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Research Article

Developing a Consensus-Based Nature Prescribing Framework for Australian Healthcare: A Delphi Study

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Background: With growing interest in nature-based interventions for health, establishing implementation frameworks for prescribing nature in diverse settings is crucial. This study aims to develop and validate a nature prescribing framework tailored for the Australian healthcare context, employing a Delphi methodology to harness expert consensus.
Methods: The study utilised a two-round Delphi technique to gather insights from experts across various health and environmental sectors. Participants included healthcare providers, managers and policymakers engaged in or knowledgeable about nature prescribing. The initial framework, which was informed by earlier interviews with parties who prescribe or provide nature-based health interventions, was refined through the Delphi process, aiming for consensus on implementation criteria and associated practices.
Results: Sixteen experts participated in the first Delphi round, with 13 completing the second round. Participants reached consensus on five essential domains of the nature prescribing framework, which included Community: consultation and customisation, Systems: building partnerships and networks, Prescribers: cultivating awareness and capacity, Providing prescriptions: psychosocial foundations and External settings: interfacing social and natural environments. Perceived barriers and enablers to application were considered within the framework, including contextual and environmental factors, awareness and capacity among prescribers and public, and the role of infrastructure support.
Conclusion: The nature prescribing framework offers a structured approach to integrating nature-based activities into health practices, addressing both individual and community health needs. It is adaptable to various Australian settings, promoting broader implementation of nature-based prescriptions. Future research should focus on implementing and evaluating the feasibility and effectiveness of the framework in diverse demographic and geographic contexts.

1. Introduction

As emerging health challenges are exacerbated by environmental changes and social challenges, innovative approaches to healthcare are increasingly necessary [1]. Nature-based health interventions, also known as Nature Prescriptions, have been shown to promote physical, mental and social health beyond the advantages of general physical activity alone [2–4]. These interventions fall within the broader field of Social Prescribing, whereby individuals are referred to evidence-based non-pharmacological support to address biopsychosocial well-being [5], with specific inclusion of contact with nature, such as gardening, walking in forests or conservation activities [6, 7].

Nature Prescriptions impact health and well-being by improving respiratory, immune and cardiac function [8–10], reducing psychological stress [11–13] and supporting mental function [12, 14, 15]. These benefits are partially explained by established theories such as attention restoration theory [16], biophilia [17] and stress reduction theory [18], which together propose that natural environments help restore attention, reduce stress and increase innate affinity towards natural settings. However, many commentators have critiqued these theories, arguing that they do not fully account for the complex, multidimensional, multisensorial and interactive relationship between humans and nature [3, 19–21]. Extensions and elaborations of these theories, like the Domains of Pathways, offer a more nuanced understanding of these interactions, proposing that nature contact benefits health across personal, relational and collective levels [22].

Beyond individual health benefits, nature-based activities and access to green space promote social cohesion and community health and are associated with health equity [23] and pro-environmental behaviours [24]. Participating in group activities within natural settings strengthens community bonds and increases a sense of belonging and purpose among individuals [25, 26]. For instance, a meta-analysis of community garden interventions demonstrated moderate improvements in perceived social support, community cohesion and loneliness [27]. This aspect is particularly relevant to social prescribing, which influences not only individual health outcomes but also community well-being and upstream social health determinants [28].

Nature prescription interventions also align with global health priorities such as those of the World Health Organization (WHO), which emphasises the interconnections between human health and environmental sustainability, recognises nature as the greatest source of well-being, prioritises psychosocial interventions and promotes a sense of urgency in building equitable, resilient health systems to mitigate the climate crisis [29–32]. Nature-based experiences intersect with both planetary health concepts of human interconnection with nature, systems change and equity, and the social determinants of health [33, 34], offering an opportunity to simultaneously improve individual, community and environmental health. However, despite their well-established benefits and inclusion in broader social prescribing [7, 35], the systematic incorporation of nature-based interventions in healthcare practices, particularly in diverse and geographically vast countries like Australia, remains under-explored and inconsistently applied.

While some countries like Japan [36], New Zealand [37] and the United Kingdom [38] have begun to adopt nature prescribing practices, integration is not routine and guidance on implementation remains scarce. The fragmented nature of Australia's healthcare system, with its mix of public and private providers and funding bodies, further complicates the standardised integration of health interventions. Notwithstanding, there has been recent interest and investment in nature prescribing in Australia [39–41]. Integrating nature prescriptions into health service delivery is not only feasible but also essential, delivering scalable benefits to individual, community and systemic health needs. While it is imperative such interventions are designed effectively, to date, research remains limited regarding how best to design nature prescription programs to generate sustained positive change [22].

In response to the increasing need to effectively evaluate and integrate nature prescriptions into health systems for community benefit, the research team initiated a project to explore best practices for designing and implementing nature prescribing in Australia [42]. This research identified key gaps in current practice and provided preliminary insights into the delivery of nature prescriptions for health and well-being. The study presented in this paper addresses these gaps by refining a nature prescribing framework, using the Delphi technique and a panel of experts across healthcare, environmental management and community engagement sectors. The framework seeks to establish actionable guidelines that can be adapted for different settings and geographical contexts, promoting the inclusion of nature prescriptions within the broader public health agenda. In doing so, the findings of this study contribute to the global discourse on nature-based health interventions while addressing local needs and promoting systemic health improvements.

2. Materials and Methods

2.1. Aims. This study aimed to refine and validate the content of a novel framework to foster the implementation of nature prescribing in health care.

2.2. Design. The study used a two-round Delphi technique to address the study aims [43, 44]. The Delphi technique was used as it is an effective ground-up approach to gaining reliable expert consensus and is ideally suited to producing clear design principles and implementation processes. The approach also promoted the capacity of the framework to be broadly responsive to the Australian health and environmental contexts. In essence, the method facilitated structured insights from experts, helping to translate the initial

findings into actionable strategies. This study was conducted and reported with consideration to the Conducting and Reporting Delphi Studies (CREDES) guidelines [43].

2.3. The Nature Prescribing Framework. The nature prescribing framework was initially informed by interviews with relevant 'community partners' (i.e., individuals who play a role of connecting community members with nature prescribing activities, whether in a professional capacity or community-based role). Namely, these community partners included individuals in professional or community roles that involved either the prescribing of nature prescriptions (e.g., health care providers and managers) or the provision of nature prescription activities (e.g., facilitators of nature-based experiences) in Australia [42]. Participants were interviewed about barriers, enablers, experiences and needs relating to the implementation of nature prescribing. Thematic findings from the interviews were then synthesised into guiding criteria for effective implementation of nature prescribing programs and practices. The synthesis was undertaken by re-framing the identified themes as directive recommendations as appropriate. The framework was originally entitled 'The Green Prescribing Framework' and was re-named following the first round of the Delphi study in response to participant recommendations (as described in the Results section below).

The primary purpose of the framework is to provide a tool to support routine nature prescribing throughout the community. The framework is designed for adaptability, so it may be applied to different settings and user needs, whether in the development of community-wide programs or in the provision of individualised health care. The initial draft of the framework (as presented to Delphi participants in round one of this study) included 5 domains, supported by 13 criteria. The final version of the framework is presented in the Results section.

2.4. Participants and Sampling. Purposive and snowballing sampling were used to invite potential participants with a range of expertise in prescribing nature prescriptions (prescribers), providing nature-based experiences (providers) or facilitating nature prescribing through policy-development, infrastructure management and consumer support (policymakers/facilitators). Expertise was defined as holding a role of recognised authority or leadership in a field related to nature prescribing (e.g., heading a relevant professional association, academic expertise developed through research), or having demonstrated deep knowledge and substantial experience through the practice of nature prescribing and related roles (e.g., clinical practice of nature prescribing, experience designing and implementing nature prescribing programs). Professional diversity was prioritised in the sampling process as heterogeneous samples have been recommended as a means to mitigate professional biases in cross-disciplinary Delphi studies [45].

Individuals were eligible to participate in the study if they were aged 18 years or older, identified as a prescriber, provider or policymaker/facilitator (as defined above), able to read and understand written English, and capable of providing informed consent. No exclusion criteria were applied. While there is not yet consensus on sample size calculations for Delphi studies, 5 to 10 participants from each category of roles was considered appropriate in accordance with similar studies [44, 46]. As a number of potential panellists in the purposive sampling frame held cross-disciplinary expertise, a sample size of 12–20 participants was sought.

2.5. Recruitment. Potential participants were identified through networks developed during previous studies on nature prescribing, contacts known to the research team, relevant published research and news articles, and member directories of professional association websites relevant to the research topic. Invitations to participate were emailed to potential participants along with a detailed information sheet, a link to the first survey and a request for the names and contact details of other expert prescribers, providers or policymaker/facilitators who may be suitable participants for the study. A follow-up email was sent 1 week later if no response was received. An additional round of invitations was sent to a purposive selection of 'snowballed' contacts whose professional expertise was not yet adequately represented in the sample. While the information sheet indicated that completion of the surveys would imply consent, participants were required to indicate they had read and understood the information sheet before proceeding with the survey. An honorarium of AU$50 was offered to participants in thanks for their contributions upon completion of both Delphi rounds.

2.6. Data Collection. The surveys were conducted online using the Qualtrics survey management platform. Personalised survey links were used to ensure round two surveys were sent only to participants who completed round one. The round one survey was open for 2 weeks, at which point the desired sample size was reached. The round two survey link was emailed to participants 4 weeks after round one and remained open for 3 weeks. Data collection began 19 September 2022 and was completed on 2 October 2022. A flowchart of the study process is shown in Figure 1.

2.7. Round One Survey. The round one survey included a total of 67 items and took an estimated 35 min to complete. It comprised three sections: participant characteristics (seven items), the framework (52 items) and contextual questions about nature prescribing (eight items). Participant characteristics included age, gender, location, level of professional qualification, primary discipline/field of expertise, years of experience in primary discipline and role in nature prescribing (prescriber, provider and/or policymaker/facilitator).

The section outlining the framework began with an open-text item for feedback on the definition of nature prescribing—or 'green prescribing,' as it was initially termed—to be applied in the framework. Definitions of the

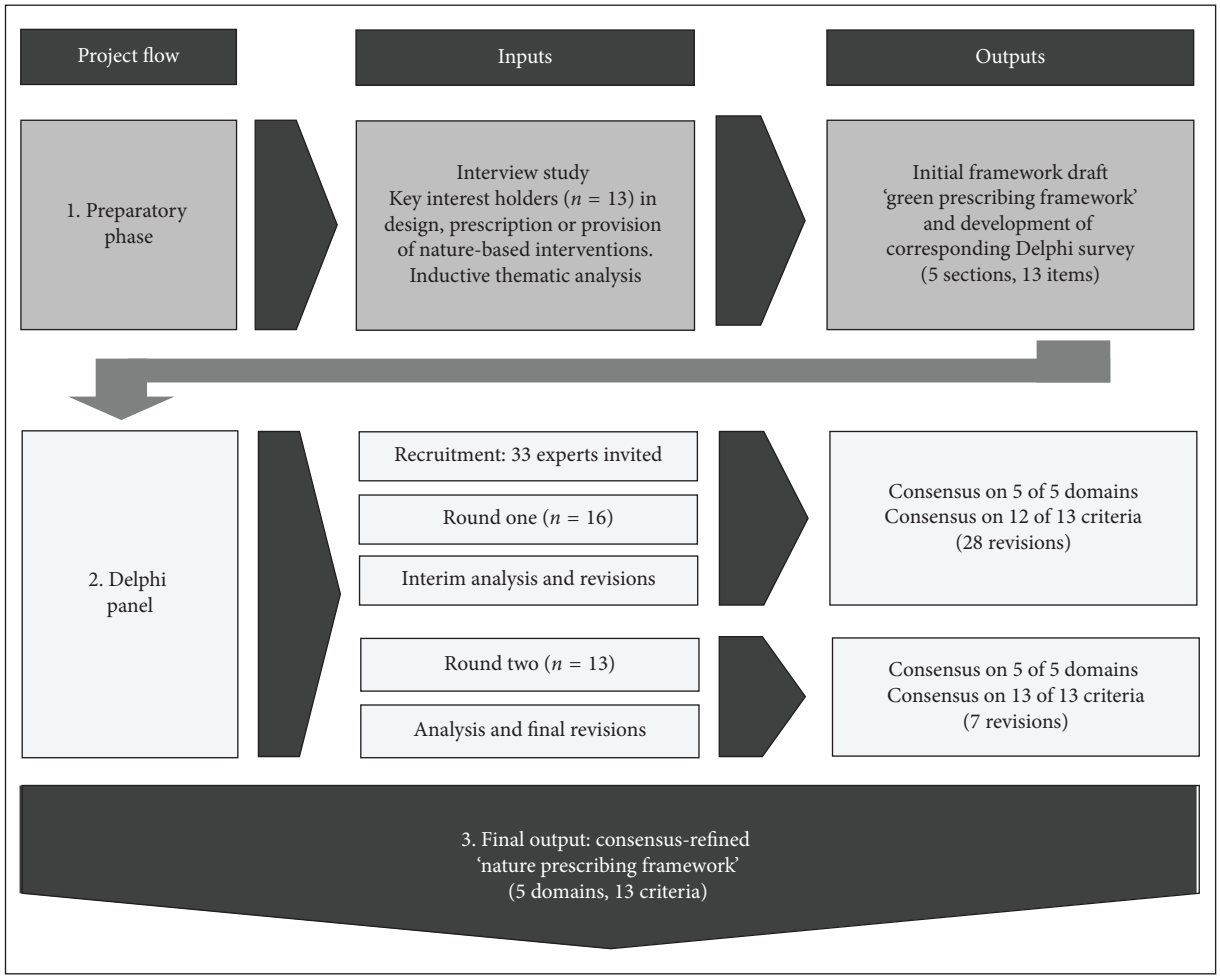

Figure 1: Flowchart overview of project phases and Delphi process.

framework domains and supporting criteria were then presented, each alongside an item assessing the level of consensus (five-point Likert scale from Not at all important to Extremely important) and an open-text item to review the clarity of the definition (What, if any, elements do you feel are missing from the definition, or require clarification or modification?). Each criterion definition also included an item asking participants to rate the level of responsibility held by prescribers, providers and policymaker/facilitators (visual analogue scale from 0 to 10) in order to assess whether any criteria may be more relevant to particular settings. An additional two open-text items provided participants with the option to provide general comments about the framework and the term 'green prescribing.'

The contextual questions about nature prescribing comprised six items on the context of the framework criteria, and two items on the practical aspects of prescription provision. The six items related to the framework criteria asked participants about existing pathways (Criterion 2.1) and resources (Criterion 2.2) for nature prescribing implementation, the perceived extant level of prescriber (Criterion 3.1) and public awareness (Criterion 5.1), current clinical capacity for implementation and referrals (Criterion 3.2) and education or training required to support behavioural change aspects of implementation (Criterion 4.2). The two items regarding prescription provision asked about payment for services, and the method of prescription (i.e., paper vs. digital); these items were shown only to participants who had identified as prescribers.

2.8. Round Two Survey. The round two survey included a total of 21 items and took an estimated 20 min to complete. The survey began with an introductory overview of the revised framework, an explanation of the changes to 'nature prescribing' terminology and a statement outlining the structure and purpose of the round two survey. The survey presented participants with four components: the revised definition of nature prescribing for consensus and final comments (one item), the retained domains and criteria for confirmation of revisions (17 items), the revised remaining criterion (5.2) for consensus and comments on clarity (two items) and an optional open-text question for any final comments on the framework (one item). Consensus on the revised definition of nature prescribing was assessed with the question. For the purposes of the Nature Prescribing Framework, does the definition above appropriately communicate the concept of nature-based activities for health and well-being? Participants provided a binary response of

'yes' or 'no, further revisions are required,' with the option to provide explanatory comments. The same binary response options were provided to participants in the items confirming revisions to domains and criteria. The revised definition of Criterion 5.2 was presented with an item assessing consensus (five-point Likert scale from Not at all important to Extremely important) and an open-text item to review the clarity of the definition (What, if any, further modifications do you feel are required for this criterion?).

2.9. Data Handling and Analysis. Responses from round one were analysed to determine the level of consensus for each domain and criterion of the framework, and to ascertain whether any modifications were required to improve the clarity and relevance of the framework content. Data were exported as a Microsoft Excel spreadsheet and incomplete responses were removed ($n = 3$). Descriptive analyses of quantitative data were completed in Microsoft Excel, and qualitative analyses were undertaken in NVivo 11. Data were aggregated during analysis and open-text responses regarding participants' specific disciplinary expertise were reported separately from sociodemographic data to maintain participant anonymity. Missing values were excluded from the analysis.

Consensus to retain domains and criteria was considered to be reached if ≥ 70% of participants rated the item as Extremely important or Very important, while items receiving < 50% consensus were excluded from the framework. Remaining items (i.e., items reaching 50%–69% consensus) were reviewed by consulting the qualitative comments provided by participants for each respective item to critically examine the perceived role of the item in the framework, with the decision made to either revise or remove the item made through discussion between researchers (HF, EB and ML). Consensus on the definition of nature prescribing presented in round two was determined if ≥ 70% of participants had responded Yes to the revised definition. While consensus was not required on the revisions to retained domains and criteria presented in round two, confirmation from ≥ 70% of participants was considered an indicator that sufficient clarity had been achieved.

Ratings of perceived responsibility were analysed using summary statistics (mean and range) and criteria attracting a mean < 7.0 for any of the three roles were scrutinised, along with any associated qualitative data, to assess potential relevance to specific roles or settings. Responses from the open-text contextual questions were examined for themes and recommendations to further guide the content or potential future applications of the framework. Content analysis was applied to qualitative items to discern trends and themes, and where data were insufficient to produce themes, a heuristic approach was taken to pragmatically integrate recommendations that were likely to improve clarity and usability of the framework.

2.10. Ethics. Ethical review and approval for this study was provided by the Southern Cross University Human Research Ethics Committee (approval no. 2022/035).

3. Results

3.1. Participant Characteristics. A total of 33 experts were invited to participate in the study, 16 of whom completed the first survey (48% response rate). The round two survey was completed by 13 of the original 16 participants who completed round 1, producing a response rate of 81%. Participants were most commonly aged between 40 and 59 years ($n = 11$, 68.8%) and more than half were female ($n = 9$, 56.3%) (Table 1). Geographic representation covered four of the eight Australian States and Territories, with participants predominantly located in the most populous state of New South Wales ($n = 9$, 56.3%). One-half of participants held a postgraduate degree (PhD or doctorate $n = 4$, 25.0%; master's degree $n = 4$, 25.0%) as their highest qualification. Representation was well-balanced across the three roles of prescriber ($n = 8$, 50.0%), provider ($n = 11$, 68.8%) and policymaker/facilitator ($n = 8$, 50.0%), with nine participants reporting expertise in two or more roles.

Participants reported a diverse range of disciplinary expertise, including a variety of clinical, health service management, environmental/ecological, nature-based, community and consumer engagement experiences (Table 2). The number of years of experience within the discipline or field ranged from 2 to 38, with an average of 20 years.

3.2. Nature Prescribing Definition and Framework Terminology. Participants shared their views on the definition of nature prescribing and the terminology used, which was initially presented as 'green prescribing.' Many participants expressed a preference to replace the word 'green' with 'nature' to better convey the concept, capture natural environments that are not necessarily green (i.e., blue and red spaces) and avoid confusion with other practices that may share similar 'green' terminology, such as medicinal cannabis. These perspectives were repeated and elaborated upon in a later open-text item asking for general comments on the framework terminology. As a result, the name of the framework was changed to the nature prescribing framework.

In addition, participants suggested the definition of nature prescribing should be explicitly inclusive of health promotion and illness prevention, rather than defining the practice solely as an intervention or treatment. The responses also challenged the implication that a formal prescription is required and noted that such terminology may not be suitable outside of clinical medicine settings. Two sentences were added to the definition of nature prescribing to clarify and explicate these factors. Responses to the general comments question called for greater clarity regarding the purpose and intended applications of the framework. Consequently, the introduction of the framework was extended to include relevant background information and to outline the purpose of the framework. When the revised definition and framework title were presented in the round two survey, consensus was achieved amongst all respondents ($n = 13$, 100%) with no further revisions required.

Table 1: Participant characteristics of Delphi panellists.

Characteristic	*N*	%
Sample		
Round one	16	100
Round two	13	81.3
Age		
30–39	2	12.5
40–49	6	37.5
50–59	5	31.3
60–69	3	18.8
Gender		
Female	9	56.3
Male	7	43.8
Location of work (state)		
New South Wales	9	56.3
Queensland	4	25.0
Victoria	2	12.5
South Australia	1	6.3
Highest educational qualification		
Certificate/diploma/advanced diploma	2	12.5
Bachelor or baccalaureate	3	18.8
Graduate certificate/diploma	3	18.8
Master's degree	4	25.0
PhD or doctorate	4	25.0
Role in nature prescribing[*]		
Prescriber	8	50.0
Provider	11	68.8
Policy maker or facilitator	8	50.0

Note: Prescriber = someone who might prescribe or suggest the uptake of nature experiences. Provider = someone who provides nature experiences. Policy maker or facilitator = someone who provides the infrastructure and/or supports the possibility of green prescription programs.
[*]Many participants had expertise or experience across multiple roles.

3.3. Round One Consensus Results and Revisions. At the completion of round one, consensus was reached on all five domains and 12 of the 13 supporting criteria of the framework, with ≥ 75% of participants selecting Extremely important or Very important (Table 3). The single criterion that did not reach consensus in round one was criterion 5.2 (Adaptability to Environmental Challenges), which achieved consensus amongst 63% ($n = 10$) of participants, thus warranting modification before the criterion could be retained. Participants indicated the definition of the criterion and its relevance to the over-arching domain were not clear. Subsequent minor revisions were made to the criterion and associated domain definitions (i.e., provision of more explicit language regarding the bi-directional relationship between human health and that of the natural environment) to improve the clarity of the definitions. Following examination of all qualitative feedback regarding the clarity of each framework item, minor revisions were also undertaken on all five domains and 13 criteria to refine the language, sentence structure and detail. No major revisions affecting the meaning or purpose of these criteria were required. Full details of revisions are shown in Supporting Table S1.

When participants were asked to rate the perceived responsibility for each criterion, all mean values exceeded five (out of a maximum score of 10), suggesting that participants supported shared responsibility across the professional roles of prescribing, providing and facilitating nature prescriptions (Table 4). Eight criteria included one or more roles for which perceived responsibility was rated below seven. These responses were examined alongside associated qualitative data for relevance to specific contexts or settings. This resulted in two modifications to the definitions of domains one and four; an addition was made to domain one specifying its relevance to community populations rather than individual settings, and to domain four specifying its relevance to both prescribers and providers.

3.4. Contextual Findings. Qualitative responses from two of the eight contextual questions provided supporting information for the framework; specifically, the existing pathways and resources for nature prescribing implementation identified by participants in relation to Criteria 2.1 and 2.2 were integrated to form an appendix outlining potential points of connection for framework users to explore. The remaining six contextual questions elicited information related to the application of the framework, and potential future research and development. Participants consistently identified a need to address the lack of awareness of nature prescribing and its evidence base amongst health care professionals (regarding Criterion 3.1) and the general public (Criterion 5.1). This need was expressed by some as relating to a broader necessity to move toward health systems more focussed on preventive care and health promotion, with policymakers/facilitators seen as playing an important role in such a shift.

Another factor identified by participants as necessary to the successful application of the framework was training and cross-training of prescribers and providers to build capacity for routine nature prescribing and referrals (regarding Criterion 3.2), as well as developing skills to support patients and consumers through behavioural change, utilising strategies such as motivational interviewing (Criterion 4.2). Some participants also discussed the potential role of policymakers/facilitators in encouraging behavioural change at a social or population level. The challenges of funding and the burden of labour related to such training and skills development were frequently noted as barriers to implementation.

When asked for comments on receiving payment for nature prescribing, prescribers suggested the practice should be treated as any other form of health care and remunerated accordingly, although two participants suggested temporary financial incentives to prescribers could instigate change in prescribing behaviour. Participants considered that nature prescribing could be subject to private health insurance and public health subsidies according to the service context and patient circumstances. Prescribers also noted that while the traditional medium of a paper prescription may be suitable for some patients, the use of electronic prescriptions and associated resources such as digital apps is increasingly important for the accessibility and streamlining of future implementation.

Table 2: Self-described professional expertise of participants.

Primary discipline or field of expertise	Years of experience
Community nursing	12
Agricultural/horticultural research, development and community engagement	30
Adventure-based youth work	20
Occupational therapy, mental health	38
Community health promotion, mental health	10
Exercise physiology	15
Psychology	15
Forest therapy	2
Health services management	20
Landscape architecture and therapeutic horticulture	30
Healthcare consumer advocacy	2
Public health, allied health	30
Clinical psychology	25
Environment, ecology and community engagement	30
Social-ecological systems	15
Nature connection and social anthropology	25

Table 3: Rates of consensus achieved for each framework item during Delphi rounds one and two.

Item	Round one consensus ($n = 16$)	Round two consensus ($n = 13$)
Nature prescribing definition	—	100%
Domain 1. Community: consultation and customisation	81%	—
Criterion 1.1. Tailoring to unmet community needs	75%	—
Criterion 1.2. Accessibility in nature prescribing	81%	—
Criterion 1.3. Engagement and trust-building with community	81%	—
Domain 2. Systems: building partnerships and networks	94%	—
Criterion 2.1. Establishing connections and building pathways	94%	—
Criterion 2.2. Locally relevant, easily utilised resources	100%	—
Criterion 2.3. Integrating infrastructure with purpose	94%	—
Domain 3. Prescribers: cultivating awareness and capacity	81%	—
Criterion 3.1. Prescriber awareness and familiarity with nature prescribing	88%	—
Criterion 3.2. Capacity in the clinical consultation	80%*	—
Domain 4. Providing prescriptions: psychosocial foundations	87%*	—
Criterion 4.1. Person-centred delivery	81%	—
Criterion 4.2. Supporting behavioural change	75%	—
Criterion 4.3. Social engagement	75%	—
Domain 5. External settings: interfacing social and natural environments	81%	—
Criterion 5.1. Raising the public profile of nature prescribing	94%	—
Criterion 5.2. Adaptability to environmental challenges	63%**	92%

*Missing data from $n = 1$.
**Failed to reach consensus, requiring revision.

Table 4: Perceived responsibility for each criterion across the professional roles of prescribing, providing or facilitating nature prescriptions.

Item	Perceived responsibility, mean (min, max)		
	Prescriber	Provider	Policymaker/facilitator
Criterion 1.1. Tailoring to unmet community needs	7.25 (3, 10)	7.69 (5, 10)	7.5 (3, 10)
Criterion 1.2. Accessibility in nature prescribing	5.69 (0, 10)	7.44 (4, 10)	8.38 (5, 10)
Criterion 1.3. Engagement and trust-building with community	6.75 (1, 10)	8.06 (4, 10)	7.06 (3, 10)
Criterion 2.1. Establishing connections and building pathways	7.44 (1, 10)	7.56 (1, 10)	8.38 (4, 10)
Criterion 2.2. Locally relevant, easily utilised resources	7.27 (2, 10)	7.5 (2, 10)	8.13 (3, 10)
Criterion 2.3. Integrating infrastructure with purpose	5.53 (1, 10)	6.81 (1, 10)	8.94 (4, 10)
Criterion 3.1. Prescriber awareness and familiarity with nature prescribing	8.57 (5, 10)	6.69 (2, 10)	8.0 (5, 10)
Criterion 3.2. Capacity in the clinical consultation	7.0 (1, 10)	7.21 (3, 10)	7.71 (3, 10)
Criterion 4.1. Person-centred delivery	8.67 (3, 10)	8.15 (4, 10)	6.43 (4, 10)
Criterion 4.2. Supporting behavioural change	8.23 (5, 10)	8.0 (4, 10)	6.46 (1, 10)
Criterion 4.3. Social engagement	7.43 (3, 10)	7.73 (3, 10)	7.29 (5, 10)
Criterion 5.1. Raising the public profile of nature prescribing	7.57 (5, 10)	7.71 (2, 10)	9.2 (6, 10)
Criterion 5.2. Adaptability to environmental challenges	5.43 (2, 10)	8.67 (4, 10)	5.93 (2, 9)

3.5. Round Two Consensus Results and Revisions. One criterion did not reach consensus in round one (i.e., Criterion 5.2); this criterion was subsequently revised and reviewed in round two. Criterion 5.2 achieved consensus in round two with 92% ($n = 12$) of participants selecting Extremely important or Very important. Qualitative responses regarding revised Criterion 5.2 suggested the definition was clear; however, participants recommended the concept of planetary health be referenced more directly. Accordingly, the criterion definition, associated domain definition and framework introduction underwent minor revisions to position the framework more explicitly alongside the paradigm of planetary health. Participants also noted that changes to the social environment can have both challenging and enabling impacts on accessibility and demand for nature prescribing, resulting in further revisions to better reflect these dynamics in the criterion definition.

The retained domains and criteria that achieved consensus in round one and underwent only minor revisions for clarity were all presented to participants to confirm the revisions. All revised items were confirmed for clarity and appropriateness (yes responses from 83% to 100% of participants). Few comments were provided in the open-text response options and only two criteria underwent further revisions (i.e., an example was added to Criterion 1.1 to provide contextual clarity, and minor modifications were made to the language in Criterion 2.3 to better align the terminology with nature prescribing). Full details of the consensus results are shown in Table 3, with revisions detailed in Supporting Table S1.

3.6. Refined Framework. Following the two-round Delphi process, consensus was reached on the preliminary version of the nature prescribing framework. This refined framework comprises five domains of nature prescribing implementation, including (1) Community: consultation and customisation, (2) Systems: building partnerships and networks, (3) Prescribers: cultivating awareness and capacity, (4) Providing prescriptions: psychosocial foundations and (5) External settings: interfacing social and natural environments. These domains are supported by 13 criteria, as shown in Figure 2. Full details of the framework are provided in Supporting File S2.

4. Discussion

This research refined and validated a novel nature prescribing framework to offer guidance on the prescribing of nature-based interventions for health and well-being. The resultant framework is a timely response to emerging healthcare needs, with nature prescribing responding to a range of contemporary public health challenges, including preventive health and chronic illness management [6, 7], social issues such as loneliness [22] and planetary health considerations such as the health impacts of climate change [24, 47]. Establishing resources such as the nature prescribing framework is crucial not only for enhancing individual and community health outcomes but also for advancing policy discussions on environmental health and sustainable healthcare practices. While the current framework represents a preliminary outcome requiring further exploration to determine its functional application, the comprising criteria touch on practical and ethical considerations spanning the full scope of an implementation process.

The process of implementing a framework for health interventions can look different depending on the specific circumstance; however, successful implementation typically covers the three core phases of development, translation and sustainment [48]. A key component of the development phase, following initial synthesis of evidence, is understanding the host setting and considering the fit of an intervention to ensure readiness to adopt. Crucially, the nature prescribing framework lays the foundation for addressing this relationship between the setting and nature-based interventions across multiple domains, at the community, local systems and prescriber levels. Criterion 1.3 (Engagement and trust-building with the community) considers the needs of community members in the host setting who will engage with nature prescriptions, while Criterion 2.1 (Establishing connections and building pathways) broadens these considerations to the fit with local systems of health care, government and nature-based activity providers. Domain 3 (Prescribers: cultivating awareness and capacity) provides guidance on understanding the needs of health care providers and the practical logistics of the prescribing settings, which could be particularly impactful for success given the trust placed in health professionals by community members [49]. Previous research has suggested leadership is critical to implementation and 'champions' of nature prescribing programs play key roles in the promotion, facilitation, mitigation of challenges, sustainability and evaluation of programs [6]. The promotion of nature engagement as essential to health by health professionals acting as 'Champions' could be integral to the uptake of nature prescriptions, which over 80% of adults say they would welcome if offered [50].

Following the development phase of framework implementation, the translation phase is reflected most strongly in Domains 1, 2 and 4. Criteria 1.1 (Tailoring to unmet community needs) and 1.2 (Accessibility in nature prescribing) of the first Domain prioritise community needs, access and engagement. Criteria 2.2 (Locally relevant, easily utilised resources) and 2.3 (Integrating infrastructure with purpose) of the second Domain reinforce commitment to community by building partnerships and networks that ensure nature prescription programs are relevant and adaptable to the local circumstances. Translating nature prescriptions into successful practice requires the identification of opportunities for location specific nature-based activities, and the development of relationships with existing community partners (e.g., bird buddies, community gardens, Landcare groups, councils, and geocaching groups) [7]. These relationships offer potential opportunities to develop codesigned health and well-being activities that can be used as a nature prescription or health promotion initiative.

Domain 1	Community: consultation and customisation
1.1	Tailoring to unmet community needs
1.2	Accessibility in nature prescribing
1.3	Engagement and trust-building with the community
Domain 2	Systems: building partnerships and networks
2.1	Establishing connections and building pathways
2.2	Locally relevant, easily utilised resources
2.3	Integrating infrastructure with purpose
Domain 3	Prescribers: cultivating awareness and capacity
3.1	Prescriber awareness of and familiarity with nature prescribing and its benefits
3.2	Capacity in the clinical consultation
Domain 4	Providing prescriptions: psychosocial foundations
4.1	Person-centred delivery
4.2	Supporting behavioural change
4.3	Social engagement
Domain 5	External settings: interfacing social and natural environments
5.1	Raising the public profile of nature prescribing
5.2	Adaptability to environmental challenges

Figure 2: Nature prescribing framework domains and criteria, following Delphi panel completion.

Codesigned activities may reduce barriers to engagement, increase uptake and have flow-on psychosocial benefits to involved parties [51], thereby providing a solid foundation for sustained implementation. The three criteria in Domain 4 (Providing person-centred prescriptions from psychosocial foundations) also aim to reduce barriers to uptake, promote patient adherence and support translation through behaviour change at the interface of individual and community-based health care. The criteria in Domain 4 consider the need for translation to be guided by an individual's personal and social circumstances, needs and motivations, as an essential component of nature prescribing in the context of holistic healthcare partnerships occurring in community settings [7]. Translation may be most equitable and effective when programs recognise and prioritise autonomous forms of motivation (e.g., enjoyment and identity) over those of a more controlling form (e.g., contingent rewards and guilt avoidance) [52, 53]. Criterion 3.4 (Social engagement) in particular recognises that the suitability of group activities in nature prescribing may vary for some individuals, yet nature prescriptions may be especially beneficial for such individuals considering that nature-based activities and engagement with green space have been shown to promote pro-social behaviour and community connection [35, 54].

The sustainment phase of framework implementation represents the continued use of nature prescribing in routine practice. Some consideration of sustainment has been included in each domain of the nature prescribing framework through recognition of the need for ongoing adaptability and inclusion of tailorable guidance. This phase also includes monitoring implementation to improve and further refine the framework to the local context [48], a process which has yet to be undertaken with the nature prescribing framework and is a topic for further application and study.

The broader implications of sustainment also extend to sociological and environmental concerns such as biodiversity and climate change [1], which our Delphi participants considered especially relevant to nature prescribing, and are thus addressed in Domain 5 (External Settings: interfacing social and natural environments). Embedding nature in both health systems and public perception as a fourth pillar of health (alongside sleep, exercise and diet) could contribute to the sustainment of interventions

utilising the nature prescribing framework [39]. Additionally, being responsive and adaptable to the natural environments in which nature prescriptions occur, and to the changes in those environments over time, is essential for longer-term sustainability. Therefore, it follows that reinforcing awareness of our dependence on biodiverse ecosystems for well-being, and communicating the ability of nature-based interventions to affect an individual across multiple domains of health may facilitate sustained uptake with mutually beneficial outcomes for people and the natural environment [47].

The significance of the nature prescribing framework lies not only in its response to the interface of human and environmental health but also in its potential utility in other complex contemporary and emerging health challenges, such as those relating to health equity and social determinants of health [1, 28, 55]. Incorporating nature as part of a prescribing program enhances access to preventative and therapeutic interventions, especially in circumstances where access to conventional health services can be limited (e.g., for individuals living in rural/remote regions, communities affected by sociocultural, economic or environmental disruption, or where eligibility criteria for conventional services limits access) [56, 57]. For the most part, nature-based experiences do not rely on experts trained in health or the use of specialist equipment. Such prescriptions can originate from trusted community partners at a grassroots level, facilitating access for populations typically underserved by formal healthcare systems, who generally have poorer mental and physical health, and may not have the skills, capacity or resources to access formal health services [28]. This includes socioeconomically disadvantaged populations [5, 58], disabled people facing accessibility obstacles [41], groups impacted by societal and systems-based barriers (e.g., exclusion or discrimination targeting cultural, religious or language differences) [59, 60] and those facing a range of other challenges. For example, First Nations peoples in places such as Australia and New Zealand often do not trust formal healthcare services as a result of colonial history [56], yet have traditional medicine systems rooted in the natural environment that may be highly compatible with culturally tailored nature prescribing [61, 62]. Nature prescriptions can also be applied to a variety of environments, be adapted for affordability and provide various scalable opportunities to impact community and planetary health [63].

4.1. Limitations. While the nature prescribing framework may guide innovative implementation of nature-based health interventions, our study has limitations that should be considered when interpreting our results or utilising the Framework. Most specifically, the study is reflective of health systems, environmental circumstances and individual experiences within the Australian context. The sampling processes undertaken during the Delphi study and the earlier framework development sought diversity regarding participant expertise and basic demographics; however, other important factors such as disability, cultural and racial identity, or economic status were not explicitly represented. Consequently, the transferability of our findings and the nature prescribing framework to other geographical locations, or to specific social and cultural settings, may be limited. While the Delphi panel was predominantly representative of the Australian East Coast, development of the initial framework was informed by interview participants across a diverse range of Australian locations.

Consensus was reached on the inclusion of almost all framework criteria within the first survey round, which may reflect the high level of rigour and data saturation in the preceding interview study, or reflect the intended adaptability of the framework to different settings. However, this early consensus also may be an indication that more diverse perspectives on the framework are required. While many of the Delphi panellists had backgrounds in frontline primary care, there was no participation from general practitioners (even though they were invited), meaning the only contributions to the Framework from general practitioners occurred in the preceding interview study. Another important perspective that has not been directly included in the nature prescribing framework is that of the patient or end-user. It is crucial that future research or implementation studies investigating the application of the framework include the perspectives of general practice providers, as well as patients and community members, to enhance the framework's relevance and effectiveness. Finally, the response rate and sample size for the Delphi panel were modest, in part due to the emerging nature and limited practice of nature prescribing in Australia. While there are no standardised guidelines for calculating sample sizes in Delphi methodology for health research [64], larger samples are frequently recruited.

4.2. Future Directions. In keeping with the rigour of implementation science processes and the importance of evaluation in creating effective, sustainable practices [48], further research should be undertaken to test the nature prescribing framework in practice. Pilot studies with a range of community partners and interest-holders across different environments could further refine the framework, including examination of prescriber, provider and end-user experiences. Additionally, if the Framework is to demonstrate fidelity to its own criteria regarding being tailored to the community, the economic considerations of its use when implementing nature prescriptions must be explored to assess the feasibility of such interventions in resource-limited settings. Such exploration necessitates participatory research approaches with attention to both the immediate and long-term needs expressed by end-users, giving explicit consideration to sustained benefit through reciprocal consultation with end-users in genuine alignment with person-centred and community-centred ethos [65].

As implementation requires time and investment (which can be scarce in many healthcare environments), incorporating continuous updates and adaptability mechanisms will be essential to keeping the framework relevant amidst dynamic public health and environmental changes.

Further development of the framework through considered implementation and ongoing study may also facilitate adoption of the framework in different healthcare settings by streamlining the framework content, language and utility. Implementation studies with codesign approaches could produce extensions, checklists or appendices with terminology, resource suggestions and additional guidelines tailored to the specific needs of particular populations, settings or contexts. In keeping with the focus of the framework on accessibility, tailoring to community needs and providing person-centred approaches, future directions should involve codesign with marginalised, vulnerable and underserved populations. In Australia, this could involve initiatives tailored to communities identified as priority populations in current health policy, including Aboriginal and Torres Strait Islanders, culturally and linguistically diverse groups, LGBTQI + communities, people from lower socioeconomic groups, people with mental illness, people with disabilities and those living in rural and remote areas [66].

5. Conclusions

Meeting the emerging health challenges regarding population and planetary health is complex and requires new strategies and systems. The novel nature prescribing framework described herein outlines key domains to consider when implementing a nature prescription program and lays foundation for health promotion in this dynamic field of nature-based social prescribing. While the framework provides a full scope of criteria for implementing nature-based prescriptions, it is essential to consider the specific cultural, geographic and systemic contexts in which it is applied. The diversity of the panel and the iterative nature of the Delphi process support the validity of the findings; however, broader testing and adaptation in different settings would enhance the generalisability and robustness of the framework. Translating the nature prescribing framework into practice presents opportunities to meet and adapt to those challenges and improve health outcomes for current and future generations.

Data Availability Statement

The data that support the findings of this study are available as de-identified files on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting Information 1. Supporting Table S1 outlines full details of the revisions made to each item of the Nature Prescribing Framework at each stage of the Delphi process.

Supporting Information 2. Supporting File S2 presents the full preliminary nature prescribing framework.

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