frontiers in Sustainable Cities

TYPE Original Research
PUBLISHED 12 November 2026
DOI 10.3389/frsc.2026.1858698

Check for updates

OPEN ACCESS

EDITED BY
Daniel Jato-Espino,
Valencian International University, Spain

REVIEWED BY
Gert Everaert,
Flanders Marine Institute, Belgium
Alexander Hooyberg,
Ghent University, Belgium

*CORRESPONDENCE
C. C. Iodice-Kraft
chiara.iodice-kraft@ils-forschung.de

RECEIVED 17 April 2026
REVISED 15 October 2026
ACCEPTED 16 October 2026
PUBLISHED 12 November 2026

CITATION
Iodice-Kraft CC, Specht K, Otsuka N, Gutjahr M, Schätte E, Moonga L, Xu S, Michael B, Neuberger K, Giedych R and Gawryszewska B (2026) Bringing nature-based health prevention into cities: the role and perception of Green Care in Germany.
Front. Sustain. Cities 8:1858698.
doi: 10.3389/frsc.2026.1858698

COPYRIGHT
© 2026 Iodice-Kraft, Specht, Otsuka, Gutjahr, Schätte, Moonga, Xu, Michael, Neuberger, Giedych and Gawryszewska. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Bringing nature-based health prevention into cities: the role and perception of Green Care in Germany

C. C. Iodice-Kraft[1]*, K. Specht[1], N. Otsuka[1], M. Gutjahr[1], E. Schätte[1], L. Moonga[1], S. Xu[2, 3], B. Michael[4], K. Neuberger[5], R. Giedych[6] and B. Gawryszewska[6]

[1]Research Group Spatial Planning and Urban Design, Research Institute for Regional and Urban Development, Dortmund, Germany, [2]Research Group Geoinformation and Monitoring, Research Institute for Regional and Urban Development, Dortmund, Germany, [3]Department of Geography, Humboldt University of Berlin, Germany, [4]Department Health, City of Herne, Herne, Germany, [5]Association for Horticulture and Therapy GGuT e.V., Hückeswagen, Germany, [6]Department of Landscape Architecture, Warsaw University of Life Sciences, Warsaw, Poland

Germany lags behind other European countries in implementing preventive health measures, particularly in nature on prescription (green prescribing) to support mental health, while countries such as the United Kingdom, have made substantial progress in implementing nature-based interventions. One promising approach is Green Care—ranging from everyday experiences in green and blue spaces to structured nature-based health promotion and therapy—which supports individual health, community wellbeing, and ecosystem restoration. From a public health perspective, Green Care can contribute to health promotion and prevention by addressing stress, anxiety and depressive symptoms, loneliness, social isolation, and physical inactivity. However, in Germany, the concept of Green Care remains largely unknown. It is only marginally embedded in public discourse, professional practice, and technical language, with limited research on its implementation. Although Germany offers many nature-based services in green and blue spaces, these initiatives are often fragmented, barely visible, and rarely labelled as "Green Care." Understanding the landscape and stakeholder perceptions is essential for closing knowledge gaps, increasing visibility, and informing a national strategy. This study examines Green Care in Germany using the Ruhr area as a case study. It aims to reveal stakeholder perceptions, identify reasons for low awareness of Green Care, and highlight opportunities and barriers. The empirical basis comprises qualitative interviews (n = 12) and a co-creation workshop involving Green Care actors. Findings reveal limited awareness despite existing initiatives like therapeutic gardening. Main barriers include unequal access, limited cross-sector cooperation, funding gaps, staff shortages, and dominance of pharmaceutical health approaches. Identified potentials include existing networks, initial financing structures and the multifunctional use of green and blue spaces. This study addresses a research gap by identifying factors that hinder and promote the integration of Green Care in Germany, offering guidance for policymakers, practitioners, and researchers to scale initiatives and embed nature-based approaches into sustainable urban development.

KEYWORDS
environmental justice, green prescribing, mental health, nature-based interventions, qualitative analysis, urban green & blue spaces

1 Introduction

Despite being one of Europe's highest spenders on healthcare (6,444 € per capita in 2024, roughly 50% above the EU average), Germany consistently lags behind its peers in preventive health, ranking 17th out of 18 European countries in the Public Health Index 2025 (AOK-Bundesverband and Deutsches Krebsforschungszentrum, 2025; Statistisches Bundesamt, 2026). In contrast, countries such as the UK, Finland, and Ireland rank among the highest performers in implementing scientifically recommended prevention measures (AOK-Bundesverband and Deutsches Krebsforschungszentrum, 2025). This stronger emphasis on prevention is also reflected in national policy approaches, such as the UK's "Prevention is Better than Cure" strategy (Department of Health and Social Care, 2018) and Ireland's "Healthy Ireland" Framework (Department of Health, 2013). Germany's comparatively weak performance highlights the need for innovative, evidence-based approaches to strengthen its preventive health.

Mental health has become a central priority on the European policy agenda. The European Commission's Comprehensive Approach to Mental Health (2023) calls for integrating mental wellbeing across sectors such as education, employment, urban planning, and the environment, while the European Parliament advocates a coordinated EU Mental Health Strategy addressing social and environmental determinants of health (European Parliament, 2022). The COVID-19 pandemic has further revealed vulnerabilities in health systems and drawn attention to mental health, emphasizing the importance of strategies that enhance both individual and collective resilience (Noël et al., 2021; World Health Organization, 2022). Following the WHO's (2005) definition, mental health is not merely the absence of disorders but a state in which individuals realize their abilities, cope with everyday stresses, and contribute meaningfully to their communities. In this study, mental health is understood as a broader concept, while mental wellbeing refers more specifically to subjective psychological experiences.

In response, interactions with nature and exposure to green and blue spaces (GBS) have gained increasing attention as accessible, low-threshold resources for promoting mental health, wellbeing, and resilience (Hartig et al., 2014; Rehman et al., 2024; Twohig-Bennett and Jones, 2018). Beyond their role in climate change mitigation, including flood prevention and urban cooling (Wang et al., 2022), these spaces function as public health assets. They can reduce stress (Hunter et al., 2019) and maladaptive rumination (Bratman et al., 2015), while providing recreational opportunities (Ingmann et al., 2025). Studies further associate GBS with reduced stress and depression symptoms and enhanced subjective wellbeing (Bragg and Atkins, 2016; Hartig et al., 2014). Blue infrastructure such as rivers, lakes, and coastal environments may additionally promote psychological restoration and reduce stress-related health risks (Völker and Kistemann, 2011). While these benefits are well documented, it is important to note that exposure to GBS is not inherently risk-free, and its health effects are context-dependent. This is also reflected in the "Ocean for Health" framework, which considers both beneficial and adverse pathways linking environmental exposure and human health (Everaert et al., 2025). Environmental conditions within GBS can also entail potential risks, including exposure to air pollutants in urban-adjacent green areas, waterborne pathogens in recreational waters, allergens such as pollen, vector-borne diseases, and heat stress, depending on vegetation structure and urban design (Markevych et al., 2017; Lõhmus and Balbus, 2015; Cariñanos and Casares-Porcel, 2011; White et al., 2020). Within the social dimension, GBS can promote social cohesion and help reduce loneliness by creating opportunities for social contact and strengthening neighborhood connectedness (Enssle and Kabisch, 2020; Ingmann et al., 2025). Informal encounters, shared activities, and opportunities for social interaction can strengthen neighborhood relationships and contribute to a greater sense of social embeddedness (Astell-Burt et al., 2022). In addition to the social benefits, GBS can also offer physiological benefits, such as lower heart rates and a reduced risk of type II diabetes (Twohig-Bennett and Jones, 2018). However, the expansion and improvement of GBS can contribute to green gentrification, whereby environmental improvements increase the attractiveness of neighborhoods and may lead to rising property values, demographic change, and the displacement or exclusion of lower-income residents (Anguelovski et al., 2018). Such processes can undermine the equitable distribution of GBS-related health benefits, highlighting the importance of environmental justice in urban greening strategies (Cole et al., 2017).

Within this framework, Green Care serves as an umbrella term for nature-based interventions designed to systematically harness these multi-dimensional benefits, including the promotion of physical and mental health, wellbeing, social inclusion, and environmental sustainability (Hassink, 2006; Sempik et al., 2010). Since the early 2000s, previously isolated activities – from agricultural social work to therapeutic gardening – have been consolidated under this overarching term to create a common conceptual and professional identity (Stanley, 2017; Haubenhofer, 2014). Green Care can be conceptualized as a three-stage continuum ranging from experiencing nature in everyday life to nature-based health promotion and nature-based therapy (GreenME Project, 2024). This continuum reflects the idea that contact with nature contributes to health and wellbeing through multiple pathways – from recreational and restorative experiences in daily life, to more formalized interventions such as therapeutic gardening, care farming, or forest therapy (Figure 1).

Beyond clinical effects, Moriggi et al. (2020) argue that these practices promote a transformative ethic of care that strengthens the bond between urban dwellers and their environment. By emphasizing both preventive and therapeutic dimensions, Green Care thereby bridges public health, social innovation, and environmental restoration, making it a promising approach for sustainable and health-promoting cities. From a public health perspective, Green Care can contribute to health promotion and prevention while also complementing care for people with existing health problems, particularly stress-related symptoms, anxiety and depressive symptoms, and psychological distress (Salomon et al., 2018; Coventry et al., 2021; Jessen et al., 2025). Green Care may also address related modifiable risk factors, including loneliness, social isolation, and physical inactivity (Catena et al., 2026). While Green Care should not be understood as a substitute for clinical treatment, it can complement existing care by supporting mental health and wellbeing and strengthening resilience (Salomon et al., 2018; Jessen et al., 2025). Depending on the intervention type, Green Care may particularly benefit urban populations, older adults, children and adolescents, people experiencing psychological distress, and socioeconomically disadvantaged groups who often face limited access to health-promoting environments (Murray et al., 2019; Harrison et al., 2023; Campbell et al., 2026). Potential mechanisms include improved access to restorative environments and opportunities for stress reduction, social interaction and physical activity.

Despite documented benefits, the implementation and institutionalization of Green Care vary across countries. In the international



FIGURE 1
Three-stage continuum of Green Care (GreenME Project, 2024). Reproduced with permission.

context, Germany is characterized as a "follower country" within the framework of the GreenME project—an EU-funded research initiative that analyzes the implementation of the Green Care concept across seven European countries, distinguished from "frontrunner countries" like the UK or Sweden (Giedych et al., 2024). The reasons for this lagging development are multifaceted and rooted in the structural path dependencies of the German welfare state, which prioritize high-cost clinical and pharmacological interventions over decentralized, nature-based interventions. This systemic bias is underscored by the fact that in 2023, Germany spent 743 EUR per capita on pharmaceuticals in pharmacies—the highest amount in the European Union (OECD/European Observatory on Health Systems and Policies, 2025). This spending pattern illustrates Germany's strong orientation toward conventional treatment-focused healthcare, which may create less favorable conditions for the cross-sectoral integration of preventive approaches such as Green Care.

The German Green Care landscape itself remains fragmented. While numerous initiatives exist that align with its principles, including therapeutic horticulture, social farming, or green prescriptions, they are rarely recognized under a unified conceptual framework or explicitly referred to as Green Care (Haubenhofer et al., 2010). Instead, they operate under diverse labels such as "Social farming," "Animal-assisted-Pedagogic," or "Horticultural Therapy" (Haubenhofer et al., 2010; Sempik et al., 2010). Several organizations (e.g., GhL, EAG-FPI, IGT-Berlin f.i) provide training and services aligned with Green Care principles, including garden therapy in clinics (often as part of occupational therapy), landscape gardening in workshops for disabled people, animal-assisted therapy (increasingly in pediatrics), as well as spa- and healing forests. However, these organizations rarely use the term Green Care and instead emphasize the distinct identity of their approaches, which may also compete for clients, patients, and limited financial resources. However, the term itself is slowly entering academic discourse, professional language, and policy debate. As Petzold et al. (2018) point out, while the conceptual groundwork for "New Nature-Based Therapies" has been laid academically, the movement in Germany is still in its early stages of professionalization and is mostly characterized by isolated pioneering efforts. Consequently, the lack of clarity in Green Care, with its three pillars of Nature in everyday life, Nature-based health promotion, and Nature-based therapy—complicates its systematic integration and implementation, with no clearly defined pathway or steps for embedding Green Care across relevant sectors currently established in Germany.

Current research in Germany reflects this situation by predominantly focusing on Social Farming, mostly in rural settings, where initiatives foster social inclusion and economic benefits (Gallis, 2007). The Chamber of Agriculture North Rhine-Westphalia has been actively engaged with the topic since 2014, but its scope remains largely restricted to agricultural settings (Landwirtschaftskammer Nordrhein-Westfalen, 2020). While documentation exists regarding health effectiveness—particularly in dementia care (Wolf-Ostermann and Schmidt, 2018) or the restorative potential of nature-based interventions (Kals et al., 2023), a systematic overview of the general status and professional perception of Green Care in Germany, especially within the urban context, is currently missing. Relevant research from other Western European contexts has examined the development and implementation of Green Care and related nature-based health approaches, including in highly urbanized settings (Haubenhofer et al., 2010; De Bell et al., 2024). To our knowledge, no previous study has specifically investigated Green Care in the Ruhr region, making this study a first exploratory assessment of its current status, implementation, and opportunities for further development. This research gap is critical, as the need for Green Care is arguably highest in densified urban areas where residents face a significantly higher risk of developing mental health disorders, such as anxiety and mood disorders, compared to their rural counterparts (Peen et al., 2010; Gruebner et al., 2017). This "urban health penalty" (Galea et al., 2005; Gould, 1998; Zhu et al., 2021) makes the integration of nature-based interventions into city planning a matter of urgency. The Ruhr area, as one of Europe's largest metropolitan regions, serves as a compelling case study. Although the region has invested heavily in GBS as part of its

post-industrial transformation, these spaces are seldom viewed through the strategic lens of Green Care.

This study addresses this gap through a qualitative analysis of stakeholder perceptions in the Ruhr region, aiming to: (1) reveal stakeholder perceptions, (2) identify reasons for low awareness of Green Care, and (3) highlight opportunities and barriers for further development. It thereby provides new insights into the transformative potential of Green Care for promoting community resilience and sustainable urban development.

2 Materials and methods

2.1 Study area: Ruhr region

The Ruhr region is located in western Germany and is part of the federal state of North Rhine-Westphalia (NRW), Germany's most populous federal state. It is considered one of the largest contiguous urban regions in Europe. It comprises more than a dozen medium-sized cities that are located close to each other and together form a polycentric conurbation (Regionalverband Ruhr, 2018). Administratively, the area is coordinated by the Regional Association of the Ruhr (RVR), an association of the participating municipalities. The Ruhr region covers an area of approximately 4,400 km^2, home to around 5 million people as of 2024. This corresponds to a population density of around 1,150 inhabitants/km^2, making the region one of the most densely populated urban areas in Europe (Regionalverband Ruhr, 2025). The Ruhr region is characterized by the dense spatial interconnection of numerous large and medium-sized cities, which together form a highly urbanized fabric that is also interspersed with green spaces and open areas. This extensive network of GBS serves as a vital ecological backbone, transforming former industrial sites and river corridors into high-quality natural habitats. By weaving these "green lungs" and aquatic lifelines—most notably the revitalized Emscher river and the Ruhr river—into the heart of the metropolis, the region effectively fosters regional biodiversity and maintains a cohesive landscape despite its high urban density. Consequently, the strategic distribution and restored state of these terrestrial and aquatic spaces have become a cornerstone of the Ruhr region's transition toward a resilient and sustainable urban landscape (Figure 2).

Historically, the Ruhr region was shaped by mining and the steel industry, which had determined the economic development and urban structure of the region since the 19th century (Czierpka, 2019; Dahlbeck et al., 2021). Many cities sprang up in the immediate vicinity of industrial plants and railway junctions, creating an urban fabric of industrial areas, workers' housing estates, a network of motorways, and inland port zones. Green spaces played only a minor role in this context. Since the 1960s, the Ruhr region has been undergoing profound structural changes. The closure of mines and industrial plants led to considerable economic and social challenges, but at the same time opened up opportunities for the conversion of post-industrial sites (Regionalverband Ruhr, 2018; Dahlbeck et al., 2021). Renatured industrial wastelands, slag heaps, and reclaimed green spaces now offer ideal conditions for Green Care initiatives that combine nature-based approaches with social and health benefits.

The combination of high urbanity, socio-economic spatial challenges, and a dense network of revitalized GBS makes the Ruhr region a particularly relevant study area for Green Care. Compared to other urban regions in Germany, the Ruhr region is

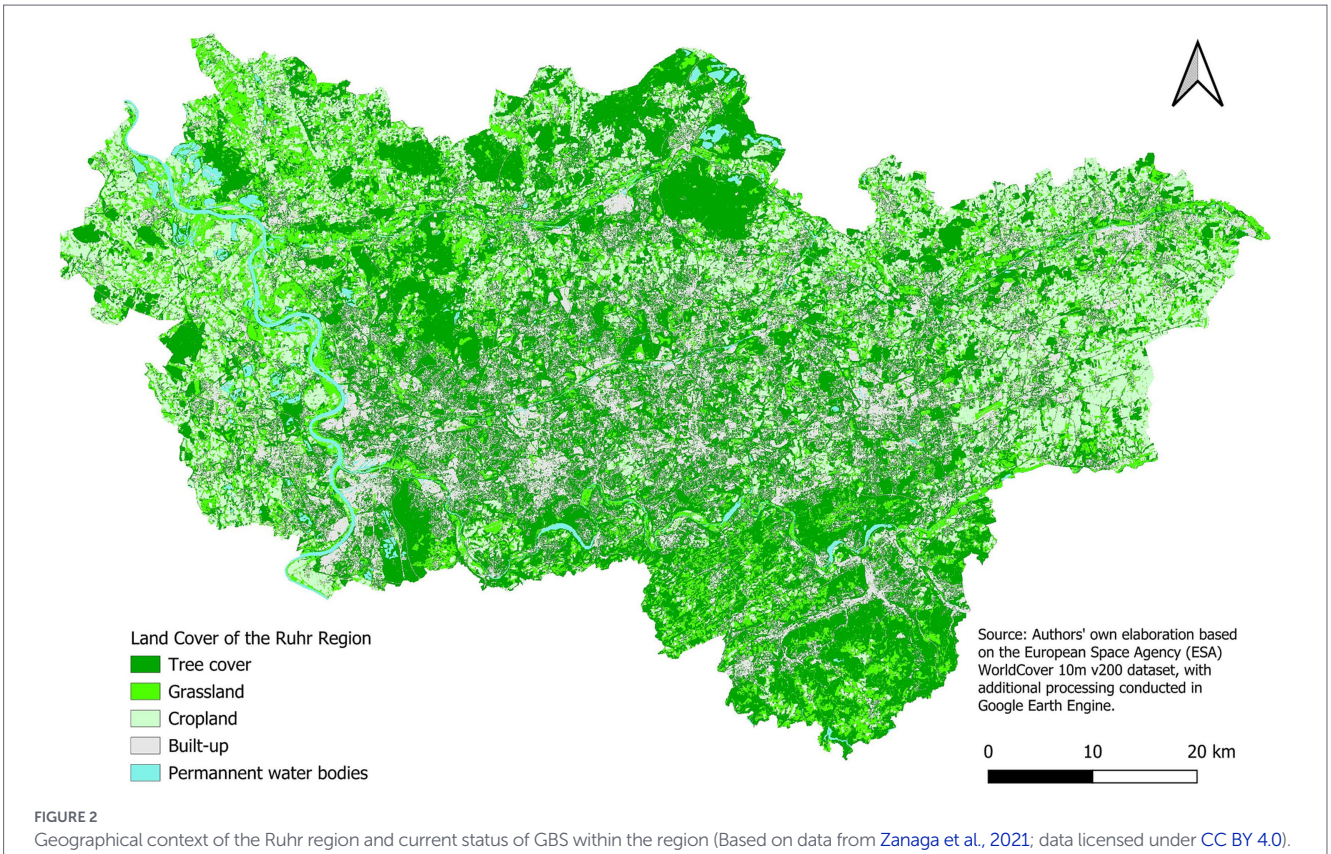


FIGURE 2
Geographical context of the Ruhr region and current status of GBS within the region (Based on data from Zanaga et al., 2021; data licensed under CC BY 4.0).

distinguished by its unique polycentric structure, closely interconnected medium-sized cities, its extensive post-industrial landscape transformation, and its exceptionally dense network of regenerated industrial sites, river corridors, and accessible green spaces embedded within the urban fabric. These conditions create specific opportunities for Green Care by enabling the integration of health promotion, social participation, and ecological restoration into the ongoing transformation process. At the same time, they are associated with challenges typical of densely populated conurbations, including competing land uses, high spatial pressure, and fragmented governance across multiple municipalities. In addition, the Ruhr region constitutes one of the core project regions of the GreenME project, enabling close collaboration with local stakeholders and facilitating the direct investigation of ongoing Green Care developments in a real-world implementation context.

2.2 Data collection

This study draws on empirical material generated between 2024 and 2025 using two complementary data sources: semi-structured stakeholder interviews and a participatory co-creation workshop (Figure 3). The study followed a sequential mixed-method design, with the interviews providing an initial understanding of stakeholders' perceptions, existing practices, implementation barriers, and opportunities for Green Care in the Ruhr region. These findings informed the planning and thematic focus of the subsequent co-creation workshop, in which stakeholders collaboratively discussed, prioritized, and refined the implementation challenges and opportunities. Together, both methods provided complementary insights by combining individual stakeholder perspectives with collaboratively developed priorities and implementation pathways. The study was not pre-registered.

Ethical approval for the stakeholder interviews and the co-creation workshop was obtained through the internal ethics review process at the ILS (Research Institute for Regional and Urban Development).

2.2.1 Semi-structured stakeholder interviews

Semi-structured interviews were conducted with stakeholders from practice, policy, and research in the Ruhr area to gather in-depth insights into Green Care. This provided a diverse and holistic understanding across different professional backgrounds. A total of 12 interviews were conducted, including two double interviews with participants from the same organization. Participant characteristics and stakeholder affiliations are provided in Supplementary Material 4. Participants were grouped into three categories: Implementers (I, $n = 6$), Supporters (S, $n = 3$), and Policy and Decision Makers (P, $n = 3$). Following the stakeholder typology developed by Giedych et al. (2023), implementers are actors directly involved in the provision and delivery of Green Care activities (e.g., therapeutic farms or urban green space managers). Supporters include stakeholders who actively promote or facilitate Green Care through activities such as research, funding, education, or dissemination. Policy and decision makers refer to actors in positions of authority who shape strategic frameworks and make decisions regarding the development and implementation of Green Care (e.g., public authorities or administrative bodies).

Stakeholders were purposively selected based on the stakeholder mapping developed by Giedych et al. (2023), a publicly available project deliverable identifying relevant actors across sectors, including municipalities, public health authorities, research institutions, healthcare practitioners, and Green Care practice fields (see Supplementary Material 4). Potential participants were contacted via personalised email invitations introducing the GreenME project and its objectives related to Green Care, nature-based therapies, mental health, spatial planning, and

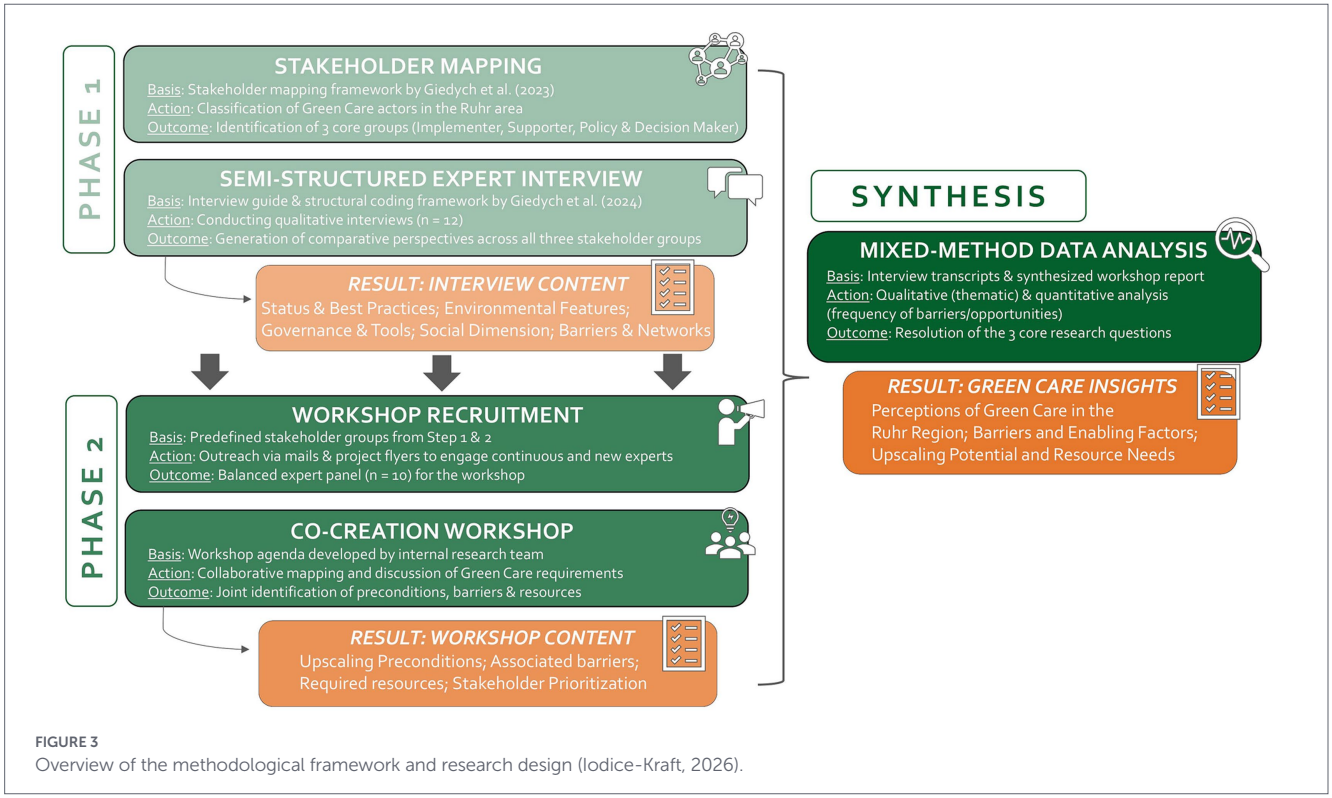


FIGURE 3
Overview of the methodological framework and research design (Iodice-Kraft, 2026).

health equity, and invited stakeholders to contribute their expertise on the status and implementation of Green Care. The selection aimed to represent all three levels of Green Care and stakeholder groups, ensuring broad coverage of perspectives relevant to the Ruhr area. The sampling strategy focused on professional and institutional stakeholders to capture expert perspectives on Green Care implementation, barriers and future development in the Ruhr region. Potential end-users and local community members were therefore not included, as adequately capturing their perspectives would have required a distinct methodological approach and, particularly for potentially vulnerable or underserved populations, additional ethical considerations. Their perspectives were outside the scope of this study and are acknowledged as an important area for future research.

The final sample size was not determined by a predefined numerical target but resulted from stakeholder availability, voluntary participation, and the project timeframe. Within these constraints, the aim was to include as many relevant stakeholders as possible while ensuring representation across all stakeholder groups. These categories were used throughout the analysis to explore similarities and differences in stakeholder perspectives and contextualize emerging themes.

The semi-structured interview guide was developed by the project team and structured around nine thematic domains derived from the Green Care framework and stakeholder-relevant topics (see Supplementary Material 2). The domains were designed to directly address the study objectives by exploring stakeholder's perceptions and understanding of Green Care, its current implementation in the Ruhr region, including existing practices and projects, perceived barriers and enabling factors, and opportunities for future development.

The interviews were conducted online between April and May 2024 and lasted approximately 40–60 min. They were conducted by one or two researchers. Informed consent for participation and audio recording was obtained from all participants. The interviews were conducted in German, transcribed using f4x software, anonymized, and subsequently translated into English using DeepL.

2.2.2 Co-creation workshop

In addition to the interviews, a co-creation workshop was conducted to capture and deepen stakeholder perspectives through an interactive, collaborative process. The workshop took place on 21st February 2025 in a hybrid format, with on-site participation at the City Hall of Herne. A total of 10 participants represented practice, research, and policy sectors. While 4 out of 10 participants had previously taken part in the interviews, 6 were newly included stakeholders (see Supplementary Material 5). The additional participants were not recruited as substitutes for interview participants but were identified through ongoing project activities and stakeholder recommendations to expand the network.

Participants were selected based on their relevance to Green Care in the Ruhr region and representation of the different levels and stakeholder groups (Implementers, Supporters, and Policy and Decision Makers), following Giedych et al. (2023). Recruitment was conducted via email invitations and project flyers, introducing the GreenME project and its objectives related to Green Care, the generation of evidence on nature-based therapies, and their integration into planning and health systems. Participation was voluntary and depended on stakeholders' availability and willingness to engage in the workshop series within the project timeframe.

The 3-h workshop was facilitated by the project partner, the City of Herne. It was the first nationally focused, content-driven workshop within the broader GreenME co-creation process and explored opportunities and challenges for advancing Green Care in the Ruhr region. This was the only workshop included in the study, as subsequent workshops had not yet taken place at the time of analysis. The facilitator implemented the workshop based on a concept and agenda developed by the responsible research team. No external moderator was involved.

The workshop followed a structured sequence from generating preconditions to their collective prioritization and the exploration of implementation barriers and resource needs. Participants received introductory information on the current status of Green Care, the country-specific objective, and related guiding questions developed from the preceding stakeholder interviews, which informed the workshop framing while the specific preconditions were generated by participants themselves. Following this introductory input, participants engaged in an open brainstorming exercise. They were asked to identify preconditions necessary for achieving the country-specific objective. Each participant could generate a maximum of three preconditions, with each contribution recorded on a separate sticky note. No predefined categories or additional criteria were imposed. Participants could therefore draw on the introductory information as well as their individual professional knowledge and experience.

After the brainstorming exercise, each participant briefly presented the preconditions they had proposed. The collected preconditions were then prioritized through a voting exercise. Each participants received three voting points, represented by stars, which could either be distributed across different preconditions or all allocated to a single precondition. The voting aimed to select approximately ten key preconditions for more detailed discussion within the available workshop time. The prioritization process resulted in nine preconditions being taken forward (PC1-PC9; Supplementary Material 3). The highest-ranked preconditions were subsequently discussed using a structured table. For each prioritized precondition, the proposing participant first suggested required resources and possible barriers, which were subsequently discussed in the plenary to incorporate additional perspectives.

Throughout the process, the facilitator guided participants through the activities and tasks. The workshop was documented in written minutes and compiled into a report comprising the generated preconditions, their collective prioritization, and their associated barriers and resource requirements. These outputs formed the basis for subsequent qualitative and quantitative analysis (see Section 2.2) and complemented the interviews with collectively generated and prioritized insights into Green Care implementation at the regional level.

2.3 Data analysis

Following the data collection, a mixed-methods approach was employed for the purpose of analysis, combining qualitative thematic analysis to capture stakeholder perceptions, experiences, and insights (Section 2.2.1), with quantitative elements to assess the relative importance of barriers and opportunities (Section 2.2.2).

2.3.1 Qualitative analysis

The qualitative analysis focused on capturing the perceptions and experiences of stakeholders regarding Green Care in the Ruhr region, providing insights from both the interviews and the workshop. The

interview transcripts were systematically analyzed using CATMA, a browser-based software for text marking, annotation, and coding (Gius et al., 2025). The analysis followed an existing GreenME coding framework (Giedych et al., 2024), derived from the common interview guide and applied across participating countries to ensure methodological consistency and comparability. The framework was developed collaboratively by the country teams through test interviews, initial coding and subsequent discussions to establish a standardized coding scheme. Consequently, the analysis followed a framework-guided qualitative content analysis approach. The resulting framework comprised nine main codes and 45 subcodes, which were applied deductively to the interview material. The overarching focus of the analysis was the implementation of Green Care and the use of nature-based approaches to support mental health and wellbeing. The analysis covered the following thematic categories: (1) Status, (2) Cooperation, (3) Area characteristics, (4) Provision guidelines, (5) Equity & justice, (6) Promotion activity, (7) Barriers & conflicts, (8) Promotion tool, and (9) Best practices.

The workshop results were consolidated into a synthesized report (see Section 2.1.2). Due to the different objectives and methodological approaches, workshop data were analysed separately from the interviews, without using the interview coding framework or CATMA. The workshop structure itself provided the main analytical dimensions: preconditions for scaling up Green Care, their prioritization by stakeholders, associated barriers, and required resources. For this study, the workshop report was analyzed to identify the key preconditions for scaling up Green Care, their prioritization by stakeholders, and the associated barriers and required resources. The findings were subsequently considered alongside the interview findings to provide complementary perspectives on the current implementation and future development of Green Care in the Ruhr region.

2.3.2 Quantitative analysis

The qualitative analysis was complemented by a quantitative procedure. Both the interview transcripts and the workshop outputs were coded to identify mentions of Green Care potentials and barriers in the Ruhr region. While the qualitative content analysis followed the predefined GreenME coding framework, categories representing potentials and barriers were subsequently derived inductively from the coded interview and workshop material. Each instance of a potential or barriers was marked, and overlaps between the interviews and the workshop were assessed. The three stakeholder groups were tracked throughout the analysis: Implementers (I1–6), Supporters (S1–S3), and Policy Decision Makers (P1–P3). A mapping procedure was then applied to determine which stakeholders mentioned each category. Each stakeholder was counted once per category, irrespective of how often the respective topic was mentioned within an interview. These counts were used to identify recurring patterns and assess the relative prominence of potentials and barriers across the stakeholder sample. The analytical mapping and visualization approach was adapted from Specht et al. (2019). For the workshop data, the identified conflicts and potentials were mapped onto the predefined preconditions, and the frequency of references was similarly assessed by the research team. The extracted data were organized and analyzed in Excel. This quantitative approach identified the most frequently reported potentials and conflicts and highlighted recurring patterns and sectoral priorities and challenges across stakeholder perspectives.

3 Results

3.1 Stakeholder perceptions and understanding of Green Care

The perspectives of stakeholders from diverse professional backgrounds, including healthcare, education, agriculture, social services, and environmental sectors, provide insights into how Green Care is conceptualized, implemented, and valued across institutional and practical contexts.

The results indicate that stakeholders hold diverse and context-dependent perceptions of Green Care. Its understanding varies according to professional background, experience, and institutional mandate. Participants with a background in healthcare, education, and environmental and social sectors describe Green Care as a therapeutic, preventive, or social approach. Some emphasize its health-promoting function, while others highlight experience-oriented interventions that foster psychosocial health in particular. Across these perspectives, nature contact was understood not only as an environmental or recreational component, but also as a resource that can be intentionally used within health-promoting, preventive, therapeutic, and socially oriented activities. Stakeholders referred to a range of settings, including forests, parks, natural landscapes, and gardens, and emphasized that their suitability for therapeutic purposes depends on the intended intervention and the needs of specific target groups. These included, among others, children and adolescents, older adults, people with disabilities, and people with psychiatric, psychosomatic, or dementia-related characteristic of any natural environment, but as the purposeful use and, where necessary, adaptation of natural settings to specific health-related needs. This reflects the broad continuum of Green Care, ranging from everyday contact with nature to more structured nature-based interventions.

At the same time, the term Green Care itself is not uniformly understood. Different expectations, associations, and priorities lead to varying understandings of what Green Care actually encompasses and how it is implemented in practice. For example, some groups emphasize the integration of nature experiences into therapeutic settings, while others focus on social inclusion, enabling vulnerable or marginalized groups to participate in meaningful activities in natural settings, or on environmental education, aimed at fostering environmental awareness, ecological knowledge, and sustainable behavior. These differences also illustrate that stakeholders do not necessarily associate Green Care with a single type of intervention or health outcome, but rather with a range of nature-based practices that may serve therapeutic, preventive, psychosocial, social, or educational purposes.

Despite these differences, there is a broad agreement that Green Care represents a promising interdisciplinary approach, bridging agriculture, the health sector, and social services, and combining health, social, and environmental potential. Stakeholders therefore perceived Green Care as extending beyond the provision of GBS itself, emphasizing the purposeful use of nature within activities intended to support health, wellbeing, participation, and social inclusion. At the same time, stakeholders highlight the need for standardized quality criteria and formal recognition to consolidate these diverse perceptions into a coherent and professional field.

Overall, the results show that stakeholders' perceptions of Green Care are multifaceted and context-dependent. They range from therapeutic, preventive, and social perspectives to ecological and participatory approaches. The health-related dimension is therefore embedded

within a broader understanding of Green Care rather than perceived as an isolated function. However, the call for standardized quality criteria and official accreditation remains a central theme to transform these diverse perceptions into a recognized professional field.

3.2 Reasons for the low level of awareness

Building on these findings regarding stakeholders' perception and understanding of Green Care, the analysis identifies several reasons for what interviewees perceive as limited awareness and recognition of Green Care among the broader public and across relevant professional and institutional sectors. While the interviewed stakeholders are generally familiar with the concept, their understanding often remains superficial, and its professional, health-promoting applications are not widely acknowledged.

There are many reasons for this. On the one hand, fragmented communication between sectors – different technical languages, inconsistencies in terminology, and a lack of coordinated public relations work—makes it difficult to achieve a clear and uniform understanding. There is a widespread lack of target group-specific information tailored to decision-makers in the health sector, teachers, urban planners, or the general population. On the other hand, many stakeholders perceive a lack of verifiable evidence regarding the effectiveness of Green Care. However, scientific evidence already demonstrates health benefits associated with exposure to green spaces (Twohig-Bennett and Jones, 2018) and improvements in mental health outcomes through structured nature-based interventions (Coventry et al., 2021). The interview findings therefore suggest that existing scientific evidence may not be sufficiently known, accessible, or applicable to stakeholders' specific professional contexts. In particular, stakeholders referred to a perceived lack of large, standardized data sets or randomized controlled trials on the health, psychosocial, and economic effects of nature and gardening practices. As a result, the benefits of Green Care seem abstract to many stakeholders and difficult to apply to their practice or decision-making.

Institutional factors also contribute to limited awareness. Green Care is not yet an integral part of curricula, professional training, or political strategies, so stakeholders have limited practical experience. Although model projects and pilot initiatives demonstrate concrete applications, their impact on general understanding remains limited because they are scattered across regions and topics. Furthermore, public perception and media coverage have a significant impact on awareness. Green Care initiatives are rarely communicated visibly, and there is a lack of consistent branding, storytelling, and compelling case studies that clearly convey their health-promoting, social, and environmental benefits. As a result, although stakeholders have a basic understanding, the importance, opportunities, and concrete feasibility of Green Care are often underestimated.

3.3 Barriers to the further development of Green Care

While Green Care is still at an early stage of development in the Ruhr area, certain conflicts and challenges are already visible. These issues point to existing structural and organizational barriers that currently limit broader implementation (Figure 4; Supplementary Material 1). Overall, $n = 10$ conflict areas were identified that were mentioned in at least three contributions. This threshold was applied solely to improve the readability of the figure and to highlight recurring patterns. Additional themes that were mentioned less frequently are reported in Supplementary Material 1. The identified conflicts are based on a synthesis of all collected data and reflect both shared perspectives and differing priorities among stakeholders. Rather than distinguishing between data sources, the following section summarizes the key barriers to Green Care implementation,

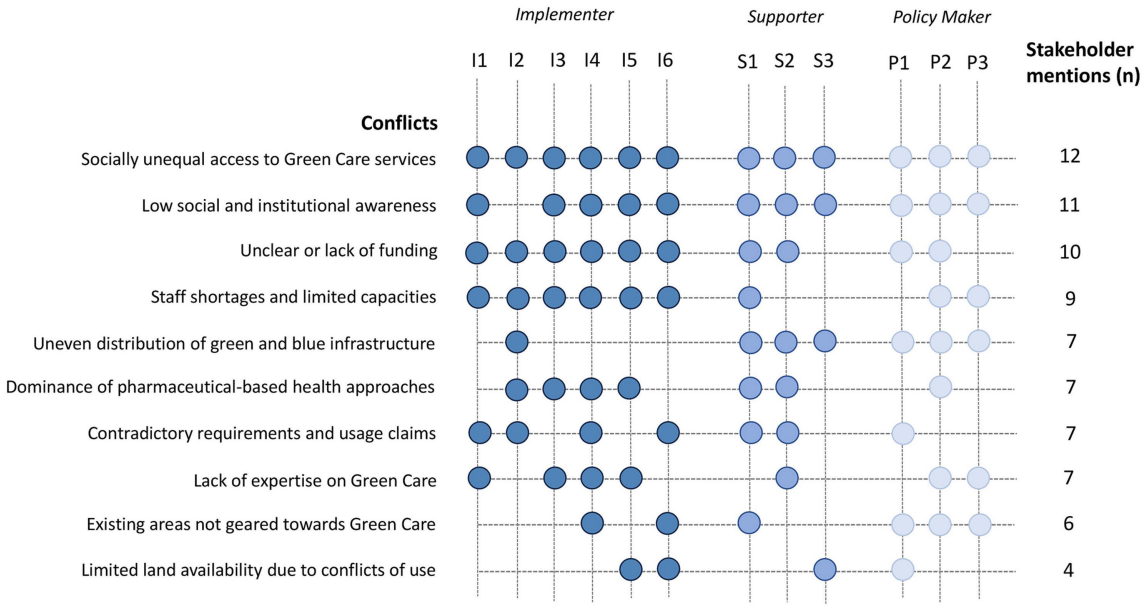


FIGURE 4
Overview of the most frequently mentioned conflicts of Green Care. Each dot indicates that a specific conflict was mentioned by an individual stakeholder. The number of dots per conflict, therefore, reflects how many stakeholders mentioned the respective conflict. The right-hand column shows the total number of stakeholders who mentioned each conflict (Iodice-Kraft, 2026).

highlighting the most frequently recurring areas of tension and challenge.

Participants in the co-creation workshop elaborated nine preconditions (PC1–PC9) considered essential for the upscaling of Green Care (Supplementary Material 3). Comparing the workshop results with the interviews reveals recurring patterns, highlighting consistent challenges and providing a more comprehensive picture of obstacles to Green Care development. Figure 4 provides an overview of the identified barriers to Green Care implementation, which are further elaborated in the following sections.

3.3.1 Socially unequal access to Green Care services

If it comes to barriers for the further development of Green Care, the most prominent concern is socially unequal access to Green Care services ($n = 12$), shaped by interacting social, institutional, and spatial factors. Respondents emphasized that socioeconomic factors exclude certain groups from equal participation: *"The two factors of income and education play a role in access. […] Some disadvantaged groups of people do not have the awareness or capacity to deal with the topic of Green Care. […] they are confronted with other everyday problems"* (I3). These barriers are particularly pronounced among lower-income populations, migrants, socially disadvantaged groups, and people with disabilities, who face additional obstacles such as language barriers, physical accessibility issues, limited awareness of offerings, entry fees at certain sites, or inadequate transport infrastructure in densely urbanized regions like the Ruhr area (PC3, PC4). Spatial disparities reinforce these social inequalities, as residents in higher socioeconomic positions are more likely to live in greener neighborhoods or have private access to nature, reflecting the observation that "*access is of course easier for people who are socially higher up, because they usually have a garden, […]. Or are integrated into residential areas, where it doesn't take long to get out into nature*" (I4). This reflects broader spatial inequalities, where access to green and blue infrastructure is unevenly distributed due to urban segregation, historical disinvestment, and planning processes that tend to favor more affluent and politically influential populations (PC8).

Green Care initiatives are therefore often perceived as selectively reaching urban, educated, and health-conscious groups, reinforcing concerns about elitist structures. Institutional dynamics further exacerbate these inequalities, as well-resourced regions and organizations are better positioned to navigate funding and administrative requirements (PC5). In addition, unintended consequences of greening, such as rising rents and displacement—phenomena often referred to as green gentrification—as well as unequal access in the education sector, where well-resourced institutions implement Green Care more easily than underserved ones, further deepen existing disparities (PC8, PC9). Together, these dynamics undermine equitable access to Green Care by turning an inclusive approach into a privilege for selected groups.

3.3.2 Low social and institutional awareness

Low social and institutional awareness ranks second ($n = 11$) and is closely linked to issues of access. Green Care remains insufficiently recognized across society, healthcare systems, and policy contexts. Individuals experiencing health issues tend to rely on conventional medical pathways such as physicians and medication, while nature-based approaches are rarely considered. Although the benefits of Green Care are increasingly recognized in specialized areas like dementia care, a broader societal disconnection from nature persists. This perception gap is compounded by the lack of formal recognition and protection for professions such as garden therapy:

> *"I didn't even know or had heard about it [Green Care] before you asked me about it, and that I had also spoken to my colleagues, and they weren't aware of it either, that they rather understood that you maintain green spaces, or what exactly is meant by that?" (S3).*

Green Care is frequently perceived as a "soft" or non-medical approach and is often reduced to or confused with leisure activities such as gardening or nature conservation, rather than being understood as an integrated health-promoting intervention (PC1, PC4, PC6). Consequently, even providers themselves rarely frame their work explicitly within a Green Care context. Green Care is rarely recognized or prioritized within health ministries, statutory health insurance institutions (GKV), or policy documents, and competing agendas often push it to the background (PC1–PC3). Most health insurers have not yet integrated nature-based approaches into their agendas. Similarly, political stakeholders outside the health domain exhibit limited familiarity: "*this concept is not very widespread, especially in the municipality*" (P3). This situation highlighted the marginalization of Green Care in administrative, medical, and planning contexts.

Overall, this low level of visibility and institutional embedding contributes to skepticism among health professionals, decision-makers, and the public, while also reinforcing existing social inequalities, as awareness remains particularly limited among already underserved populations (PC4, PC8).

3.3.3 Unclear or lack of funding

Closely related to the awareness challenges, unclear or a lack of funding emerged as the third most frequently cited conflict ($n = 10$). All implementers emphasized its practical relevance, highlighting the absence of stable financing mechanisms and official state recognition, which leaves providers in a precarious position, particularly in competition with well-established sectors such as the pharmaceutical industry:

> *"Due to the dominant role of the pharmaceutical industry, the focus is more on prescribing medication. As the pharmaceutical industry is a supply market and […] profit-oriented, not enough funding is provided for the non-pharmaceutical sector" (I3).*

Beyond limited resources, the funding landscape was described as highly opaque, with unclear financial responsibilities and the difficulty of identifying appropriate funding bodies within a complex "*jungle of authorities*" (I4). Participants repeatedly stressed the need for sustainable, long-term financing covering both service delivery and maintenance of GBS, the latter "is almost as expensive over the years as the production" (P1).

Unclear or insufficient funding pathways, uncertainty about who should fund Green Care—health insurers, municipalities, or environmental programs – and the predominance of short-term,

project-based schemes focused on pilots rather than sustainable initiatives further limit the capacity to implement and scale Green Care (PC1, PC3, PC5, PC6). High upfront costs for infrastructure, training, and pilot implementation further limit capacity to implement and scale Green Care. Funding frameworks were also described as rigid and restrictive. Limited flexibility prevents adaptation to grassroots initiatives or underserved areas, while resources are often disproportionately allocated to already green or politically active neighborhoods (PC8, PC9). Essential components such as outdoor learning infrastructure, professional development, and project support staff are frequently underfunded, requiring creativity and cross-sectoral financing to bridge gaps (PC9).

Regional economic pressures, including strained municipality budgets, further compound these challenges, prioritizing revenue over green preservation and highlighting tensions between short-term economic needs and long-term community benefits from nature-based interventions.

3.3.4 Staff shortages and limited capacities

Staff shortages and limited capacities constituted the fourth most frequently cited conflict ($n = 9$) and were mentioned by all implementers, underscoring their significance for program delivery. A lack of specialists, time, and personnel was consistently described as a key barrier. As a consequence, supplementary activities like garden therapy are often deprioritized when core responsibilities in sectors like nursing, childcare, or nature conservation require attention. Few individuals can commit to Green Care on a full-time basis, and reliance on volunteers was widely regarded as unsustainable:

> *"I also see a lot of things that are beautifully presented but are not so easy to reconcile in practice, and that I also define our work by this, and that it cannot be completely outsourced to volunteers. This work also has to be coordinated and supported, and we have to feed it conceptually […]. It doesn't just happen on its own. That's why there are often a lot of small projects" (I6).*

Skilled labor shortages also affect everyday nature integration, for example, when childcare excursions are cancelled due to a shortage of staff needed to maintain basic care provision. Maintenance of GBS adds further pressure, as it depends on personnel resources that are frequently unavailable. Limited time and financial resources further constrain program development, particularly in school and educational settings, where overloaded curricula, inflexible schedules, and the absence of mandates for nature-based or experiential education hinder implementation (PC6, PC9).

Participants additionally noted the lack of unified training, accreditation, and professional recognition for Green Care practitioners (PC1, PC3, PC5, PC6, PC9). Incentives to specialize are scarce, with unclear career paths, billing options, and professional representation (PC1, PC5). Coordination and implementation work is often underfunded or voluntary, while experience with public funding mechanisms and professional advocacy is limited (PC3, PC4, PC5, PC6). Despite these constraints, respondents highlighted strong interest among practitioners and municipal stakeholders, pointing to considerable untapped potential. Expanding Green Care, therefore, requires not only additional staff but also structured training, certification, and institutional support.

3.3.5 Uneven distribution of green and blue infrastructure

The uneven distribution of green and blue infrastructure was identified as the fifth most frequently mentioned conflict ($n = 7$) and is closely linked to socially unequal access. This concern was primarily raised by supporters and policymakers, reflecting their focus on spatial planning and conceptualization, rather than daily implementation. While a basic level of access exists, GBS are unevenly distributed within cities with *"a certain degree of access to […] green infrastructure and blue infrastructure everywhere, […] still not equally distributed"* (S2). In the Ruhr area, such spaces are often concentrated on the periphery or in less densely populated areas, leaving high-density urban cores underserved. Intra-urban disparities further exacerbate this pattern, with northern neighborhoods often less endowed than southern parts "*and there's also a bit of an equator, in that the south is often greener and you might want to do more in the north*" (S3). Residents in underserved areas must travel farther to reach natural spaces, creating barriers for programs requiring proximate access. Participants further noted that these spatial inequalities disproportionately affect low-income populations, older adults, individuals with limited mobility, and residents without access to private transportation, for whom longer travel distances can significantly reduce participation opportunities. Moreover, stakeholders emphasized that unequal access is not solely a matter of quantity but also of quality. GBS in disadvantaged neighborhoods were often perceived as less attractive, less well-maintained, and less suitable for therapeutic or recreational activities, further limiting their potential use for Green Care initiatives. As a result, those groups that could potentially benefit most from nature-based interventions may face the greatest challenges in accessing them.

In the workshop, the uneven distribution of green and blue infrastructure was mentioned less frequently but remained a recognized concern. Participants noted that initiatives often reach urban, educated, and health-conscious populations, while historical planning, urban segregation, and disinvestment in low-income areas limit access. Funding and implementation tend to favor neighborhoods that are already green or politically active (PC4, PC8, PC9), reinforcing spatial inequalities and constraining equitable participation in Green Care programs.

3.3.6 Dominance of pharmaceutical-based health approaches

Complementing spatial and resource-related challenges, the dominance of pharmaceutical-based health approaches emerged as another key conflict ($n = 7$). Participants described a systematic bias towards drug-centric treatments: "*I think the mindset is: we have ten other things to do before we think about Green Care on the eleventh*" (I5). Green Care is often marginalized in healthcare planning despite its preventive and holistic potential, and it is frequently perceived as "soft" or non-medical, framed more as wellness than healthcare and misaligned with traditional evidence hierarchies (PC1).

Participants reported that nature-based interventions receive little attention in medical education and perceived many healthcare professionals as having limited knowledge of their application. Several interviewees further expressed the view that Green Care is often regarded as a "nice add-on" rather than a legitimate therapeutic approach comparable to more conventional medical interventions. The established

pharmaceutical sector benefits from greater evidence accumulation and heightened awareness, making it

> *"very difficult at the moment to get into the white sector as a Green. My colleagues often work outside the white sector, and they also have to fight for a lot of things. These are things that often run under a different name but are still garden therapy" (I4).*

Medical and insurance associations may be hesitant to expand reimbursable services, and nature-based therapy remains largely outside mainstream medical and public culture, particularly among marginalized groups (PC2, PC4, PC6). Overall, both interview and workshop findings highlight skepticism toward Green Care, misalignment with medical norms, and limited institutional support, which collectively hinder its integration into conventional healthcare systems.

3.3.7 Contradictory requirements and usage claims

Contradictory requirements and usage claims ($n = 7$) arise from multiple stakeholders contesting access to shared GBS. Nature protection objectives often conflict with Green Care use, resulting in restrictions:

> *"I'd say authorities often impose a lot of things, or this typical sign,'Don't step on the lawn,' unfortunately, still exists. This is also something that can be categorized as a conflict or barrier, because you often have to deal with municipal and state institutions. What is allowed? Are you allowed to use this park in such and such a way, etc.?" (I4).*

Private ownership and associated costs further limit access,

> *"because on the one hand you want to enjoy and promote nature and the environment, and also promote it in education, but on the other hand, there are a lot of bans or private forest owners who don't want you to use their forests in order to ultimately get an economic branch" (I1).*

These conflicts extend across multiple sectors, including health, education, environmental protection, and social work. Differing priorities, professional languages, and legal recognition across federal states, competition for urban GBS, unclear responsibilities, safety concerns, and bureaucratic hurdles further complicate access and program implementation (PC2, PC3, PC6, PC9). Both interview and workshop findings underscore intersectoral fragmentation and competing interests as a central barrier.

3.3.8 Lack of expertise

A further conflict concerns the lack of expertise ($n = 7$), including limited knowledge of Green Care principles, unfamiliarity with the concept, and absence of standardized definitions. Garden therapists lack professional recognition, and insufficient cross-departmental knowledge hampers coordinated planning, "*[which] means that the various specialist areas still work relatively often in parallel and do not pursue a common goal*" (P3). Participants highlighted the absence of unified standardized curricula, fragmented terminology and practices, and insufficient familiarity among educators and health professionals with Green Care methods (PC1, PC4, PC5, PC6, PC9). Health professionals sometimes view Green Care as non-scientific or non-essential, reinforcing hesitancy in adoption (PC6). Lack of expertise was mentioned more frequently in the workshop than in the interviews, reflecting the emphasis on capacity-building and standardization.

3.3.9 Existing areas not geared towards Green Care

Another identified conflict relates to existing areas not geared towards Green Care ($n = 6$). A key point emerging here involves spaces intended for Green Care use, particularly urban parks, suffering from high noise levels due to proximity to traffic axes, which prevents relaxation and recovery:

> *"The city parks are usually very, very loud. You really can't switch off there because there's always background noise around it, which of course also has a disturbing effect on people. And urban parks in particular are designed in such a way that they are usually located in the center of cities" (I1).*

Another issue was the high frequency of users in densely populated or popular areas, which can disrupt individual therapeutic experiences: "*They [urban parks] are also heavily frequented, so many people also use such areas. In other words, I personally can't switch off without being watched*" (I1). This highlights a paradox: while locating parks in densely populated areas improves accessibility and promotes equality, it can simultaneously reduce the quality of restorative experiences due to crowding. Moreover, these spaces lack purposeful design for the second and third pillars of Green Care (nature-based health promotion and therapy), as they are primarily intended to support nature in everyday life (the first pillar of Green Care) and tend to prioritize aesthetic and recreational considerations over therapeutic purposes. Conversely, stakeholders described therapeutically suitable environments as settings that can be adapted to the needs of specific user groups, for example through clearly structured and enclosed spaces or sensory elements such as different textures, fragrant or edible plants, and water features. Additional barriers include competition for urban GBS, bureaucratic hurdles in using public land, historical exclusion of marginalized groups, and insufficient infrastructure in schools and universities (PC6, PC8, PC9).

3.3.10 Limited land availability due to conflicts of use

The final conflict, least frequently mentioned ($n = 4$), concerns limited land availability due to conflicts of use. Cities generally face multiple demands on open spaces, with different sectors competing to expand and improve them. In the Ruhr area but across Germany in general, housing shortages drive the conversion of open areas into buildings for residential and economic purposes, eliminating natural spaces essential for Green Care, exactly where usage pressure and need are highest in dense urban settings:

> *"We also have this need for housing. I don't see health, green spaces, and the protection of natural spaces as being firmly anchored in the building code. And the pressure on these areas is enormous, and a municipality doesn't do anything about it" (P1).*

Limited land availability also includes urban GBS scarcity and administrative obstacles to using public land for therapeutic or social projects (PC6). While less frequently discussed, these challenges reinforce the broader issues of spatial access and usage conflicts.

3.4 Opportunities for the further development of Green Care

Although Green Care is not well known in the Ruhr area and has played a rather minor role in political and social discourse to date, initial positive developments and thus potential areas for action are already becoming apparent. A total of $n = 7$ potential areas were identified that were mentioned in more than three interviews (Figure 5). Figure 5 provides an overview of the identified potentials for Green Care implementation, which are further elaborated in the following section.

3.4.1 Existing Green Care pilot projects

It is striking that there is almost unanimous consensus ($n = 11$), with the exception of I3, that there are already Green Care projects in the Ruhr area. Concrete examples include the horticultural therapy program at the Community Hospital Herdecke, the Vitrea Rehabilitation Clinic Hattingen, and various urban gardening initiatives (Gemeinschaftskrankenhaus Herdecke, 2023; VITREA Holding Deutschland GmbH, 2026). This can be an advantage for the further expansion of Green Care in the Ruhr area, as there are already replicable templates and project approaches that could minimize risks and problems in new project developments and thus ensure rapid implementation. Established projects also offer a certain infrastructure and knowledge base that could be drawn upon. In addition, this aspect shows that there is fundamental interest in such offerings and that there are already initial institutions and stakeholders who have approached this topic, albeit not under the Green Care branding.

3.4.2 Existing partnerships and networks

Another frequently mentioned potential ($n = 10$) is that, in addition to pilot projects, there are already existing partnerships and networks between various actors. This means that these established structures enable knowledge exchange and resource pooling. While the Green Care concept itself may not yet be widely recognized, "*the content […] can be found in many of the organizations" (I6). And they* "*are networked with a wide variety of institutions*" (I6), showing that a framework of collaboration already exists. Such networks can create synergies and thus raise awareness and attention, but also break down barriers to scaling. In addition, these networks and partnerships can serve as a basis on which to build in the future, i.e., the network could be expanded through further initiatives and projects, and also gain a certain appeal beyond the Ruhr area. The larger and more diverse the network in the field of Green Care is, the more effectively sustainable cooperation can be promoted in the Ruhr area and beyond.

3.4.3 Initial existing financing and funding structures

The potential offered by the fact that there are already some Green Care projects also highlights the connection with the third potential identified in this evaluation: initial existing financing and funding structures ($n = 7$). In contrast to the first two potentials, this aspect was only mentioned by the implementers and supporters and not by any of the policy and decision makers. This may indicate an information asymmetry. Practitioners are familiar with possible financing structures due to their daily work, as they have dealt with them intensively and built-up expertise in this area, while the interviewed administrative decision-makers, primarily municipal officers and public administrators, have less detailed knowledge of these structures and their design. This points to a need for communication between the actors. In addition, the aspect of initial financing structures underlines that funding for Green Care projects is fundamentally possible, which is a sign of political interest and the importance of the concept.

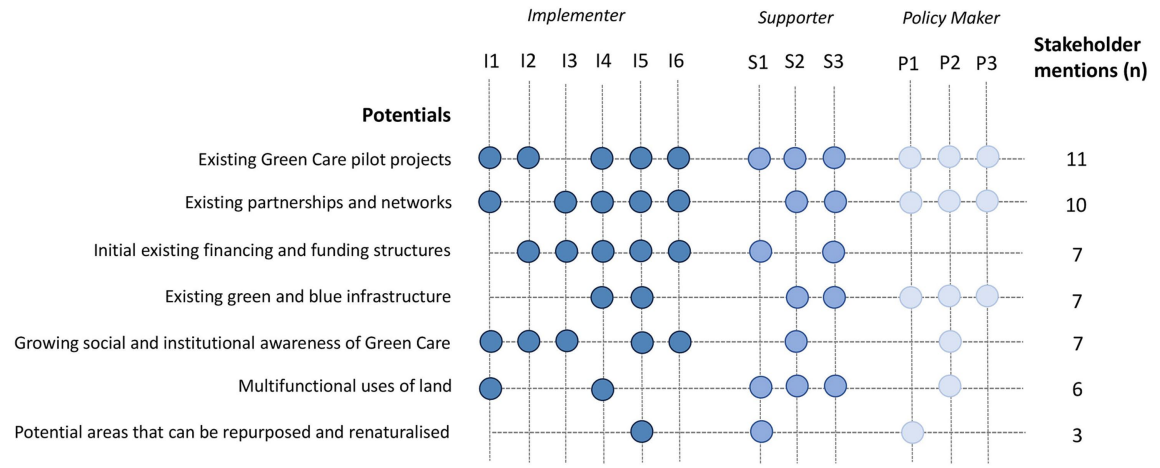


FIGURE 5
Overview of the most frequently mentioned potentials of Green Care. Each dot indicates that a specific potential was mentioned by an individual stakeholder. The number of dots per potentials therefore reflects how many stakeholders mentioned the respective potential. The right-hand column shows the total number of stakeholders who mentioned each potential (Iodice-Kraft, 2026).

3.4.4 Existing green and blue infrastructure

At the same level ($n = 7$), the aspect that green and blue infrastructure already exists in the Ruhr area was highlighted (Figure 2). This includes a network of parks, green corridors, riverbanks, and recultivated spoil tips. This provides immediately usable and accessible spaces for Green Care services. These diverse landscape types—from anthropogenic spoil tips to near-natural river courses—provide a good basis for implementing differentiated applications of all three continuums of Green Care. The existence of this infrastructure underlines the fact that GBS are increasingly being prioritized in planning in the Ruhr area. Initiatives such as the "Green Infrastructure Offensive" (Regionalverband Ruhr, 2021) and the ambitious goal of becoming the "greenest industrial metropolis in the world" (Regionalverband Ruhr, 2022) create a stable framework for long-term development and promote cooperation between planners, local authorities, and Green Care stakeholders.

3.4.5 Growing social and institutional awareness of Green Care

Such strategies and concepts are also indicative of growing social and institutional awareness of Green Care approaches ($n = 7$). In addition, the coronavirus pandemic has led to nature being given greater importance and a sharp rise in general awareness of nature-based approaches. As one interviewee noted, during the pandemic, people "*suddenly went into the forest, went for walks a lot*" (I2), which, in their view, led to people becoming more aware of the value of nature again. While this indicates a growing recognition of Green Care principles, it appears that much of this awareness is still indirect or incidental, as the term Green Care itself is rarely used in official plans or documents. Nevertheless, this growing awareness is putting Green Care on the political and social agenda, increasing demand from both stakeholders and the general public, expanding the range of services on offer, and promoting broader institutional anchoring.

3.4.6 Multifunctional use of green and blue spaces

Further potential arises from the multifunctional use of GBS, which is particularly relevant in the Ruhr area due to land scarcity and competition. An area can serve simultaneously for recreation, nature-based therapies, biodiversity promotion, and climate protection. This underlines the synergies that can exist. Green Care services can be integrated into existing uses (e.g., public parks as therapy rooms) without requiring additional space, which in turn can reduce costs and increase acceptance among cities and planners.

3.4.7 Potential areas that can be repurposed and renaturalized

The final potential shown ($n = 3$) refers to potential areas that can be repurposed and renaturalized, including numerous brownfield sites in the Ruhr areas. These transformation areas offer the opportunity to integrate Green Care in a targeted manner, e.g., by establishing community gardens. In this context, large former industrial and commercial sites that are currently being redeveloped are perceived as offering: "*The greatest opportunity to do it in planning*" (P1), highlighting the strategic relevance of integrating Green Care into urban redevelopment processes. In addition, the temporary use of these previously unused areas enables flexible, low-threshold Green Care implementation without long-term land commitment and optimal testing of the offer. It is particularly noteworthy that although this potential was only mentioned three times, it was raised equally by all three stakeholder groups. This broad support across all levels indicates high implementation potential.

In summary, the identified potential indicates a promising starting point for the expansion of Green Care in the Ruhr area. Although the concept is not yet widespread, initial developments are already underway, and it is clear that the basic prerequisites—from space and acceptance to planning opportunities—are in place. This creates the basis for rapid scaling, broad social integration, and the sustainable anchoring of nature-based approaches.

4 Discussion

The results indicate that the key challenge for the further development of Green Care in the Ruhr region is the limited degree of institutionalization. The findings suggest that Green Care in the Ruhr region currently lacks a clear institutional and administrative framework, partly because nature-based approaches are often perceived as "non-medical" and lack formal recognition within the healthcare system (Haubenhofer et al., 2010; Sempik et al., 2010). This missing institutional anchor triggers a chain reaction: without official recognition, there are no secure funding pathways, no coherent terminology, and a lack of standardized training or quality control (Hassink, 2006; Gallis, 2007). Consequently, Green Care is rarely considered by decision-makers and urban planners, which significantly hinders the development of bottom-up providers. Without public recognition and sustainable funding, many initiatives remain precarious. While awareness of nature-based interventions is increasing, it remains insufficient to trigger systemic change, highlighting that the German healthcare system still lags behind in preventive approaches (AOK-Bundesverband and Deutsches Krebsforschungszentrum, 2025). Given Germany´s comparatively high overall healthcare expenditure, these findings highlight the need for greater attention to preventive and cross-sectoral approaches within the healthcare system.

Interestingly, the analysis reveals that the elements necessary for scaling up Green Care already exist in Germany, particularly in the Ruhr region, but remain fragmented within sectoral silos. The problem is therefore not a lack of potential, but the absence of an integrated framework. There is no universal understanding of Green Care; definitions vary significantly depending on the stakeholders' professional backgrounds (Moriggi et al., 2020). While the activities themselves often appear indirectly on political agendas, they are rarely framed as "Green Care." This lack of a "conceptual bracket" prevents existing informal networks from consolidating into a strong political lobby with the necessary leverage to challenge the dominance of purely pharmaceutical-oriented health approaches. Nevertheless, the identified opportunities provide concrete starting points for overcoming this fragmentation. Existing pilot projects could serve as demonstration sites and facilitate the transfer of practical knowledge, while established stakeholder networks could support stronger cross-sectoral collaboration. At the spatial level, existing GBS and former industrial sites further provide opportunities to integrate Green Care into urban planning processes without requiring entirely new

infrastructure. To translate these opportunities into broader implementation, however, local initiatives would need to be supported by more stable financing mechanisms and stronger institutional recognition.

The challenges identified in the Ruhr region are not unique to the German context. Similar barriers have also been observed in other European regions where Green Care and related nature-based interventions are already more established and institutionally integrated. In the province of Barcelona, challenges include fragmented cross-sectoral governance, insufficient and insecure funding, limited formal recognition of nature-based health promotion and therapies, and gaps in professional training. However, compared with the Ruhr region, Barcelona has already developed more established structures, including social prescribing within the public healthcare system and the Catalan Health and Nature Roundtable (Giedych et al., 2024). Similarly, Sweden has a more developed landscape of nature-based therapies, with established providers and some regions formally supporting these approaches within their healthcare systems, while challenges related to stakeholder collaboration, administrative and financial constraints, evidence, professional education, and standardization remain (Giedych et al., 2024). The UK provides another example of more established implementation pathways. Green social prescribing offers referral routes into nature-based activities, while initiatives such as the "Test & Learn" programme have supported the development of cross-sectoral networks and the integration of environmental organisations into healthcare pathways. Professionalisation is further supported through training, standards, and quality-assurance mechanisms such as the Green Care Quality Mark. Nevertheless, challenges related to sustainable funding, clinical acceptance, and evidence requirements persist (Giedych et al., 2024). These parallels suggest that many of the barriers identified in the Ruhr region represent broader challenges for scaling Green Care. At the same time, the comparison indicates that regions with more advanced institutional structures continue to face such barriers, but have already established mechanisms through which nature-based interventions can be more systematically integrated into health promotion and healthcare. Conversely, the Ruhr region may offer relevant insights for other urban regions through its potential to integrate Green Care into existing GBS and the redevelopment of post-industrial sites, demonstrating how nature-based approaches can be linked to ongoing urban transformation processes.

The synthesis of workshop and interview findings highlights a strong convergence regarding structural barriers and unequal access. Green Care in the Ruhr region can therefore be understood as a matter of environmental justice, as its benefits are unevenly distributed across social groups and access is shaped by factors such as socio-economic status, institutional resources, and geographic location. Marginalized groups and residents of disadvantaged neighborhoods face linguistic, cultural, and infrastructural barriers, exacerbated by the historically unequal distribution of GBS (Enssle and Kabisch, 2020; Gruebner et al., 2017). Furthermore, a knowledge gap exists between stakeholders: while implementers have a strong understanding of the field's efficacy, decision-makers often lack the evidence or strategic awareness required for institutional support. Although the scientific evidence for the health benefits of nature exposure is already substantial (Hartig et al., 2014; Twohig-Bennett and Jones, 2018; Bratman et al., 2015), this knowledge has not yet been sufficiently translated into policy frameworks or healthcare systems, particularly in Germany. The data sets also reveal subtle differences in the perception of these hurdles. Workshop participants emphasized the lack of standardized curricula and the complexity of financing mechanisms, whereas interviewees reflected more critically on the medical status quo. Notably, the fact that the scientific evidence base was not seen as a primary barrier in the workshops, suggests a high level of confidence among practitioners—an optimism that contrasts sharply with the rigid evidence-based criteria of the German healthcare system. Ultimately, the successful implementation of Green Care requires more than the mere provision of GBS; it demands a fundamental transformation of the administrative and financial frameworks to transition Green Care from a niche phenomenon into a resilient, integrated component of public healthcare (World Health Organization, 2022; OECD/European Observatory on Health Systems and Policies, 2025).

Beyond these governance challenges, the findings highlight the preventive public health dimension of Green Care. Rather than focusing on a single health condition, Green Care offers a preventive approach that addresses several interconnected risk factors for poor health, including chronic stress, loneliness, social isolation, and limited access to health-promoting environments. In the Ruhr region, where the urban health penalty and socio-spatial inequalities are pronounced, stakeholders perceived Green Care as a promising low-threshold approach to strengthen population mental health and resilience before clinical treatment becomes necessary. The findings further suggest that socially disadvantaged populations and residents of underserved neighborhoods may particularly benefit from improved access to Green Care, reinforcing the need to embed these approaches within broader preventive health strategies through stronger collaboration between public health, urban planning, environmental management, and social services, while addressing linguistic, cultural, financial, and spatial barriers to participation.

By focusing on the Ruhr region, this study contributes to the existing literature by providing an urban, stakeholder-based perspective on Green Care in Germany, complementing previous research that has predominantly focused on specific interventions or rural contexts.

4.1 Limitations and outlook for further research

While this study provides valuable insights into the implementation of Green Care, certain methodological parameters should be considered. First, the selection of stakeholders for the interviews and workshops was strategically focused on key professional actors in the Ruhr area. While this allowed for deep, expert-driven insights into structural barriers, the findings primarily reflect the perspectives of providers and decision-makers. The absence of direct input from potential end-users, particularly from marginalized or underserved populations, as well as from responsible municipal actors such as park department heads overseeing public green spaces, means that the barriers identified (such as linguistic or cultural hurdles) are viewed through a professional lens rather than lived experience. Second, the workshop format was designed to foster broad consensus. While effective for identifying overarching themes for scaling Green Care, the inherent time constraints naturally limited the ability to explore specific technical details of administrative processes in exhaustive depth. These factors were addressed by combining semi-structured interviews with the co-creation workshop, enabling a more comprehensive assessment of the Green Care landscape in the Ruhr area through both

individual stakeholder perspectives and collectively developed priorities and insights.

A further limitation is the potential for selection bias. Although the study aimed to explore the current state of Green Care without promoting specific outcomes, participants were informed about the GreenME project's objective of advancing Green Care, implying a general assumption that strengthening Green Care is beneficial. This may have made participation more attractive to stakeholders with positive attitudes toward the topic. While recruitment also included actors with limited prior engagement in Green Care and was not restricted to active advocates, a certain degree of self-selection bias cannot be excluded.

The transferability of these findings is limited by the study's regional focus and qualitative design. Rather than providing statistically generalizable conclusions, the results offer a context-specific snapshot of stakeholder perceptions in the Ruhr area. Future comparative case studies in other urban and rural contexts would be valuable to examine whether similar patterns of institutional fragmentation, funding insecurity, and unequal access emerge elsewhere.

The findings of this study offer a robust starting point for future research. Expanding the research scope to other German regions would help determine whether the identified institutional and sectoral fragmentation is specific to the Ruhr region or reflects broader patterns across Germany. A longitudinal perspective could further assess whether the rising awareness identified in this study translates into structural changes, such as more secure funding pathways or improved institutional recognition. Future research should also strengthen the evidence base on how nature-based interventions achieve health outcomes and involve interdisciplinary perspectives from medicine and public health. Finally, participatory approaches involving end-users, particularly marginalized populations, are needed to better understand who benefits from different Green Care approaches and how interventions can be tailored to their needs.

4.2 Conclusion

This study provides a comprehensive analysis of the Green Care landscape in the Ruhr region, drawing primarily on the perspectives and experiences of key stakeholders. The findings reflect stakeholder perceptions of its current state and future potential and provide insights into the challenges of professionalizing nature-based interventions within a highly urbanized post-industrial context. While the foundations for Green Care are already in place, the field remains at an early-stage development, largely overshadowed by more dominant policy agendas. While the Ruhr region's GBS are increasingly valued for climate change mitigation, ecosystem restoration, and recreation, they are not yet strategically utilized as public health assets. As a result, their potential to contribute to the prevention of stress-related mental illness, symptoms of anxiety and depression, loneliness, and other health burdens associated with highly urbanized environments remains largely untapped. There is a significant gap between the general appreciation of nature for "leisure" and its formal integration into the treatment and prevention of mental health disorders.

The central finding is that Green Care operates in a strategic and regulatory gap, lacking cross-sectoral integration between healthcare, urban planning, social services, and education. Although expertise and pilot initiatives exist, they remain fragmented within a healthcare system that prioritizes high-cost curative and pharmacological treatments. This institutional path-dependency hinders the scaling of nature-based strategies, as the therapeutic potential of nature is often dismissed as a "soft" secondary benefit of recreation rather than a professional intervention. Consequently, Green Care remains a collection of pioneering efforts rather than a coordinated response to the "urban health penalty" and an integrated preventive public health strategy that addresses the social and environmental determinants of mental health through cross-sectoral collaboration.

Furthermore, this study reveals that the implementation of Green Care is fundamentally a matter of environmental justice. Stakeholders indicated that marginalized groups in underserved neighborhoods face the highest cultural and infrastructural barriers to access. Although the present study did not investigate the needs of specific end-user groups, previous research suggests that Green Care may be particularly relevant for socially disadvantaged populations, residents of underserved neighborhoods, older adults, children and adolescents, and people experiencing psychological distress, who often experience greater barriers to health-promoting environments. These barriers highlight the importance of inclusive and accessible Green Care implementation (Catena et al., 2026; Ly and Vella-Brodrick 2024; Murray et al., 2019). Without a strategic framework that explicitly links mental health promotion to urban development, Green Care risks becoming an incidental luxury for a few rather than a low-threshold public health resource for all. However, further research involving end-users is needed to better understand their specific needs and priorities. The absence of a unified and established terminology further exacerbates fragmentation, weakening the collective capacity for political advocacy among practitioners.

Ultimately, the stakeholder perspective highlights that although the groundwork was laid for a transformative approach to wellbeing in the Ruhr area, fostering urban resilience requires a fundamental shift in governance. To move toward a conceptually grounded Green Care system, decision makers must elevate nature-based health out of the shadow of purely clinical or general ecological perspectives. Future longitudinal studies, should assess whether the rising awareness documented in this study translates into structural change. By professionalizing Green Care and integrating it into the urban fabric, the Ruhr region has the potential to transform its green infrastructure into a recognized resource for preventive public health, wellbeing, mental health promotion, and social equity.

Data availability statement

The datasets presented in this article are not readily available because the raw interview data generated and analyzed during the current study are not publicly available due to the sensitive nature of the interviews and to protect participant confidentiality. Anonymized, aggregated, or excerpted data may be available from the corresponding author upon reasonable request. Requests to access the datasets should be directed to Chiara.Iodice-Kraft@ils-forschung.de.

Ethics statement

The studies involving humans were approved by Ethics Review Panel of the Research Institute for Regional and Urban

Development. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CI-K: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. KS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. NO: Conceptualization, Project administration, Supervision, Writing – original draft, Writing – review & editing. MG: Conceptualization, Methodology, Visualization, Writing – original draft, Writing – review & editing. ES: Formal analysis, Visualization, Writing – original draft, Writing – review & editing. LM: Writing – original draft, Writing – review & editing. SX: Writing – original draft, Writing – review & editing. BM: Writing – original draft, Writing – review & editing. KN: Writing – original draft, Writing – review & editing. RG: Writing – original draft, Writing – review & editing. BG: Writing – original draft, Writing – review & editing.

Funding

The author(s) declared that financial support was received for this work and/or its publication. The research leading to this publication has received funding from the European Union's Horizon Europe research and innovation program under Grant Agreement No. 101084198 (GreenME—Advancing Greencare in Europe: an integrated multi-scalar approach for the expansion of nature-based therapies to improve mental health equity). The publication reflects the author's views. The European Community is not liable for any use that may be made of the information contained herein.

Acknowledgments

Thanks to Eva Rademacher and all other contributors for their support with data collection & conceptualization. Thanks also to all interview participants, without whose expertise an analysis would not have been possible.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was not used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frsc.2026.1858698/full#supplementary-material

References

Anguelovski, I., Cole, H., Connolly, J., and Triguero-Mas, M. (2018). Do green neighbourhoods promote urban health justice?*Lancet Public Health* 3:e270. doi: 10.1016/S2468-2667(18)30096-3.

AOK-Bundesverband, and Deutsches Krebsforschungszentrum (2025). *Public Health Index 2025*. Berlin: AOK-Bundesverband; Heidelberg: Deutsches Krebsforschungszentrum (DKFZ)..

Astell-Burt, T., Hartig, T., Putra, I. G. N. E., Walsan, R., Dendup, T., and Feng, X. (2022). Green space and loneliness: a systematic review with theoretical and methodological guidance for future research. *Sci. Total Environ.* 847:157521. doi: 10.1016/j.scitotenv.2022.157521.

Bragg, R., and Atkins, G. (2016). *A Review of Nature-Based Interventions for Mental Health Care (Natural England Commissioned Reports No. NECR204)* York: Natural England.

Bratman, G. N., Hamilton, J. P., Hahn, K. S., Daily, G. C., and Gross, J. J. (2015). Nature experience reduces rumination and subgenual prefrontal cortex activation. *Proc. Natl. Acad. Sci.* 112, 8567–8572. doi: 10.1073/pnas.1510459112.

Campbell, R., McGaw, V., and Reupert, A. (2026). Systematic review and meta-analysis investigating nature-based interventions for adolescent mental health: program characteristics and effectiveness. *J. Environ. Psychol.* 110:102917. doi: 10.1016/j.jenvp.2026.102917

Cariñanos, P., and Casares-Porcel, M. (2011). Urban green zones and related pollen allergy: a review. Some guidelines for designing spaces with low allergy impact. *Landsc. Urban Plan.* 101, 205–214. doi: 10.1016/j.landurbplan.2011.03.006

Catena, L., Di Iacovo, F. P., Mariti, C., Moruzzo, R., and Granai, G. (2026). Green care practices for active aging: a scoping review. *J. Aging Environ.* 1–28. doi: 10.1080/26892618.2026.2665295

Cole, H. V. S., Garcia Lamarca, M., Connolly, J. J. T., and Anguelovski, I. (2017). Are green cities healthy and equitable? Unpacking the relationship between health, green space and gentrification. *J. Epidemiol. Community Health* 71, 1118–1121. doi: 10.1136/jech-2017-209201.

Coventry, P. A., Brown, JV. E., Pervin, J., Brabyn, S., Pateman, R., Breedvelt, J., et al. (2021). Nature-based outdoor activities for mental and physical health: systematic review and meta-analysis. *SSM - Popul. Health* 16:100934. doi: 10.1016/j.ssmph.2021.100934.

Czierpka, A., (2019). Der Ruhrbergbau. Von der Industrialisierung bis zur Kohlenkrise. Aus Politik und Zeitgeschichte (APuZ).

Dahlbeck, E., Gärtner, S., Best, B., Kurwan, J., Wehnert, T., and Beutel, J. (2021). *Analyse des historischen Strukturwandels im Ruhrgebiet (Fallstudie) (No. 29/2021)* Dessau-Roßlau: Umweltbundesamt.

De Bell, S., Alejandre, J. C., Menzel, C., Sousa-Silva, R., Straka, T. M., Berzborn, S., et al. (2024). Nature-based social prescribing programmes: opportunities, challenges, and facilitators for implementation. *Environ. Int.* 190:108801. doi: 10.1016/j.envint.2024.108801.

Department of Health (2013). *Healthy Ireland: A Framework for Improved Health and Wellbeing 2013–2025 (National Framework)*. Department of Health, Government of Ireland. Dublin.

Department of Health and Social Care (2018). *Prevention Is Better than Cure: Our Vision to Help You Live Well for Longer (Policy paper)*. Department of Health and Social Care. London.

Enssle, F., and Kabisch, N. (2020). Urban green spaces for the social interaction, health and well-being of older people—an integrated view of urban ecosystem services and socio-environmental justice. *Environ. Sci. Policy* 109, 36–44. doi: 10.1016/j.envsci.2020.04.008

European Commission (2023). *Mental health [WWW Document]*. European Commission – Public Health. Available online at: https://health.ec.europa.eu/non-communicable-diseases/mental-health_en (Accessed November 2, 2026).

European Parliament (2022). *Parliament calls for action to protect mental health [WWW Document]*. Topics | European Parliament. Available online at: https://www.europarl.europa.eu/topics/en/article/20220624STO33809/parliament-calls-for-action-to-protect-mental-health (Accessed March 23, 2026).

Everaert, G., Aerts, R., Bourgois, J. G., Buysse, A., Covaci, A., De Rijcke, M., et al. (2025). Ocean for health: a transdisciplinary framework to accelerate research on ocean–human health connections. *Environ. Sci. Technol.* 59, 13585–13593. doi: 10.1021/acs.est.5c05463.

Galea, S., Freudenberg, N., and Vlahov, D. (2005). Cities and population health. *Soc. Sci. Med.* 60, 1017–1033. doi: 10.1016/j.socscimed.2004.06.036.

Gallis, C. T. (Ed.), (2007). *Green care in agriculture: health effects, economics and policies; 1st European COST Action 866 Conference; proceedings; 20 - 22 June 2007, Vienna, Austria*.University Studio Press, Thessaloniki.

Gemeinschaftskrankenhaus Herdecke (2023). *Gartentherapie [WWW Doc.]*.Gemeinschaftskrankenhaus Herdecke – Medizin, Therapie & Pflege. Available online at: https://www.gkh.de/medizin-therapie-pflege/therapien/gartentherapie/ (Accessed March 23, 2026).

Giedych, R., Gawryszewska, B., Maksymiuk, G., Cieszewska, A., Olszewska-Guizzo, A., Gąsior, W., et al. (2024). Green care baseline reports for each study country (No. Deliverable D2.2). GreenME Project (Horizon Europe GA 101084198).

Giedych, R., Maksymiuk, G., de Prado-Bert, P., Palmlöf, K., Creus, E., Pennisi, G., et al. (2023). Green care actor map for each study country (No. Deliverable 2.1). GreenME Project (Horizon Europe GA 101084198).

Gius, E., Meister, J. C., Meister, M., Petris, M., Gerstorfer, D., Akazawa, M., et al. (2025). *CATMA*. doi: 10.5281/ZENODO.1470118.

Gould, W. T. S. (1998). African mortality and the new `urban penalty' *Health Place* 4, 171–181. doi: 10.1016/S1353-8292(98)00009-4.

GreenME Project, (2024). *Glossary [WWW Document]*. GreenME Project. Available online at: https://greenme-project.eu/glossary/ (Accessed November 2, 2026).

Gruebner, O., Rapp, M. A., Adli, M., Kluge, U., Galea, S., and Heinz, A. (2017). Cities and mental health. *Dtsch. Ärztebl. Int.* 114, 121–127. doi: 10.3238/arztebl.2017.0121.

Harrison, H., Burns, M., Darko, N., and Jones, C. (2023). Exploring the benefits of nature-based interventions in socio-economically deprived communities: a narrative review of the evidence to date. *Perspect. Public Health* 143, 156–172. doi: 10.1177/17579139231170768.

Hartig, T., Mitchell, R., De Vries, S., and Frumkin, H. (2014). Nature and health. *Annu. Rev. Public Health* 35, 207–228. doi: 10.1146/annurev-publhealth-032013-182443

Hassink, J. (2006). *Farming for Health*. Dordrecht: Springer Netherlands.

Haubenhofer, D. K. (2014). Green Care – grüne Pflege? *Green Care: Fachz. für Nat. Interakt.* 1, 4–7.

Haubenhofer, D. K., Elings, M., Hassink, J., and Hine, R. E. (2010). The development of green care in Western European countries. *EXPLORE* 6, 106–111. doi: 10.1016/j.explore.2009.12.002

Hunter, R. F., Cleland, C., Cleary, A., Droomers, M., Wheeler, B. W., Sinnett, D., et al. (2019). Environmental, health, wellbeing, social and equity effects of urban green space interventions: a meta-narrative evidence synthesis. *Environ. Int.* 130:104923. doi: 10.1016/j.envint.2019.104923.

Ingmann, K., Katsavounidou, G., and Mehnen, N. (2025). Different, different but same? Recreational opportunities and user preferences of inner-city urban green spaces in Hanover and Thessaloniki. *Front. Sustain. Cities* 7:1538171. doi: 10.3389/frsc.2025.1538171

Jessen, N. H., Løvschall, C., Skejø, S. D., Madsen, L. S. S., Corazon, S. S., Maribo, T., et al. (2025). Effect of nature-based health interventions for individuals diagnosed with anxiety, depression and/or experiencing stress—a systematic review and meta-analysis. *BMJ Open* 15:e098598. doi: 10.1136/bmjopen-2024-098598.

Kals, E., Müller, M., Zieris, P., and Bruckbauer, S. (2023). *GreenCare | Natur und psychische Gesundheit: Abschlussbericht der wissenschaftlichen Begleitstudie (Final project report)* Eichstätt: Katholische Universität Eichstätt-Ingolstadt, Professur für Sozial- und Organisationspsychologie.

Landwirtschaftskammer Nordrhein-Westfalen (2020). Green Care – Fallbeispiele.

Lõhmus, M., and Balbus, J. (2015). Making green infrastructure healthier infrastructure. *Infect. Ecol. Epidemiol.* 5:30082. doi: 10.3402/iee.v5.30082.

Ly, V., and Vella-Brodrick, D. A. (2024). Effects of school-led greenspace interventions on mental, physical and social wellbeing in children and adolescents: a systematic review. *Educ Psychol Rev*. 36:133. doi: 10.1007/s10648-024-09963-1.

Markevych, I., Schoierer, J., Hartig, T., Chudnovsky, A., Hystad, P., Dzhambov, A. M., et al. (2017). Exploring pathways linking greenspace to health: theoretical and methodological guidance. *Environ. Res.* 158, 301–317. doi: 10.1016/j.envres.2017.06.028.

Moriggi, A., Soini, K., Bock, B. B., and Roep, D. (2020). Caring in, for, and with nature: an integrative framework to understand green care practices. *Sustainability* 12:3361. doi: 10.3390/su12083361

Murray, J., Wickramasekera, N., Elings, M., Bragg, R., Brennan, C., Richardson, Z., et al. (2019). The impact of care farms on quality of life, depression and anxiety among different population groups: a systematic review. *Campbell Syst. Rev.* 15:e1061. doi: 10.1002/cl2.1061.

Noël, C., Rodriguez-Loureiro, L., Vanroelen, C., and Gadeyne, S. (2021). Perceived health impact and usage of public green spaces in Brussels' metropolitan area during the COVID-19 epidemic. *Front. Sustain. Cities* 3:668443. doi: 10.3389/frsc.2021.668443

OECD/European Observatory on Health Systems and Policies (2025). *Länderprofil Gesundheit 2025: Deutschland. State of Health in the EU*. Brussels: European Commission.

Peen, J., Schoevers, R. A., Beekman, A. T., and Dekker, J. (2010). The current status of urban-rural differences in psychiatric disorders. *Acta Psychiatr. Scand.* 121, 84–93. doi: 10.1111/j.1600-0447.2009.01438.x.

Petzold, H. G., Ellerbrock, B., and Hömberg, R. (2018). *Die neuen Naturtherapien: Handbuch der Garten-, Landschafts-, Wald- und Tiergestützten Therapie, Green Care und Green Meditation*. Bielefeld: AISTHESIS Verlag.

Regionalverband Ruhr (2018). *Kleiner Atlas Metropole Ruhr: Das Ruhrgebiet im Wandel*. Essen: Regionalverband Ruhr.

Regionalverband Ruhr (2021). *Offensive Grüne Infrastruktur 2030 – Konzeption und Strategie Grüne Infrastruktur*. Regionalverband Ruhr. Essen.

Regionalverband Ruhr (2022). Charta Grüne Infrastruktur Metropole Ruhr.

Regionalverband Ruhr, (2025). *Einwohnerzahl Ruhrgebiet bleibt stabil bei rund 5,13 Millionen [WWW Document]*. Available online at: https://www.rvr.ruhr/news/startseite-news/news/einwohnerzahl-im-ruhrgebiet-bleibt-stabil-bei-rund-513-millionen (Accessed March 23, 2026).

Rehman, Z., Zubair, M., Hafiz, D. O., and Manzoor, S. A. (2024). Biodiversity and quality of urban green landscape affect mental restorativeness of residents in Multan, Pakistan. *Front. Sustain. Cities* 5:1286125. doi: 10.3389/frsc.2023.1286125

Salomon, R. E., Salomon, A. D., and Beeber, L. S. (2018). Green care as psychosocial intervention for depressive symptoms: what might be the key ingredients? *J. Am. Psychiatr. Nurs. Assoc.* 24, 199–208. doi: 10.1177/1078390317723710.

Sempik, J., Hine, R., and Wilcox, D. (2010). *Green Care: A Conceptual Framework; A Report of the Working Group on the Health Benefits of Green Care, COST 866, Green Care in Agriculture*. Loughborough: Centre for Child and Family Research.

Specht, K., Zoll, F., Schümann, H., Bela, J., Kachel, J., and Robischon, M. (2019). How will we eat and produce in the cities of the future? From edible insects to vertical farming—a study on the perception and acceptability of new approaches. *Sustainability* 11:4315. doi: 10.3390/su11164315

Stanley, C. (2017). Green Care – Wie eine intakte Natur den Menschen heilen kann. *ANLiegen Natur* 39, 111–116. doi: 10.63653/nlaw4537

Statistisches Bundesamt. (2026). *Gesundheitsausgaben im Jahr 2024 auf 538 Milliarden Euro gestiegen [WWW Document]*. Available online at: https://www.destatis.de/DE/Presse/Pressemitteilungen/2026/04/PD26_115_23611.html (Accessed November 3, 2026).

Twohig-Bennett, C., and Jones, A. (2018). The health benefits of the great outdoors: a systematic review and meta-analysis of greenspace exposure and health outcomes. *Environ. Res.* 166, 628–637. doi: 10.1016/j.envres.2018.06.030.

VITREA Holding Deutschland GmbH (2026). *VITREA Klinik Hattingen – Reha in Hattingen [WWW Document]*. Available online at: https://www.vitrea-gesundheit.de/reha/hattingen/ (Accessed November 2, 2026).

Völker, S., and Kistemann, T. (2011). The impact of blue space on human health and well-being – salutogenetic health effects of inland surface waters: a review. *Int. J. Hyg. Environ. Health* 214, 449–460. doi: 10.1016/j.ijheh.2011.05.001.

Wang, K., Sun, Z., Cai, M., Liu, L., Wu, H., and Peng, Z. (2022). Impacts of urban blue-green space on residents' health: a bibliometric review. *IJERPH* 19:16192. doi: 10.3390/ijerph192316192

White, M. P., Elliott, L. R., Gascon, M., Roberts, B., and Fleming, L. E. (2020). Blue space, health and well-being: a narrative overview and synthesis of potential benefits. *Environ. Res.* 191:110169. doi: 10.1016/j.envres.2020.110169.

Wolf-Ostermann, K., and Schmidt, A. (2018). Implementing green care farms for people with dementia in Germany. *Innov. Aging* 2, 373–373. doi: 10.1093/geroni/igy023.1381

World Health Organization (2005). *Promoting Mental Health: Concepts, Emerging Evidence, Practice; A Report*. World Health Organization. Geneva.

World Health Organization (2022). *World Mental Health Report: Transforming Mental Health for All*. 1st ed. Geneva: World Health Organization.

Zanaga, D., Van De Kerchove, R., De Keersmaecker, W., Souverijns, N., Brockmann, C., Quast, R., et al. (2021). ESA WorldCover 10 m 2020 v100.

Zhu, D., Ye, X., Li, W., Ding, R., and He, P. (2021). Urban health advantage or urban health penalty? Urban-rural disparities in age trajectories of physiological health among Chinese middle-aged and older women and men. *Health Place* 69:102559. doi: 10.1016/j.healthplace.2021.102559.