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Title Identifying opportunities for nature engagement in cancer care practice and design: protocol for four-round modified electronic Delphi

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Abstract

Introduction Opportunities to engage with nature have shown relevance in cancer patients' experiences of health and recovery and are attracting interest in cancer care practice and design. Such healthcare innovations can widen the horizon of possible supportive care solutions but require deliberate and rigorous investigation to ensure responsible action is taken and wastage avoided. The aim of this study is to solicit knowledge from relevant experts drawn from a range of healthcare practitioners, management representatives, designers, and researchers to explore levels of opinion consensus for determining opportunities for, and barriers to, providing helpful nature engagement in cancer care settings.

Methods and analysis Four-round modified electronic Delphi methodology will be used to conduct a structured, iterative feedback process for querying and synthesizing expert opinion. Round 1 administers an open-ended questionnaire to a panel of selected, relevant experts who will consider cancer patients' own recommendations for nature engagement (drawn from preceding investigation) before contributing salient issues (items) with relevance to the topic. Round 2 circulates anonymized summaries of responses back to the experts who verify and, if they wish, reconsider their own responses. Rounds 3 and 4 determine and rank experts' top-10 items using a 10-point Likert-type scale. Descriptive statistics (median and mean scores) will be calculated to indicate the items' relative importance. Levels of consensus will be explored with consensus defined as 75% agreement.

Ethics and dissemination Ethics for this study was gained from the Institution's Human Research Ethics Committee. It is anticipated that the results will be published in peer-reviewed journals and presented in a variety of forums.

Strengths and Limitation of the study

- The aim of this study is to determine opportunities for contact with nature in oncology contexts in order to develop novel healthcare design solutions.

- Cancer patients' own nature experiences and recommendations for opportunities to engage with nature in oncology contexts form the basis for this investigation.

- This study represents the first international cross-disciplinary collaboration between healthcare and healthcare facility design experts to better understand the feasibility of appropriate and helpful nature engagement in oncology contexts.

- The electronic Delphi method enables experts across disciplines and geographic locations to anonymously contribute valuable knowledge and experience through a structured and iterative feedback process.

- Participant sample is determined by the willingness of healthcare and design experts to participate in questionnaire survey, which can prove challenging due to common time constraints.

INTRODUCTION

Background

With the worldwide surge in incidence, cancer will soon impact at least one in three people [1]. Reducing the burden of cancer and supporting those affected by cancer has become a healthcare priority. It is known that a significant amount of this healthcare burden is preventable; one third of lives lost to cancer are attributable to behavioral and lifestyle choices, and 30% of these cancer deaths are preventable by attending to key risk factors [1]. In response, healthcare policy must not only consider effective clinical care and alleviate the burden associated with cancer treatment but also promote positive health behavior and prevent poor lifestyle choices. Such health-centric strategies focus on patients' own resources to manage health and disease [2] and aim to strengthen patients' capacity to maintain or regain good health in the context of pathogenic biological or psycho-social stressors. To this end, exposure to, and engagement with, nature presents an often underappreciated health resource [3] and could be considered an opportunity to broaden health-centric care strategies: "contact with nature may offer an affordable, accessible and equitable choice on tackling the imminent epidemic, with both preventive and restorative [public] health strategies" [4]. In this context, Nightingale's seminal and timeless instructions for "those who have personal charge of the health of others" are still relevant for healthcare givers and receivers today: "What nursing has to do … is to put the patient in the best condition for nature to act upon him" [5] (p.133). Empirical evidence suggests various bio-psycho-social benefits from contact with nature in cancer settings [6-10].

Rationale

Healthcare setting design represents an expensive intersection of healthcare industry and infrastructure as well as potential opportunities for healthcare improvements [11] and increased consumer satisfaction [12]. Opportunities to connect with nature are attracting interest in healthcare setting and service design. Such healthcare innovations can widen the horizon of possible solutions to growing healthcare burden but require deliberate and rigorous investigation to ensure responsible action is taken and wastage avoided. This complex issue involves multiple governing bodies and stakeholders who have the task of innovating cost-efficient and high quality healthcare that responds to cancer patients' health and recovery requirements. To evaluate the feasibility of integrating nature engagement opportunities into healthcare, a synthesis of opinion from a range of experts is needed. This study will solicit input from relevant experts drawn from a range of professional and academic roles (including cancer-specific experts, where relevant) about opportunities for nature engagement in the cancer care setting and explore factors they deem critically important for its provision. The

present study follows from Phase 1 qualitative research into cancer patients' use of nature and its relevance in their experiences of health and recovery, which uncovered cancer patients' own recommendations for integrating nature engagement opportunities in healthcare.

Aim

The primary aim is to solicit knowledge from relevant healthcare and design experts in order to explore levels of opinion consensus about opportunities for, and barriers to, providing nature engagement in cancer care settings.

METHOD AND DESIGN

Figure 1 illustrates the study flow according to the modified Delphi methodology adopted in this study, which structures an iterative feedback process using a pre-determined number of 4 questionnaires (rounds) rather than using as many as needed to reach strict consensus. First, an open-ended questionnaire is administered to an "expert panel" with the aim to uncover salient issues (items) with relevance to the topic, which are subsequently verified and finally ranked according to their priority reflecting the relative degree of consensus among the panel. The protocol and related study materials were designed following the SPIRIT 2013 Checklist [13] where appropriate.

[INSERT FIGURE 1]

Rounds and timeline

Following Okoli and Pawlowski's [14] recommendation, the four-round Delphi will aim to collect rich data, consolidate ranging expert opinion and, indicate levels of consensus. Round 1 serves idea generation, Round 2 verifies summaries of responses, Round 3 short-lists items of priority, and Round 4 ranks prioritized items. The four questionnaires will be electronically administered via email. Rounds are planned to take four weeks [15]: two to three weeks for panelists to respond (including one reminder one week prior to the round closing deadline) and; one week to analyze response data and, based thereon, draft the next questionnaire.

Questionnaires

Delphi is a form of iterative enquiry that builds upon ongoing data collection. Its primary research tool is a series of questionnaires built from participants' stepwise input. Questionnaire 1 will be available for distribution at the start of recruitment and questionnaires 2 to 4 are subsequently created to reflect content from the ongoing data collection. Questionnaire 1, Section A first introduces cancer

patients' recommendations drawn from our preceding investigation. Section B will query experts' ideas and perceptions about opportunities for nature engagement in the cancer care setting and ask for factors they perceive are barriers to its provision. Questionnaire 1 (item generation) will to take no more than 15 minutes to complete and questionnaires 2 to 4 (verification and ranking) will take no more than 10 minutes to complete unless panelists wish to elaborate. Questionnaire 1 will be pilot-tested by two to three researchers unfamiliar with the Delphi method who will be asked to provide feedback about their question-and-answer process when completing the questionnaire [16]. This is to ensure Questionnaire 1 is comprehensible to Delphi responders and that the intended scope and quality of response will be achieved.

Anonymity

The level of anonymity and confidentiality appropriate for this study is termed "quasi-anonymity" [17], which denotes that responses will remain anonymized throughout the study and are known only to the researchers. Since the panel constitutes experts from professional and academic backgrounds only, there is no need to adopt the common strictures of anonymity required when involving cancer patients. Panel members will be blinded to each other's responses throughout the Delphi process but can be known to each other as panel members. It will be clearly stated that publications will not reference any personally identifiable participant information.

PARTICIPANTS

Selection of experts

Selection of national and international experts will firstly make use of the researchers' expert networks and then follow Delbecq et al's [18] guidelines for identifying experts for nominal group studies, which increases rigour in recruiting relevant individuals outside the researchers' own networks. This procedure has shown to be transferable to Delphi studies [14, 15]. The following predefined inclusion criteria have been previously adopted in Delphi panel recruitment [15] and will supplement the selection procedure: 1) capable of contributing relevant input (knowledge and experience); 2) willingness and sufficient time to complete all four rounds; and 3) sufficient English skills to communicate ideas effectively. Please see the Discussion section for the definition of "expert" used in this study.

Sample Size

The recruitment target is a minimum of 40 experts accounting for 10 experts per group (healthcare practitioners, management representatives, designers, researchers). This will allow for diversity of

views and reveal any divergence of opinion between groups, while maintaining a volume of responses that is manageable to process. The sample target takes into account that not all participants are expected to complete all four rounds (attrition) and that a minimum of 7 panelist (for each sub-group) are required for reliable outcomes and comparisons [19]. To achieve the minimum sample size, a maximum of 200 experts will be invited to participate.

Recruitment

Identified experts will receive an email containing an invitation to participate, a Participation Information Sheet and, Questionnaire 1. Passive consent is given by responding to the email and returning Questionnaire 1. Participation is voluntary and can be withdrawn at any stage. Participants can request their demographic information and where possible other contributions to be withdrawn; however, due to the study's iterative process not all contributions can be withdrawn once included in previous rounds. Reasons for declining will be recorded if provided.

DATA COLLECTION AND ANALYSIS

Procedure

Questionnaires will be electronically administered via email according to Schmidt's [20] sequence detailed in Figure 2 below.

[INSERT FIGURE 2]

Phase 1

The initial phase constitutes creative brainstorming and aims to elicit a maximum variety of items, before quantitatively ranking them.

Questionnaire 1: Generation of items

This questionnaire will be sent on the same day the expert accepts participation. Section A constitutes a summary of cancer patients' anonymized recommendations and cautions related to nature engagement extracted from the preceding qualitative investigation. Section B asks two basic, open-ended questions requesting experts to list at least six items (as recommended by Schmidt [20]) for questions 1 and 2 followed by brief explanations of their chosen items. These follow:

1. List at least six items relevant to your expertise describing design features, applications, initiatives, or care practices related to nature engagement, which healthcare and design practitioners could feasibly implement within the cancer care context.
   This list seeks to generate a list of design and healthcare opportunities (Opportunities-List).

2. List at least six important barriers or risk factors that you believe affect the provision of nature opportunities in cancer care contexts. These can include, for example, physical, psychosocial, economic, or political factors.
   This question seeks to generate a list of barriers and key risk factors related to the provision of nature opportunities (Barriers-List).

Additionally, experts will be asked to offer a brief explanation of the importance of their suggested item. Space will be provided below each item for free text description.

Analysis (Questionnaire 1)

All data (items and explanations) will be entered and managed in qualitative data analysis software Nvivo version 10 for MacIntosh [21]. The analysis will first remove identical responses, then collate, synthesize and edit remaining ideas to achieve consistent terminology of items expressing similar ideas and, finally, logically group items into emerging categories. An inter-rater process will assist interpretative congruity as recommended for thematic analysis [22].

Questionnaire 2: Validation of categorized items

This questionnaire will be designed based on responses from Round 1 and aims to strengthen construct validity [14] according to the concept of "member-checking" [22]. All items generated thus far will be collated into meaningful categories, as produced by inter-rater agreement, and will be re-circulated to all experts. Each item is presented with a one-sentence explanation and non-identifiable background information of the panel member who generated the item (Figure 3). A brief summary of the comments from Round 1 is provided. Experts will be asked to:

1. Verify correct and fair interpretation of their responses and that items have been placed in an appropriate category;
2. Verify and, if they wish, refine the categorizations and recommend additional items.

[INSERT FIGURE 3]

Analysis (Questionnaire 2)

Based on responses, items will be further refined and again subjected to inter-rater discussion.

Phase 2

In this phase panelists will state their priorities and lists will be condensed accordingly.

Questionnaire 3: Prioritizing items

Questionnaire 3 uses a structured format and will list the items generated thus far in random arrangement to minimize response bias. Each panelist will be asked to select 10 items ("top ten") from each list (Opportunities and Barriers), which s/he deems relevant and critical to the consideration of nature opportunities in the cancer care setting. Items 1 to 10 are selected according to the their importance as judged by the expert who is asked to assign "1" to the most important item, "2" to the second ranked item and so on (Figure 4).

Analysis (Questionnaire 3)

Items selected by the majority of experts will be aggregated representing a majority vote. Lists will be reduced according to the importance of items calculated based on the sum of points allocated by each expert to their top-ten items i.e. item "1" indicating highest importance is coded with 10 points, item "2" coded with 9 points and so on. As recommended by Schmidt [20], to avoid burdening panelists with too many items, the target size of total items for the final round will be no more than 20 items for each list (Opportunities and Barriers).

[INSERT FIGURE 4]

Phase 3

The aim of this phase is to elicit levels of agreement amongst all experts and detect any diverging opinion between different expert groups.

Questionnaire 4: Ranking items

Questionnaire 4 is designed to elicit levels of consensus (not achieve consensus) in the ranking of relevant items. This questionnaire includes aggregated statistical group responses generated for each included item thus far: the total sum of points assigned to each items by the entire panel; individual panelists' own Round 3 response and; a summary of comments provided thus far (Figure 5). Each panelist will individually submit a rank ordering of the items for each of the condensed lists (Opportunities and Barriers). Each item is presented with a corresponding 10 point Likert-type scale (1= not important at all, 10 = very important) and an option to indicate "no judgment" for any given item including space for justification.

[INSERT FIGURE 5]

Analysis (Questionnaire 4)

Statistical analyses will be performed using IBM SPSS Statistics version 23 for Macintosh [23]. Descriptive statistics (median and mean scores) will be calculated to indicate items' relative importance. Descriptives will be calculated for the full sample and by expert group. The study's aim is to explore levels of consensus rather than achieve consensus. Consensus will be defined as 75% agreement [24].

Finally, if further understanding of qualitative responses is required, a small number of one-on-one follow-up interviews will be conducted with experts to clarify any ambiguity and gain a fuller understanding of final results. Experts will be informed in the participation information sheet that they may be invited to participate in a voluntary follow-up interview at study completion.

ETHICS

Ethics for this study was gained from the Institution's Human Research Ethics Committee. All consented participants will be assigned a unique identification code. Collected demographic information and contact details will include: name, contact phone number, e-mail address, description of professional role, years served in field of expertise, country of professional residence/affiliation. Participants' identifiable information will be matched with their unique identification code in one digital masterfile only. All data collected will be stored safely and securely in locked filing cabinets and in password protected folders on a secure drive (electronic data) that can be accessed only by the study investigators. Data will be kept for 5 years as per local guidelines.

DISCUSSION

Appropriateness of method

The Delphi method is an established research tool for complex problem solving, which solicits expert opinion through a structured, iterative process [20]. Its original purpose was to obtain converging consensus about relative priorities in a given topic through a progression of iterative questionnaires based on controlled feedback [25] until statistical census is reached. Since its inception, the Delphi method evolved to address a variety of research problems such as eliciting degrees of agreement, delineating differing group attitudes and positions, or understanding the rationales of particular judgments and opinions [19, 26]. Delphi variants applied to such explorative enquiry include e.g., modified, exploratory, ranking, and policy Delphis, which are particularly well suited for investigating areas where little prior knowledge exists [27]; where empirical data is lacking [28] and; where cursory understanding of group attitudes and priorities is desired [19]. The present study aims to guide concept development and elicit levels of consensus amongst diverse disciplinary viewpoints in order to generate new care opportunities related to nature engagement in the cancer care setting.

The best suited variant for this purpose is the modified electronic Delphi with a predefined four-round design, which provides following key advantages: 1) serves the dual purpose of soliciting broad expert opinion followed by priority ranking [14]; 2) can conclude at a pre-defined number of rounds because strong consensus is not required when degrees of agreement and group attitudes are of interest [19]; 3) structures a rigorous and rapid feedback-based (online) communication process [29]; 4) frees communication from logistical challenges, peer pressure and 'group-think' scenarios [30]; and 5) cross-pollinates multidisciplinary expertise achieving broader understanding than would be reached from a single discipline alone [14]. The method's flexibility and ability to easily assemble and coordinate participants across disciplines and geographic locations partly explain its growing popularity in medical and nursing research [17]. Mullen [19] reports its use in medical, health service and nursing research for "forecasting developments in medicine and health technologies", and "identifying priorities for nursing research and also priorities for spending and service developments" (p. 49). Relevant to this study are two examples showing its application in the cancer context for gathering international input for developing pain assessment tools for palliative care [31] and, engaging healthcare experts from diverse backgrounds with experience in survivorship care to develop realistic strategies for improving healthcare for cancer survivors [32].

Definition of an "expert"

An important component of the Delphi method is the identification of experts. There are no specific standards for identifying experts and "expertness" is variously defined in different Delphi studies. This presents a major criticism of the Delphi method [25, 33] and there remains little consensus as to what constitutes expertness and how it is operationally defined [19, 25]. The dictionary definition of an expert, "a person who is very knowledgeable about or skillful in a particular area" [34], has been found insufficiently instructive for assembling a Delphi expert panel [25]. Consequently, studies have employed broader terms to identify and include relevant experts including: "informed advocates" [19], "informed individuals", "specialist in their field" or persons with "knowledge about a specific subject" [17]. Central to these formulations is the description of individuals who possess both knowledge and experience representative of the capacity to articulate informed opinion and provide relevant input about a given topic, which will be this study's working definition of an expert.

Composing the expert panel

Delphis can use homogenous or heterogeneous expert panels depending on the study aim. A heterogeneous panel of experts can bring a range of disciplinary viewpoints to the surface and articulate greater complexities as well as the boundaries of the topic at hand. In regards to innovation,

Mullen cites that "many innovations and real breakthroughs … occur from outside a discipline or specialty" (cited in [19], p. 42) suggesting that cross-pollination of diverse disciplines and backgrounds can produce insightful and fruitful enquiry. Based on these precepts, five groups of diverse yet relevant stakeholders have been identified in the area of cancer care innovation: 1) cancer patients; 2) healthcare practitioners; 3) healthcare management; 4) healthcare setting designers and; 5) researchers. The panel will be composed of healthcare practitioners, management representatives, designers, and researchers. Patients' recommendations were drawn from the preceding qualitative Phase 1 study and are presented to the panel in Round 1. The rationale for not recruiting additional cancer patients is twofold. Firstly, the present study builds upon a substantial amount of data already collected from qualitative interviews eliciting patient experiences, suggestions, recommendations, and cautions related to nature engagement. Secondly, of interest, are the responses and perceptions of those who bear on decision-making and healthcare policy development to ascertain the feasibility and realistic limitations of providing opportunities for nature engagement in the cancer care setting.

Determining sample size

Delphi studies have been conducted with varying panel sizes ranging from single digits to low hundreds [19]. The absence of strict guidelines allows individual research projects to determine panel sizes according to their purpose and limitations [17]. However, the most reliable Delphi studies were conducted with fewer than 20 participants [19]. Recommendations suggest populating panels with 10 to 18 experts for sufficient input to warrant meaningful elicitation of diverse disciplinary viewpoints [14, 19]. Seven is considered an acceptable minimum panel size with accuracy rapidly declining as the number becomes smaller [19]. It is understood that the levels of census amongst experts are of more interest than the power of frequencies of response [20, 35], which is often misunderstood when mistaking the Delphi method for a quantitative survey [19].

Level of anonymity

One of Delphi's defining features and strengths is the anonymity of responses. Mullen [19] states that preserving anonymity in Delphis "removes effects of status, powerful personalities and group pressure" (pp. 46-47). Keeney [17] notes that anonymity "facilitates respondents to be open and truthful about their views" (p. 197). Varying degrees of anonymity have been used in Delphis. Some studies have adhered to strict criteria such as anonymizing responses to researchers themselves and blinding panelists to one another's identity [19]. There is no agreed upon level of anonymity or de-identification other than preserving "the anonymity of responses … for at least part of the study" [19] (p.47). Advantages of panelists knowing each other's identities include greater motivation to engage

because of association with prominent experts, stimulating exploratory thinking and idea generation, and introducing greater accountability for considered personal responses and the overall Delphi study outcome [19]. The present study will make use of these advantages and also acknowledge the known fact that complete blinding can be unrealistic because experts might know each other outside the study [17].

DISSEMINATION PLAN

Participants will be sent a summary of results at conclusion of the final phase. Presentation of results will include the total number of items generated in Phase 1 and the strength of the items taken into Phase 2. Levels of consensus will be tabled and sufficient raw data provided (e.g. number of panelists in each round) to support calculation of statistics. A summary of non-identifiable demographics will be presented to validate the participation of relevant and qualified experts. Based on the findings, it will be possible to revise the theoretical understandings and practical patient recommendations formulated in Phase 1. Preliminary expert recommendations can be drafted for testing in the cancer care context, and propositions can be generated to inform future research. It is anticipated that the results of this research project will be published in peer-reviewed journals and presented in a variety of forums, and form part of the Principal Investigator's dissertation.

Contributors SB is the principal investigator who conceived the study and drafted the initial protocol manuscript. SB, CO and PS are responsible for the design of the study and CO and PS critically revised the manuscript and related study materials. All authors have read and approved the final manuscript.

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Competing interests None declared. All authors have completed the ICMJE uniform disclosure form.

Figure 1 Design of modified four-round Delphi

Figure 2 Delphi questionnaire administration process (adapted from Schmidt [35])

Figure 3 Example of Questionnaire 2 layout

Figure 4 Example of Questionnaire 3 layout

Figure 5 Example of Questionnaire 4 layout

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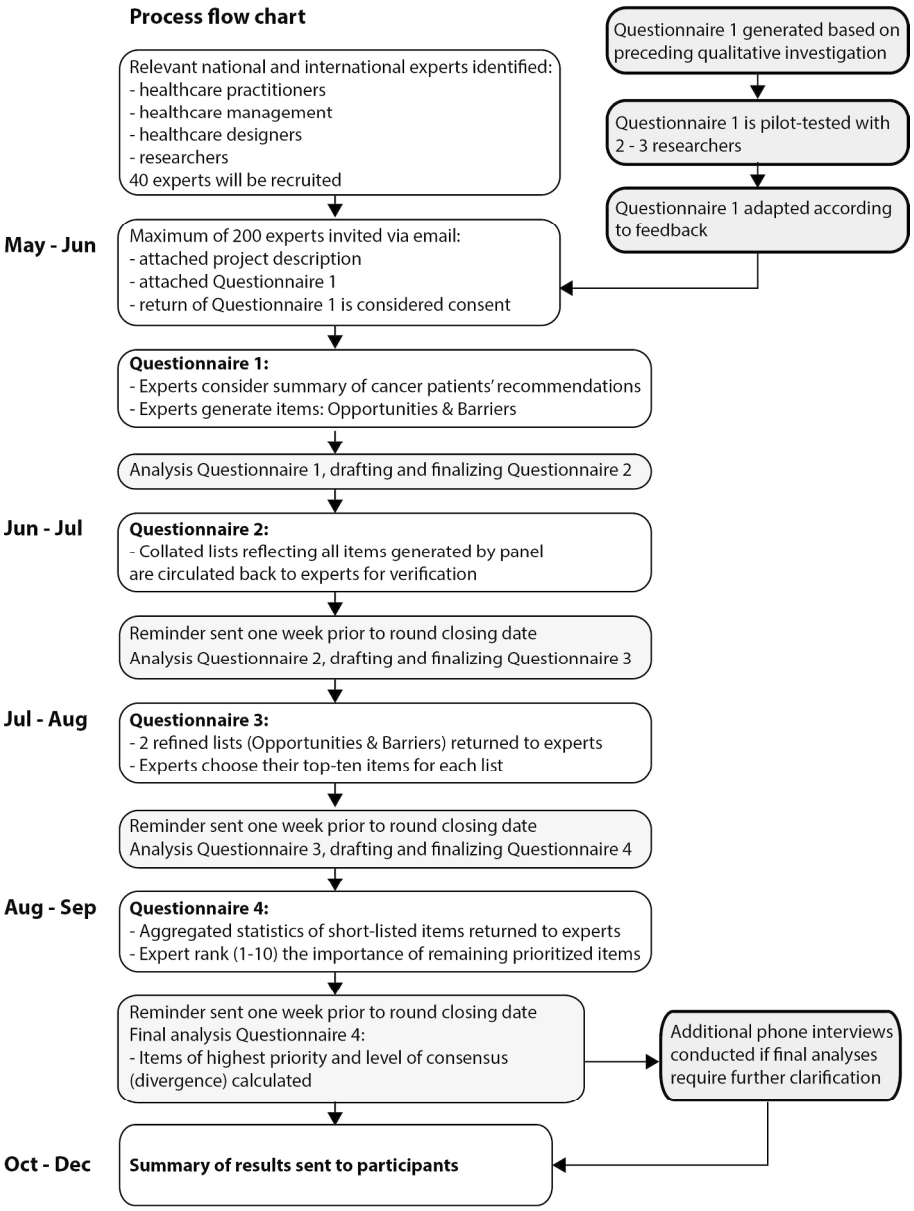

Figure 1 Design of modified four-round Delphi

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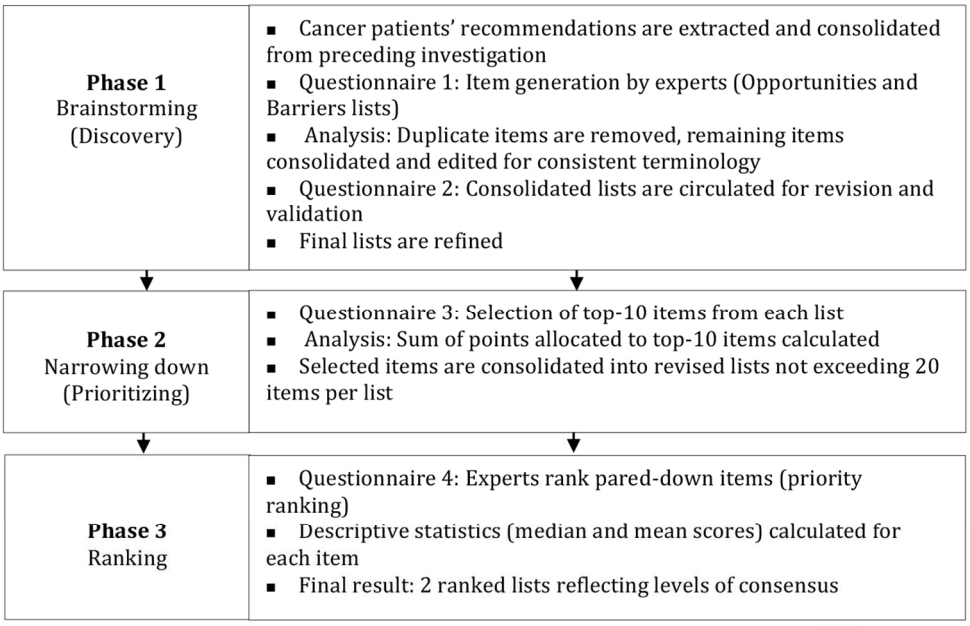

Figure 2 Delphi questionnaire administration process (adapted from Schmidt [38])

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Category XX

Nr	Item description	Item originator (profession, field of practice, time in practice, country of prof. residence)	Explanation	
1	Outdoor seating area	Architect, healthcare and public spaces, 10 years, US	24hr accessible, sheltered outdoor area with comfortable seating at different heights, access to internal emergency phone.	Accept ☐ Revise ☐ Comment: [type here]
2	Virtual reality	Radiation therapist, oncology, 3 years, AU	Virtual reality headsets for use during diagnostic procedures, selection of different nature scenes and sounds.	Comment: [type here]
				Comment: [type here]

Item description	Item originator (profession, field of practice, time in practice, country of prof. residence)	Explanation	Your top-10 items
Outdoor seating area	Architect, healthcare and public spaces, 10 years, US	24hr accessible, sheltered outdoor area with comfortable seating at different heights, access to internal emergency phone.	[type here]
Virtual reality	Radiation therapist, oncology, 3 years, AU	Virtual reality headsets for use during diagnostic procedures, selection of different nature scenes and sounds.	[type here]

Nr	Item description	Explanation	Your top-10	Total points by panel
1	Outdoor seating area	24hr accessible, sheltered outdoor area with comfortable seating at different heights, access to internal emergency phone.	"1"	64

Please tick the box on the 1 -1 10 scale below indicating the importance this item has for you.

1 2 3 4 5 6 7 8 9 10

Not at all important Very important

SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents*

Section/item	Item No	Description
Administrative information		
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended registry
	2b	All items from the World Health Organization Trial Registration Data Set
Protocol version	3	Date and version identifier
Funding	4	Sources and types of financial, material, and other support
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors
	5b	Name and contact information for the trial sponsor
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities
	5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)
Introduction		
Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention
	6b	Explanation for choice of comparators
Objectives	7	Specific objectives or hypotheses
Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory)

Methods: Participants, interventions, and outcomes		
Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered
	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease)
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests)
	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations
Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size
Methods: Assignment of interventions (for controlled trials)		
Allocation:		
Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions

Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial
Methods: Data collection, management, and analysis		
Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol
	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols
Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol
Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)
	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)
Methods: Monitoring		
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed

	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct
Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor
Ethics and dissemination		
Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval
Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators)
Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)
	26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable
Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial
Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site
Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators
Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation
Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions
	31b	Authorship eligibility guidelines and any intended use of professional writers
	31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code

Appendices

Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable

*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated. The SPIRIT checklist is copyrighted by the SPIRIT Group under the Creative Commons "Attribution-NonCommercial-NoDerivs 3.0 Unported" license.

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Identifying opportunities for nature engagement in cancer care practice and design: protocol for four-round modified electronic Delphi

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Title Identifying opportunities for nature engagement in cancer care practice and design: protocol for four-round modified electronic Delphi

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Abstract

Introduction Opportunities to engage with nature have shown relevance in cancer patients' experiences of health and recovery and are attracting interest in cancer care practice and design. Such healthcare innovations can widen the horizon of possible supportive care solutions but require deliberate and rigorous investigation to ensure responsible action is taken and wastage avoided. This protocol outlines a study designed to solicit knowledge from relevant experts drawn from a range of healthcare practitioners, management representatives, designers, and researchers to explore levels of opinion consensus for determining opportunities for, and barriers to, providing helpful nature engagement in cancer care settings.

Methods and analysis Four-round modified electronic Delphi methodology will be used to conduct a structured, iterative feedback process for querying and synthesizing expert opinion. Round 1 administers an open-ended questionnaire to a panel of selected, relevant experts who will consider cancer patients' own recommendations for nature engagement (drawn from preceding investigation) before contributing salient issues (items) with relevance to the topic. Round 2 circulates anonymized summaries of responses back to the experts who verify and, if they wish, reconsider their own responses. Rounds 3 and 4 determine and rank experts' top-10 items using a 10-point Likert-type scale. Descriptive statistics (median and mean scores) will be calculated to indicate the items' relative importance. Levels of consensus will be explored with consensus defined as 75% agreement.

Ethics and dissemination Ethics for this study was gained from the Institution's Human Research Ethics Committee (blinded for review). It is anticipated that the results will be published in peer-reviewed journals and presented in a variety of forums.

Strengths and Limitation of the study

- The aim of the study outlined in this protocol is to determine opportunities for contact with nature in oncology contexts in order to develop novel healthcare design solutions.

- Cancer patients' own nature experiences and recommendations for opportunities to engage with nature in oncology contexts form the basis for this investigation.

- This study represents the first international cross-disciplinary collaboration between healthcare and healthcare facility design experts to better understand the feasibility of appropriate and helpful nature engagement in oncology contexts.

- The electronic Delphi method enables experts across disciplines and geographic locations to anonymously contribute valuable knowledge and experience through a structured and iterative feedback process.

- Participant sample is determined by the willingness of healthcare and design experts to participate in questionnaire surveys, which can prove challenging due to common time constraints.

INTRODUCTION

Background

With the worldwide surge in incidence, cancer will soon impact at least one in three people [1]. Reducing the burden of cancer and supporting those affected by cancer has become a healthcare priority. It is known that a significant amount of this healthcare burden is preventable; one third of lives lost to cancer are attributable to behavioral and lifestyle choices, and 30% of these cancer deaths are preventable by attending to key risk factors [1]. In response, healthcare policy must not only consider effective clinical care and alleviate the burden associated with cancer treatment but also promote positive health behavior and prevent poor lifestyle choices. Such health-centric strategies focus on patients' own resources to manage health and disease [2] and aim to strengthen patients' capacity to maintain or regain good health in the context of pathogenic biological or psycho-social stressors. To this end, exposure to, and engagement with, nature presents an often underappreciated health resource [3] and could be considered an opportunity to broaden health-centric care strategies: "contact with nature may offer an affordable, accessible and equitable choice on tackling the imminent epidemic, with both preventive and restorative [public] health strategies" [4]. In this context, Nightingale's seminal and timeless instructions for "those who have personal charge of the health of others" are still relevant for healthcare givers and receivers today: "What nursing has to do … is to put the patient in the best condition for nature to act upon him" [5] (p.133). Preliminary empirical evidence from cancer populations show various bio-psycho-social benefits from contact with nature in cancer settings, including: improved quality of life [6], increased positive health behaviour such as physical exercise and fruit and vegetable consumption [7], restored attention [8] and increased social interaction [9].

Rationale

Healthcare setting design represents an expensive intersection of healthcare industry and infrastructure as well as potential opportunities for healthcare improvements [10] and increased consumer satisfaction [11]. Opportunities to connect with nature are attracting interest in healthcare setting and service design. Such healthcare innovations can widen the horizon of possible solutions to growing healthcare burden but require deliberate and rigorous investigation to ensure responsible action is taken and wastage avoided. This complex issue involves multiple governing bodies and stakeholders who have the task of innovating cost-efficient and high quality healthcare that responds to cancer patients' health and recovery requirements.

The present study follows from Phase 1 qualitative research into cancer patients' use of nature and its relevance in their experiences of health and recovery, which uncovered cancer patients' own

recommendations for integrating nature engagement opportunities in healthcare. Our preliminary findings report positive health-nature interchanges for cancer patients and support further investigation to strategically determine the opportunities for, and barriers to, safe delivery of beneficial nature engagement in cancer care contexts. To evaluate the feasibility of integrating nature engagement opportunities into healthcare, a synthesis of opinion from a range of experts is needed. This protocol outlines a study designed to solicit input from relevant experts drawn from a range of professional and academic roles (including cancer-specific experts, where relevant) and explore factors they deem critically important for the provision of nature-based engagement in cancer care settings. To our best knowledge, no such collection and synthesis of expert opinion on this topic exists across healthcare and design disciplines.

Aim

The primary aim is to solicit knowledge from relevant healthcare and design experts in order to explore levels of opinion consensus about opportunities for, and barriers to, providing nature engagement in cancer care settings.

METHOD AND DESIGN

Figure 1 illustrates the study flow according to the modified Delphi methodology adopted in this study, which structures an iterative feedback process using a pre-determined number of 4 questionnaires (rounds) rather than using as many as needed to reach strict consensus. First, an open-ended questionnaire is administered to an "expert panel" with the aim to uncover salient issues (items) with relevance to the topic, which are subsequently verified and finally ranked according to their priority reflecting the relative degree of consensus among the panel. The protocol and related study materials were designed following the SPIRIT 2013 Checklist [12] where appropriate.

[INSERT FIGURE 1]

Rounds and timeline

Following Okoli and Pawlowski's [13] recommendation, the four-round Delphi will aim to collect rich data, consolidate ranging expert opinion and, indicate levels of consensus. Round 1 serves idea generation, Round 2 verifies summaries of responses, Round 3 short-lists items of priority, and Round 4 ranks prioritized items. The four questionnaires will be electronically administered via email. Rounds are planned to take four weeks [14]: two to three weeks for panelists to respond

(including reminder emails prior to the round closing deadline to maintain a high response rate) and; one week to analyze response data and, based thereon, draft the next questionnaire.

Questionnaires

Delphi is a form of iterative enquiry that builds upon ongoing data collection. Its primary research tool is a series of questionnaires built from participants' stepwise input. Questionnaire 1 will be available for distribution at the start of recruitment and questionnaires 2 to 4 are subsequently created to reflect content from the ongoing data collection. Questionnaire 1, Section A first introduces cancer patients' recommendations drawn from our preceding investigation. Section B will query experts' ideas and perceptions about opportunities for nature engagement in the cancer care setting and ask for factors they perceive are barriers to its provision. Questionnaire 1 (item generation) will take no more than 15 minutes to complete and questionnaires 2 to 4 (verification and ranking) will take no more than 10 minutes to complete unless panelists wish to elaborate. Questionnaire 1 will be pilot-tested by two to three researchers unfamiliar with the Delphi method who will be asked to provide feedback about their question-and-answer process when completing the questionnaire [15]. This is to ensure Questionnaire 1 is comprehensible to Delphi responders and that the intended scope and quality of response will be achieved.

Anonymity

The level of anonymity and confidentiality appropriate for this study is termed "quasi-anonymity" [16], which denotes that responses will remain anonymized throughout the study and are known only to the researchers. Since the panel constitutes experts from professional and academic backgrounds only, there is no need to adopt the common strictures of anonymity required when involving cancer patients. Panel members will be blinded to each other's responses throughout the Delphi process but can be known to each other as panel members. It will be clearly stated that publications will not reference any personally identifiable participant information.

PARTICIPANTS

Selection of experts

National and international experts in academic and professional roles will be selected based on relevant backgrounds who possess both knowledge and experience representative of the capacity to articulate informed opinion and provide relevant input about the given topic. Nature engagement in cancer care is a novel topic and thus requires tapping into related expert groups, which diversely address healthcare architecture and design and supportive cancer care. Relevant professional

backgrounds include, for example, oncology and allied healthcare practitioners, management representatives working in healthcare planning and development, and healthcare setting architects and designers. Academics and educators may be included if they have taught subjects on health-nature and related healthcare design topics or have published and presented related research articles in academic forums.

The identification process uses two strategies. Firstly, the researchers' own expert networks will be used and consulted for referrals to potential study participants (snowballing). Secondly, we will follow Delbecq et al's [17] guidelines for identifying experts for nominal group studies, which increases rigour in recruiting relevant individuals outside the researchers' own networks. This procedure has shown to be transferable to Delphi studies [13, 14] and includes identifying relevant disciplines, sectors, and organizations and retrieving relevant academic and practitioner literature in order to build an expert list. The following predefined inclusion criteria have been previously adopted in Delphi panel recruitment [14] and will supplement the above selection procedures: 1) capable of contributing relevant input (knowledge and experience); 2) willingness and sufficient time to complete all four rounds; and 3) sufficient English skills to communicate ideas effectively. Please see the Discussion section for the definition of "expert" used in this study.

Sample Size

The recruitment target is a minimum of 40 experts accounting for 10 experts per group (healthcare practitioners, management representatives, designers, researchers). This will allow for diversity of views and reveal any divergence of opinion between groups, while maintaining a volume of responses that is manageable to process. The sample target takes into account that not all participants are expected to complete all four rounds (attrition) and that a minimum of 7 panelist (for each group) are required for reliable outcomes and comparisons [18]. To achieve the minimum sample size, a maximum of 200 experts will be invited to participate.

Recruitment

Identified experts will receive an email containing an invitation to participate, a Participation Information Sheet and, Questionnaire 1. Passive consent is given by responding to the email and returning Questionnaire 1. Participation is voluntary and can be withdrawn at any stage. Participants can request their demographic information and where possible other contributions to be withdrawn; however, due to the study's iterative process not all contributions can be withdrawn once included in previous rounds. Reasons for declining will be recorded if provided.

DATA COLLECTION AND ANALYSIS

Procedure

Questionnaires will be electronically administered via email according to Schmidt's [19] sequence detailed in Figure 2 below.

[INSERT FIGURE 2]

Phase 1

The initial phase constitutes creative brainstorming and aims to elicit a maximum variety of items, before quantitatively ranking them.

Questionnaire 1: Generation of items

This questionnaire will be sent on the same day the expert accepts participation. Section A constitutes a summary of cancer patients' anonymized recommendations and cautions related to nature engagement extracted from the preceding qualitative investigation. Section B asks two basic, open-ended questions requesting experts to list at least six items (as recommended by Schmidt [19]) for questions 1 and 2 followed by brief explanations of their chosen items. These follow:

1. List at least six items relevant to your expertise describing design features, applications, initiatives, or care practices related to nature engagement, which healthcare and design practitioners could feasibly implement within the cancer care context.
   This list seeks to generate a list of design and healthcare opportunities (Opportunities-List).
2. List at least six important barriers or risk factors that you believe affect the provision of nature opportunities in cancer care contexts. These can include, for example, physical, psychosocial, economic, or political factors.
   This question seeks to generate a list of barriers and key risk factors related to the provision of nature opportunities (Barriers-List).

Additionally, experts will be asked to offer a brief explanation of the importance of their suggested item. Space will be provided below each item for free text description.

Analysis (Questionnaire 1)

All data (items and explanations) will be entered and managed in qualitative data analysis software Nvivo version 10 for MacIntosh [20]. The analysis will first remove identical responses, then collate, synthesize and edit remaining ideas to achieve consistent terminology of items expressing similar ideas and, finally, logically group items into emerging categories. An inter-rater process will assist interpretative congruity as recommended for thematic analysis [21].

Questionnaire 2: Validation of categorized items

This questionnaire will be designed based on responses from Round 1 and aims to strengthen construct validity [13] according to the concept of "member-checking" [21]. All items generated thus far will be collated into meaningful categories, as produced by inter-rater agreement, and will be re-circulated to all experts. Each item is presented with a one-sentence explanation and non-identifiable background information of the panel member who generated the item (Figure 3). A brief summary of the comments from Round 1 is provided. Experts will be asked to:

1. Verify correct and fair interpretation of their responses and that items have been placed in an appropriate category;
2. Verify and, if they wish, refine the categorizations and recommend additional items.

[INSERT FIGURE 3]

Analysis (Questionnaire 2)

Based on responses, items will be further refined and again subjected to inter-rater discussion.

Phase 2

In this phase panelists will state their priorities and lists will be condensed accordingly.

Questionnaire 3: Prioritizing items

Questionnaire 3 uses a structured format and will list the items generated thus far in random arrangement to minimize response bias. Each panelist will be asked to select 10 items ("top ten") from each list (Opportunities and Barriers), which s/he deems relevant and critical to the consideration of nature opportunities in the cancer care setting. Items 1 to 10 are selected according to the their importance as judged by the expert who is asked to assign "1" to the most important item, "2" to the second ranked item and so on (Figure 4).

Analysis (Questionnaire 3)

Items selected by the majority of experts will be aggregated representing a majority vote. Lists will be reduced according to the importance of items calculated based on the sum of points allocated by each expert to their top-ten items i.e. item "1" indicating highest importance is coded with 10 points, item "2" coded with 9 points and so on. As recommended by Schmidt [19], to avoid burdening

panelists with too many items, the target size of total items for the final round will be no more than 20 items for each list (Opportunities and Barriers).

[INSERT FIGURE 4]

Phase 3

The aim of this phase is to elicit levels of agreement amongst all experts and detect any diverging opinion between different expert groups.

Questionnaire 4: Ranking items

Questionnaire 4 is designed to elicit levels of consensus (not achieve consensus) in the ranking of relevant items. This questionnaire includes aggregated statistical group responses generated for each included item thus far: the total sum of points assigned to each items by the entire panel; individual panelists' own Round 3 response and; a summary of comments provided thus far (Figure 5). Each panelist will individually submit a rank ordering of the items for each of the condensed lists (Opportunities and Barriers). Each item is presented with a corresponding 10 point Likert-type scale (1= not important at all, 10 = very important) and an option to indicate "no judgment" for any given item including space for justification.

[INSERT FIGURE 5]

Analysis (Questionnaire 4)

Statistical analyses will be performed using IBM SPSS Statistics version 23 for Macintosh [22]. Descriptive statistics (median and mean scores) will be calculated to indicate items' relative importance. Descriptives will be calculated for the full sample and by expert group. The study's aim is to explore levels of consensus rather than achieve consensus. Consensus will be defined as 75% agreement [23].

Finally, if further understanding of qualitative responses is required, a small number of one-on-one follow-up interviews will be conducted with experts to clarify any ambiguity and gain a fuller understanding of final results. Experts will be informed in the participation information sheet that they may be invited to participate in a voluntary follow-up interview at study completion.

ETHICS

Ethics for this study was gained from the Institution's Human Research Ethics Committee (blinded for review). All consented participants will be assigned a unique identification code. Collected

demographic information and contact details will include: name, contact phone number, e-mail address, description of professional role, years served in field of expertise, country of professional residence/affiliation. Participants' identifiable information will be matched with their unique identification code in one digital masterfile only. All data collected will be stored safely and securely in locked filing cabinets and in password protected folders on a secure drive (electronic data) that can be accessed only by the study investigators. Data will be kept for 5 years as per local guidelines.

DISCUSSION

Appropriateness of method

The Delphi method is an established research tool for complex problem solving, which solicits expert opinion through a structured, iterative process [19]. Its original purpose was to obtain converging consensus about relative priorities in a given topic through a progression of iterative questionnaires based on controlled feedback [24] until statistical census is reached. Since its inception, the Delphi method evolved to address a variety of research problems such as eliciting degrees of agreement, delineating differing group attitudes and positions, or understanding the rationales of particular judgments and opinions [18, 25]. Delphi variants applied to such explorative enquiry include e.g., modified, exploratory, ranking, and policy Delphis, which are particularly well suited for investigating areas where little prior knowledge exists [26]; where empirical data is lacking [27] and; where cursory understanding of group attitudes and priorities is desired [18]. The present study aims to guide concept development and elicit levels of consensus amongst diverse disciplinary viewpoints in order to generate new care opportunities related to nature engagement in the cancer care setting. The best suited variant for this purpose is the modified electronic Delphi with a predefined four-round design, which provides following key advantages: 1) serves the dual purpose of soliciting broad expert opinion followed by priority ranking [13]; 2) can conclude at a pre-defined number of rounds because strong consensus is not required when degrees of agreement and group attitudes are of interest [18]; 3) structures a rigorous and rapid feedback-based (online) communication process [28]; 4) frees communication from logistical challenges, peer pressure and 'group-think' scenarios [29]; and 5) cross-pollinates multidisciplinary expertise achieving broader understanding than would be reached from a single discipline alone [13]. The method's flexibility and ability to easily assemble and coordinate participants across disciplines and geographic locations partly explain its growing popularity in medical and nursing research [16]. Mullen [18] reports its use in medical, health service and nursing research for "forecasting developments in medicine and health technologies", and "identifying priorities for nursing research and also priorities for spending and service developments" (p. 49). Relevant to this study are two examples showing its application in the cancer context for

gathering international input for developing pain assessment tools for palliative care [30] and, engaging healthcare experts from diverse backgrounds with experience in survivorship care to develop realistic strategies for improving healthcare for cancer survivors [31].

Definition of an "expert"

An important component of the Delphi method is the identification of experts. There are no specific standards for identifying experts and "expertness" is variously defined in different Delphi studies. This presents a major criticism of the Delphi method [24, 32] and there remains little consensus as to what constitutes expertness and how it is operationally defined [18, 24]. The dictionary definition of an expert, "a person who is very knowledgeable about or skillful in a particular area" [33], has been found insufficiently instructive for assembling a Delphi expert panel [24]. Consequently, studies have employed broader terms to identify and include relevant experts including: "informed advocates" [18], "informed individuals", "specialist in their field" or persons with "knowledge about a specific subject" [16]. Central to these formulations is the description of individuals who possess both knowledge and experience representative of the capacity to articulate informed opinion and provide relevant input about a given topic, which will be this study's working definition of an expert.

Composing the expert panel

Delphi studies can use homogenous or heterogeneous expert panels depending on the study aim. A heterogeneous panel of experts can bring a range of disciplinary viewpoints to the surface and articulate greater complexities as well as the boundaries of the topic at hand. In regards to innovation, Mullen cites that "many innovations and real breakthroughs … occur from outside a discipline or specialty" (cited in [18], p. 42) suggesting that cross-pollination of diverse disciplines and backgrounds can produce insightful and fruitful enquiry. Based on these precepts, five groups of diverse yet relevant stakeholders have been identified in the area of cancer care innovation: 1) cancer patients; 2) healthcare practitioners; 3) healthcare management; 4) healthcare setting designers and; 5) researchers. The panel will be composed of healthcare practitioners, management representatives, designers, and researchers.

Patients' recommendations were drawn from the preceding qualitative Phase 1 study and are presented to the panel in Round 1. The rationale for not recruiting additional cancer patients is twofold. Firstly, the present study builds upon a substantial amount of data already collected from qualitative interviews eliciting patient experiences, suggestions, recommendations, and cautions related to nature engagement. Secondly, of interest, are the responses and perceptions of those who bear on decision-making and healthcare policy development to ascertain the feasibility and realistic

limitations of providing opportunities for nature engagement in the cancer care setting. The strategy of using cancer patients' own nature experiences and recommendations for opportunities to engage with nature in oncology contexts, to form the basis for this investigation, provides experts with the opportunity of considering cancer patients' perspectives when developing their own views about opportunities for, and barriers to, providing helpful nature engagement in cancer care settings. It is possible that their agreement or disagreement with patients' perspectives may affect the study's findings and recommendations.

Determining sample size

Delphi studies have been conducted with varying panel sizes ranging from single digits to low hundreds [18]. The absence of strict guidelines allows individual research projects to determine panel sizes according to their purpose and limitations [16]. However, the most reliable Delphi studies were conducted with fewer than 20 participants [18]. Recommendations suggest populating panels with 10 to 18 experts for sufficient input to warrant meaningful elicitation of diverse disciplinary viewpoints [13, 18]. Seven is considered an acceptable minimum panel size with accuracy rapidly declining as the number becomes smaller [18]. It is understood that the levels of census amongst experts are of more interest than the power of frequencies of response [19, 34], which is often misunderstood when mistaking the Delphi method for a quantitative survey [18].

Level of anonymity

One of Delphi's defining features and strengths is the anonymity of responses. Mullen [18] states that preserving anonymity in Delphis "removes effects of status, powerful personalities and group pressure" (pp. 46-47). Keeney [16] notes that anonymity "facilitates respondents to be open and truthful about their views" (p. 197). Varying degrees of anonymity have been used in Delphi studies. Some studies have adhered to strict criteria such as anonymizing responses to researchers themselves and blinding panelists to one another's identity [18]. There is no agreed upon level of anonymity or de-identification other than preserving "the anonymity of responses … for at least part of the study" [18] (p.47). Advantages of panelists knowing each other's identities include greater motivation to engage because of association with prominent experts, stimulating exploratory thinking and idea generation, and introducing greater accountability for considered personal responses and the overall Delphi study outcome [18]. The present study will make use of these advantages and also acknowledge the known fact that complete blinding can be unrealistic because experts might know each other outside the study [16].

Summary of strengths and limitations

In summary, the key strengths of the Delphi method are its flexibility to modify the study procedures (e.g. number of rounds) to suit the study context; the ability to bring together experts from diverse backgrounds and locations and; participant anonymity to stimulate a free flow of ideas. The limitations include reliance on expert participants who may have limited time to contribute; the lack of a common and robust definition of "expertness" in Delphi literature and; the identification and recruitment of sufficient suitable experts when considering a low response rate in Delphi studies.

DISSEMINATION PLAN

Participants will be sent a summary of results at conclusion of the final phase. Presentation of results will include the total number of items generated in Phase 1 and the strength of the items taken into Phase 2. Levels of consensus will be tabled and sufficient raw data provided (e.g. number of panelists in each round) to support calculation of statistics. A summary of non-identifiable demographics will be presented to validate the participation of relevant and qualified experts. Based on the findings, it will be possible to revise the theoretical understandings and practical patient recommendations formulated in Phase 1. Preliminary expert recommendations can be drafted for testing in the cancer care context, and propositions can be generated to inform future research. It is anticipated that the results of this research project will be published in peer-reviewed journals and presented in a variety of forums, and form part of the Principal Investigator's dissertation.

Contributors SB is the principal investigator who conceived the study and drafted the initial protocol manuscript. SB, CO and PS are responsible for the design of the study and CO and PS critically revised the manuscript and related study materials. All authors have read and approved the final manuscript.

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Competing interests None declared. All authors have completed the ICMJE uniform disclosure form.

Figure 1 Design of modified four-round Delphi

Figure 2 Delphi questionnaire administration process (adapted from Schmidt [34])

Figure 3 Example of Questionnaire 2 layout

Figure 4 Example of Questionnaire 3 layout

Figure 5 Example of Questionnaire 4 layout

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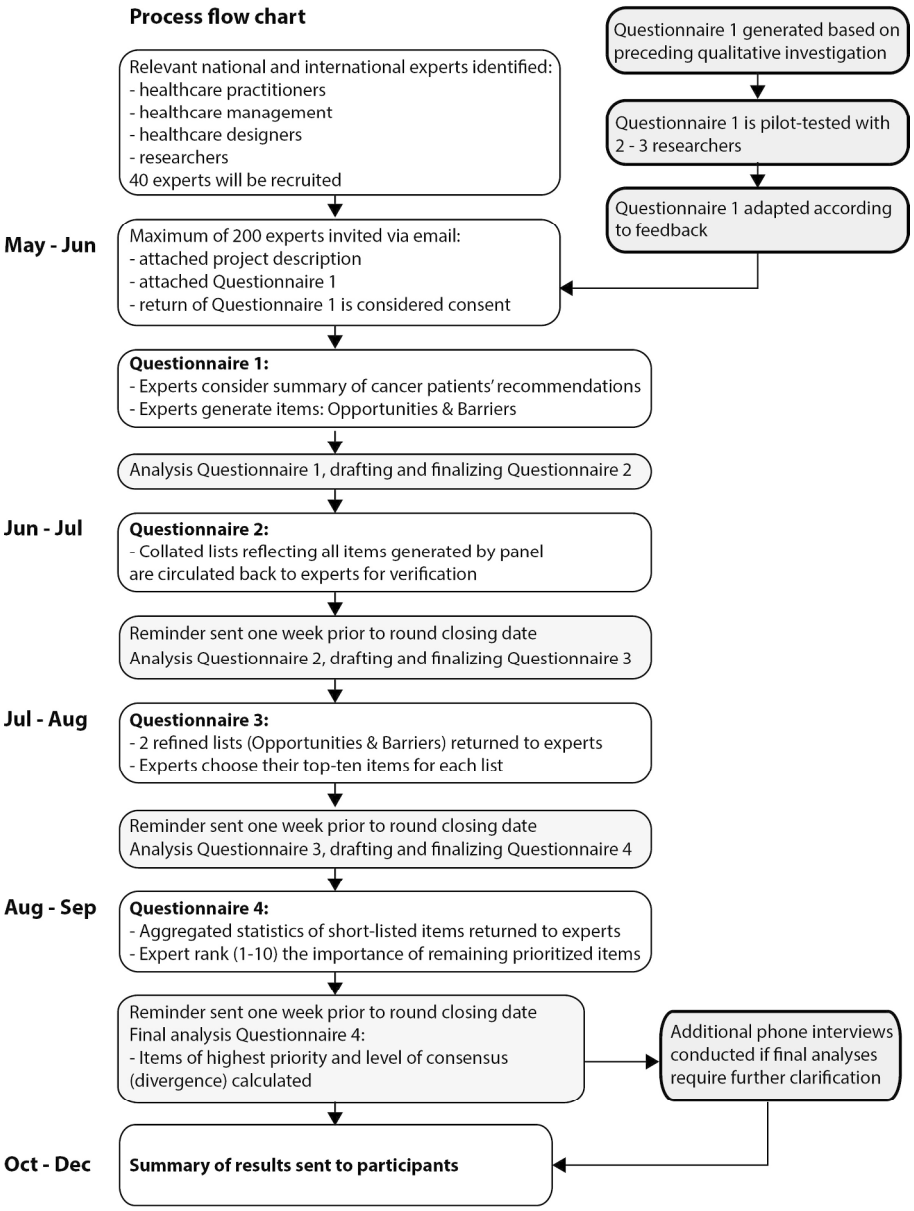

Figure 1 Design of modified four-round Delphi

203x269mm (300 x 300 DPI)

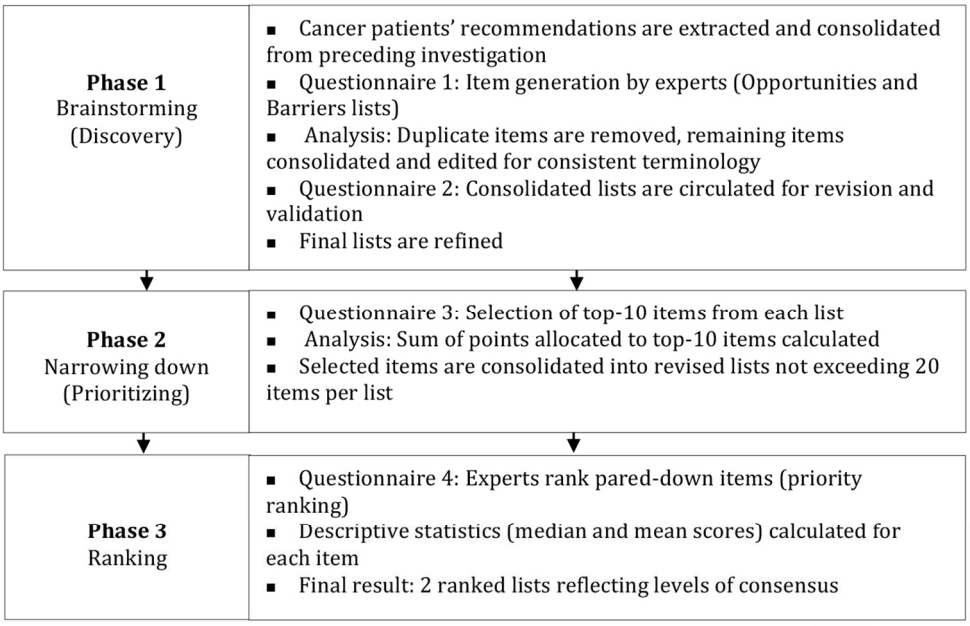

Figure 2 Delphi questionnaire administration process (adapted from Schmidt [38])

116x74mm (300 x 300 DPI)

Category XX

Nr	Item description	Item originator (profession, field of practice, time in practice, country of prof. residence)	Explanation	
1	Outdoor seating area	Architect, healthcare and public spaces, 10 years, US	24hr accessible, sheltered outdoor area with comfortable seating at different heights, access to internal emergency phone.	Accept ☐ Revise ☐ Comment: [type here]
2	Virtual reality	Radiation therapist, oncology, 3 years, AU	Virtual reality headsets for use during diagnostic procedures, selection of different nature scenes and sounds.	Comment: [type here]
				Comment: [type here]

Item description	Item originator (profession, field of practice, time in practice, country of prof. residence)	Explanation	Your top-10 items
Outdoor seating area	Architect, healthcare and public spaces, 10 years, US	24hr accessible, sheltered outdoor area with comfortable seating at different heights, access to internal emergency phone.	[type here]
Virtual reality	Radiation therapist, oncology, 3 years, AU	Virtual reality headsets for use during diagnostic procedures, selection of different nature scenes and sounds.	[type here]

Nr	Item description	Explanation	Your top-10	Total points by panel
1	Outdoor seating area	24hr accessible, sheltered outdoor area with comfortable seating at different heights, access to internal emergency phone.	"1"	64

Please tick the box on the 1 -1 10 scale below indicating the importance this item has for you.

1 2 3 4 5 6 7 8 9 10

Not at all important Very important