentally and socially conscious delivery of oncological screening activities.

4.2. Alternative oncological screening programme within inner areas

The alternative oncological screening programme is part of a five-year research project [48] focuses on developing innovative solutions from technological, organisational, and institutional perspectives. This project aims to place people, their communities, and their territories at the heart of the healthcare system.

Table 2
Environmental costs linked to kg of CO_2-eq emissions per kilometre travelled by the Valle del Serchio population to attend the oncological screening service in 2020. Costs were divided amongst screening disciplines, women, and men.

YEAR 2020	Current Alternative
ENVIRONMENTAL COSTS ($kgCO_2$-eq/km)	
Total emissions travelled linked to the breast-cancer screening programme	17959.79
Total emissions travelled linked to the cervical-screening programme	10408.84
Total emissions travelled linked to the colorectal-screening programme - women	3716.49
Total emissions travelled linked to the colorectal screening programme - men	3785.25
TOTAL ENVIRONMENTAL COSTS ($kgCO_2$-eq/km)	**35870.36**

Table 3
Social costs (working days dedicated by the community for screening and transportation costs), divided by the screening type for women and men.

YEAR 2020	Current Alternative
SOCIAL COSTS	
Working days dedicated by the community for screening visits - mammography	61471.82 €
Working days dedicated by the community for screening visits - cervical screening	30230.44 €
Working days dedicated by the community for screening visits - colorectal screening (women)	16305.16 €
Working days dedicated by the community for screening visits - colorectal screening (men)	16284.69 €
Transportation costs - mammography	21900.30 €
Transportation costs - cervical screening	12692.61 €
Transportation costs - colorectal screening (women)	4531.91 €
Transportation costs - colorectal screening (men)	4615.76 €
TOTAL SOCIAL COSTS	**168,032.69 €**

The new model for screening programmes assumes that citizens should move as little as possible in terms of kilometres travelled to reduce the environmental impact, in terms of CO_2-eq emissions, and maximise the probability of attendance, by reducing the time and expenditures dedicated to these activities. Indeed, literature reports that affordability (costs), availability and accessibility in terms of physical accessibility (proximity) and other practical barriers – e.g., presence of childcare - are critical dimensions affecting patient-service interaction in the choice to attend screenings, together with attitudinal factors, such as embarrassment or fear of an abnormal results [49–53]. Moreover, the proposed model replaces separate access points for different screening programmes and reduces the distance travelled by invitees for each screening programme—as in the model currently envisaged—with a unified service delivery process. The invitee undergoes all types of screenings needed in a single point of access, with the addition of a digital video dermatoscope for early melanoma diagnosis. The full service is delivered as close as possible to the home of the targeted individual with the introduction of a mobile screening unit, equipped with a team of health professionals – i.e. a radiology technician and an obstetrician - that can perform tests and collect screening data for the three conventional screening and novel early diagnosis programmes (dermoscopy). With the new service provision, there are no changes in the composition of the health team compared to the current screening programme.

This new approach to screening separates the steps of information acquisition and medical reporting: while the former occurs close to the home of invitees attending the screening, owing to the mobile unit, the second phase is centralised within the LHA facilities, thereby allowing economies of scale and expertise in the referral phase. On a joint basis, this approach envisages the enhancement of technologies and telemedicine services for the systematic transfer of information from the mobile unit to the health centres. Moreover, the new delivery model for oncological screening services relies on areas and assets shared by the local community, i.e. the parking spot of the mobile unit, electricity required to deliver the services, and communication and local sensitization campaigns to promote participation in each municipality.

Once the total environmental and social costs were computed, a differential cost analysis [54] to compare the current screening model with the novel one was applied. For the new delivery model, the travel CO_2-eq emissions [44] of the mobile screening unit covering the screening activities in all municipalities of the health district were computed. Detailed data and information related to environmental costs can be found in Appendix A.

With the introduction of a more environmentally conscious and population-based planning of oncological screening activities, the total environmental impact would decrease by 98%, employing 0.8 tons of

CO2-equivalent to deliver all required screening services to all invitees of the Valle del Serchio district annually (Table 4). In terms of social costs, from nearly 170,000 euros of the current alternative, the new alternative would decrease total direct non-health costs by over 95500€ annually (Table 4), as the mobile unit would significantly reduce travel time of invitees, thus working days dedicated to the screening activities and transportation costs.

5. Discussion

The results illustrate how an alternative planning of healthcare service that aims at increasing attendance to oncological screening, emphasising accessibility, can be strategically translated into a solution that reduces the environmental and social costs. The integrated approach of *One Health*, SDGs and the health agenda of the WHO has highlighted the need for interventions to preserve health, address health challenges, and safeguard the natural environment [2–5]. However, health systems rarely include these perspectives when planning health programmes.

The case presented in this study shows a gap in addressing different pillars of sustainability within the strategic planning, occurring both at national and regional level. Indeed, specific strategies, actions, measurement, and assessment methods that integrate both environmental and social sustainability are not yet fully included in the planning documents.

This study offers insights on the need for a more comprehensive approach, by including environmental and social sustainability in the planning and management of healthcare programmes. Indeed, screening programmes organised based on the LHA efficiency perspective, tend to overlook the user burden, such as distance travelled, that could lead to a low attendance causing late diagnosis and high mortality [55]. Traditionally, user burden is rarely included in the planning of health services. Nevertheless, it may greatly affect the population's health and wealth. Moreover, economic sustainability of oncological screening should be a means to achieve the public health preventive goal but with an explicit consideration of population needs (including service "retailing") to support environmental sustainability. Hence, from a *silo* organisational logic of supply of screening, a change towards integrating demand-, community-, and provider-based perspectives is required.

Table 4
Summary of differential costs linked to the transportation and working days dedicated by the community and environmental costs for screening. Comparison between the current and future screening models, comprising an itinerant mobile screening unit and e-centralised secretary that organises the screening appointments for each invitee on the same day.

YEAR 2020	Current Alternative	Future Alternative: Mobile Screening Unit	Annual Differential Costs
DIRECT NON-MEDICAL COSTS			
Travel expense for mobile unit (cost per km, capital share, fuel, tyres, and maintenance)	0.00 €	2152.84 €	2152.84 €
Total transportation and working days dedicated by the community for screening visit costs	168,032.69 €	70288.40 €	−97744.29 €
Total non-medical costs	**168,032.69 €**	**72441.24 €**	**−95591.45 €**
ENVIRONMENTAL COSTS ($kgCO_2$-eq/km)			
Total emissions travelled linked to the cancer-screening programmes - women	31721.12	656.38	−31428.72
Total emissions travelled linked to the cancer-screening programmes - men	3785.25	148.18	−3637.06
Total environmental costs ($kgCO_2$-eq/km)	**35870.36**	**804.57**	**−35065.79**

The case illustrates the application of an integrative view about environmental and social sustainability for oncological screening planning comparing the current programmes with a new approach. Adding to the traditional outcome measures, such as health, a wider array of indicators, such as environmental and social sustainability, may enable policymakers to optimise social well-being more effectively. The environmental impact of healthcare is an outcome that can yield both positive and negative effects on the environment. In traditional healthcare planning, environmental impact is often regarded as an uncontrolled side effect as it is not integrated into the strategic dimensions. However, as illustrated in this study, when this perspective is incorporated into strategic planning and service design, although the impact remains an outcome, it is deliberately managed. Recently, to quantify the value of the environmental impact, reports and academic research [56,57] have computed the monetary social cost of CO_2-equivalent emissions. A recent article [57] provides an estimate of the social cost of $185 per ton of CO_2-equivalent emissions. Further analysis is needed in order to quantify for each step of healthcare services the social costs of pollution, to be added to the direct non-medical costs computed within this study. The planning process related to healthcare services needs to be reformulated according not only to equity, clinical outcome and financial sustainability, but also including environmental and social sustainability.

The approach proposed with a first application in the inner area of Valle del Serchio shows that stakeholders' engagement and collaboration is a success factor. Indeed, in this project, not only the health workforce was involved, but also all the municipalities and the third-sector organisations, with the aim to increase the attendance to oncological screenings and to promote a new role for the population. Indeed, prevention activities need to become a collective action, enabling the community to become more responsible for its own health and ecosystem [21]. All these aspects, i.e., reducing health systems' emissions of air pollution, prioritising disease prevention, engaging the health workforce as an agent of sustainability and promoting the local community's assets, become even more relevant considering the WHO's strategic document of 2017 [58], which, amongst other key categories of sustainability actions within health systems, includes them as the possible common elements of a more environmentally sustainable approach, also at policy level.

This study, considering the field of oncological screening programmes, represents the first steps towards a comprehensive approach for planning healthcare activities, which could be adopted in the future within the broad concept of the life cycle assessment (LCA). The LCA represents a useful method to address the environmental impact of products or services in their entire cycle of life and is capable of supporting strategic planning [59] and guidance in terms of environmentally sustainable decisions [60]. Specifically, to date, the LCA within the field of healthcare has focused on products [61–63] and processes mainly related to waste management [64,65]. Nevertheless, certain studies have focused on processes in terms of the environmental impact of ambulance services and transport [66–69], indicating the need to apply this method at broader contexts within healthcare planning.

In terms of limitations, this contribution considered results based on direct emissions—in this case, from vehicle combustion—when discussing environmental impact. Future in-depth analyses should include indirect emissions, which the Greenhouse Gas protocol [45] defines in category 3 as fuel and energy not related to scopes 1 and 2.

As the proposed model has been implemented as a pilot in an inner area, future work should study the scalability and transferability to other health settings.

6. Conclusion

As illustrated in this study, health systems characterised by universal coverage should consider a shift in the planning of public health services, considering the environmental and social impact within the life cycle of the service delivered. As prevention is the domain wherein the prioritisation of the concept of citizen empowerment holds utmost significance, in order to increase accessibility, it is imperative to adopt an advanced planning and organisational approach that assesses the financial burden on the population and the environmental impact on the community engaged in seeking preventive health services.

From October 2023, the new screening programme delivery model illustrated in this paper will be carried out within the above-described geographical area. Thus, it is important now to investigate if attendance to screenings will increase as expected by means of this implementation.

This study is a first step towards including measures that support the concept of environmental and social sustainability within the planning process of healthcare services that can be proposed at local, regional, and national level. The authors have employed the case study on the oncological screening programme as an example but believe that the approach can be adopted within the planning activities of several other healthcare services, fostering a more pervasive attention on the environment and our society.

Data availability

Data mentioned in the manuscript are freely available on the internet (https://performance.santannapisa.it/pes/start/start.php).

CRediT authorship contribution statement

Vera Benedetto: Data curation, Investigation, Writing – original draft, Methodology. **Francesca Ferrè:** Validation, Methodology, Writing – review & editing. **Sabina Nuti:** Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing.

Declarations of competing interest

None

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Supplementary materials

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