ABSTRACT

Introduction  Nature provides an array of health benefits, and recent decades have seen a resurgence in nature-based interventions (NBI). While NBI have shown promise in addressing health needs, the wide variety of intervention approaches create difficulty in understanding the efficacy of NBI as a whole. This scoping review will (1) identify the different nomenclature used to define NBI, (2) describe the interventions used and the contexts in which they occurred and (3) describe the methodologies and measurement tools used in NBI studies.

Methods and analysis  Following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols Extension for Scoping Reviews, four databases will be searched (PubMed, Web of Science, Scopus, ProQuest Dissertations and Theses Global) as well as cross-referencing for published and unpublished (masters theses and dissertations) studies on NBI in humans. Eligible studies must employ intervention or observational designs, and an English-language abstract will be required. Database searches will occur from inception up to the date of the search. Animal-based therapies and virtual-reality therapies involving simulated nature will be excluded. Independent dual screening and data abstraction will be conducted. Results will be analysed qualitatively as well as with simple descriptive statistics (frequencies and percentages).

Ethics and dissemination  Since this is a scoping review of previously published summary data, ethical approval for this study is not needed. Findings will be published in a peer-reviewed journal. This protocol has been registered with Open Science Framework (https://osf.io/mtzc8).

INTRODUCTION

Time in nature supports physical health, mental health and overall quality of life. Historically used as a therapeutic modality, nature-based interventions (NBI) have seen a resurgence in the modern era. As medicine has evolved, so have NBI. For example, treating tuberculosis with fresh air in the countryside has transformed into treating an array of maladies, including, but not limited to, high blood pressure, psychosomatic disorders and post-traumatic stress disorder in a variety of settings ranging from city parks to wildland areas. With the emergence of NBI in the modern era, researchers are currently working to build empirical support and guidance for these interventions, including the NBI locations, outcomes and dose–response relationship.

Previous research has addressed the health benefits of nature from a non-interventional lens. For example, among other benefits, Wolf et al found that urban forests reduce the impacts of pollution and excess heat, improve cognition and psychological stress, boost immune systems and a community’s birth outcomes and promote active living practices. In another study, Christiana et al found that positive health, cognitive and social outcomes are associated with nature-based physical activity in populations across the lifespan, while also identifying persisting...
equity issues with respect to access.10 Furthermore, neig-
bourhood green space has been shown to be especially
potent for health and wellness outcomes in the paediatric
population.11

Existing research has also lent support to the use of
nature in intervention approaches that include forest
bathing, park prescriptions and nature-based physical
activity. With respect to outcomes, forest-based interven-
tions have been linked to improvements in mental health,
 systemic inflammation, cardiovascular risk factors3 and
regulation of the nervous system.12 Other NBI, including
gardening and nature-based physical activity, have been
linked to improvements in blood pressure and mood.13
Beyond the generally established efficacy of nature for
health outcomes, participant reception is a key driver of
effective intervention design. For example, among adults
living with mental illness, therapeutic outdoor recreation
interventions have been broadly found to be enjoyable
and inclusive methods of moving oneself towards mental
and physical well-being.14 With respect to dose, Shanahan
et al’s work on the ‘nature-dose framework’ found that
the duration and frequency of recurrent-activity inter-
ventions should align with the outcomes to be measured;
longer duration per session was associated with improve-
ments in depression and blood pressure, while greater
frequency of visits was linked to social cohesion.15 The
collective evidence highlights that NBI have been success-
fully implemented across divergent populations and in an
array of settings across the globe;12 13 however, concerns
have been raised about methodological rigour and appro-
priate application of theoretical frameworks.16

As multiple evidence synthesis articles have previously
been conducted in this field,1 7–14 17–23 we believe that it
is important distinguish the scope and purpose of our
current study from existing work given previous criti-
cism regarding the production of redundant reviews.24
Along those lines, Munn et al identified six purposes
for conducting a scoping review, two of which the
current study will focus on: (1) clarifying concepts and
definitions, for example, nomenclature use to define
NBI and (2) examining how research is conducted, for
example, interventions, methodologies and measure-
ment instruments used in NBI studies.25 Concerning
our first purpose, previous research has suggested that a
wide array of terminology has been used to define and
describe NBI by both practitioners and researchers;26
however, this categorisation and clarification work has
not progressed beyond this observation. A 2019 Delphi
study identified 27 types of NBI aimed at changing envi-
enments and behaviours, combining interventions with
similar processes into groups, irrespective of terminology
heterogeneity.26 As the field of NBI matures into a well-
established and recognised modality, a need exists to first
characterise these various definitions, so that commonly
acceptable terms and definitions can be established.21

The second purpose of the current study is to examine
how research on NBI is conducted.25 While previous
reviews have identified a broad array of intervention
designs, outcomes and methods for measuring outcomes
in the existing literature,3 21 22 these reviews, as opposed
to our review, were differentially focused with regards
to purpose, inclusion criteria and methodological tech-
niques. Thus, a need exists to provide a differentially
focused comprehensive analysis of the designs, method-
ologies and measurements used in current NBI inter-
ventional literature. In addition, because most studies of
NBI employ small sample sizes, future meta-analyses are
warranted to establish empirical support for such inter-
ventions. However, without consistent methodologies and
measurements, meta-analyses will be hindered. Examples
of such variability include NBI with physical activity10
versus NBI without physical activity,27 one-time immersive
experiences versus short outings repeated over a period
of time, and individual outcomes measured by a wide
variety of unique metrics across different studies. Furth-
ermore, most of the existing evidence synthesis articles have
focused on specific sectors of NBI, for example, reviews of
interventions among certain populations, such as adults23
and individuals living in institutional settings;27 reviews
of subcategories of NBI activity, such as Shinrin-yoku
forest bathing10 28–32 and nature-based exercise,10 14 20 and
reviews assessing specific outcomes such as cortisol21 28
and stress recovery.30 While syntheses of NBI subcatego-
ries are valuable, a need exists to synthesise information
more broadly for the purpose of identifying the types
of evidence available on NBI. Without such knowledge,
direction for future research on NBI, including the
reporting of such, will be hindered.

Scoping reviews provide an overview of the available
research evidence without producing a summary answer
to a discrete research question.34 Unfortunately, with
the exception of reviews that focused on specific subcat-
gegories of NBI,34 no robust scoping reviews under the
broad umbrella of NBI, to the best of the investigative
team’s knowledge, have been conducted according to
the Preferred Reporting Items for Systematic Reviews
and Meta-Analyses Extension for Scoping Reviews (PRIS-
MA-ScR).34 Adherence to such methods, including
reporting, is important because they inextricably lead
back to the robustness of the review as well as method-
ological transparency and uptake of research findings.34
Given the former, the objectives of the current study are
to conduct a scoping review to (1) identify the different
nomenclature used to define NBI, (2) describe the NBI
used and the contexts in which they occurred, and (3)
describe the methodologies and measurement tools used
in studies of NBI.

METHODS AND ANALYSIS
Study processes will follow the guidelines established by
the PRISMA-ScR.34 This protocol is registered in Open
Science Framework (https://osf.io/mtzc8).

Study eligibility
We will include articles reporting specifically on NBI for
any array of physical and/or mental health outcomes.
Using the Population, Intervention, Comparison, Outcome, Study Design/Setting (PICOS) framework (table 1), the inclusion of participants, NBI interventions, comparators, outcomes and nature-based settings will be broad, with the only restrictions being that we will exclude animal-based therapies and virtual-reality therapies involving simulated nature. Scoping reviews, systematic reviews and meta-analyses will be excluded, but their reference lists will be scanned for articles that may meet our inclusion criteria. Other types of articles discussing NBI but not assessing specific interventions will be excluded. As this area of inquiry is relatively novel and a scoping review approach used, publications will not be limited by (1) year of intervention, (2) country in which the intervention took place, (3) participant characteristics (age, sex, race/ethnicity, socioeconomic status, etc), (4) study design and (5) language in which the study was published, assuming an English-language abstract is available. With respect to publication type, both published, full-length, peer-reviewed manuscripts as well as full-length, unpublished studies (master’s theses, dissertations) will be included. Abstracts from conference proceedings will not be included because of the dearth of information provided as well as the potential difficulty in retrieving detailed information.

Due to the breadth of the available literature, some facets of NBI will not be addressed in this study. For example, while animal-assisted therapies and virtual-reality therapies involving simulated nature provide unique opportunities with respect to NBI, these types of interventions will also not be included.22 Additionally, while some research has sought to identify which natural environments are more therapeutically beneficial than others,35 we will not examine for such in our current study.

Data sources

Adhering to the recent PRISMA-S guidelines for literature searches in systematic reviews,36 the following databases will be searched: (1) PubMed, (2) Web of Science, (3) Scopus and (4) ProQuest Dissertations and Theses Global. We will not search Embase because it is not freely available to the investigative team and Scopus has been reported to provide 100% coverage of Embase.37 Draft search strings are shown in online supplemental appendix A. Search strings will include words and phrases encompassing four categories: (1) types of nature, (2) types of interventions, (3) types of outcomes and (4) human study population. The final search strategy will be developed by the authors in collaboration with a health sciences librarian at West Virginia University. Databases will be searched from the date of inception until the date of the search.

Given that this is a scoping review, our searches will be intentionally broad to reduce the chances of missing potentially eligible studies. All searches will be conducted by a health sciences research librarian. In addition to electronic database searches, cross-referencing from retrieved studies will also be conducted to identify any potentially eligible studies. The citations from each database will then be imported into EndNote V.20 by the first author38 and saved as separate files. The search files from each database will then be merged and saved into one overall file. The first author will then remove duplicates electronically and manually, save the results as another separate file and then export to Rayyan for study screening.39

Study selection

A flow diagram of the study screening process is shown in figure 1. Studies exported from EndNote into the most recent version of Rayyan39 will be independently screened by two authors. The titles and abstracts will first be screened for potentially eligible studies. If a decision regarding eligibility cannot be made based on the title and abstract screening, the full text of each article will be retrieved and reviewed for eligibility. Any discrepancies in eligibility will be settled collaboratively by the two study screeners. If agreement cannot be reached, the third author will provide a recommendation. On completion of study screening, a reference list of all excluded studies, including the reasons for exclusion, will be included as a supplementary file.

Data abstraction

A codebook for data abstraction will be developed in Microsoft Excel for Mac, V.16.53.10 To avoid data abstraction bias, two authors will use separate workbooks to independently code (dual coding) each item from every study.
to ensure accuracy and consistency. The authors will then meet to review their selections. Any disagreement in the items coded will be discussed until mutual agreement is reached. If agreement cannot be reached, the third author will provide a recommendation. A tentative list of items to code for is shown in online supplemental appendix B. Of note, type of environment will be coded according to the categories identified by Bratman et al. 41

Research synthesis
As is customary for scoping reviews, data will not be synthesised quantitatively. Rather, analysis will primarily be conducted qualitatively along with simple descriptive statistics such as frequencies and percentages.

Patient and public involvement
None.

Twitter Christiaan G Abildso @walkbikemgw

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