UNIVERSITY
OF WOLLONGONG
AUSTRALIA

University of Wollongong
Research Online

Faculty of Science, Medicine and Health - Papers

Faculty of Science, Medicine and Health

2013

What are the effects of spending time outdoors in daylight on the physical health of older people and family carers: a systematic review protocol

Victoria Traynor

University of Wollongong, vtraynor@uow.edu.au

Ritin Fernandez

University of Wollongong, ritin@uow.edu.au

Katherine Caldwell

University of Wollongong, kc582@uowmail.edu.au

Publication Details

Traynor, V., Fernandez, R. & Caldwell, K. (2013). What are the effects of spending time outdoors in daylight on the physical health of older people and family carers: a systematic review protocol. *The JBI Database of Systematic Reviews and Implementation Reports*, 11 (10), 76-88.

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library:
research-pubs@uow.edu.au

What are the effects of spending time outdoors in daylight on the physical health of older people and family carers: a systematic review protocol

Abstract

Review question/objective The overall objective of this research is to undertake a systematic review of the effects of spending time outdoors in daylight on the physical health of older adults and family carers. The specific questions to be addressed are: Which aspects of physical health are affected by spending time outdoors in daylight for older adults and family carers? To what extent is spending time outdoors in daylight effective for improving aspects of physical health in older adults and family carers?

Disciplines

Medicine and Health Sciences | Social and Behavioral Sciences

Publication Details

Traynor, V., Fernandez, R. & Caldwell, K. (2013). What are the effects of spending time outdoors in daylight on the physical health of older people and family carers: a systematic review protocol. The JBI Database of Systematic Reviews and Implementation Reports, 11 (10), 76-88.

What are the effects of spending time outdoors in daylight on the physical health of older people and family carers: a systematic review protocol

Victoria Traynor PhD, BSc(Hons), RGN, PGCHE, ILM¹,

Ritin Fernandez RN, MN, PhD¹,

Katherine Caldwell (PhD Candidate) BSc²,

1. The School of Nursing, Midwifery and Indigenous Health, Faculty of Health and Behavioural Sciences, University of Wollongong, Australia. Centre for Evidence-based Initiatives in Health Care: an Affiliate Centre of the Joanna Briggs Institute

2. School of Health Sciences. University of Wollongong

Corresponding author

Katherine Caldwell

kc582@uow.edu.au

Review question/objective

The overall objective of this research is to undertake a systematic review of the effects of spending time outdoors in daylight on the physical health of older adults and family carers. The specific questions to be addressed are:

1. Which aspects of physical health are affected by spending time outdoors in daylight for older adults and family carers?
2. To what extent is spending time outdoors in daylight effective for improving aspects of physical health in older adults and family carers?

Background

The benefits of spending time outdoors for physical health are well documented.¹ Historically, the benefits of being outdoors and exposing the body to daylight did not become a public health concern until the late 1800s, when daylight became a treatment for rickets and tuberculosis.² It was not until the 1970s that the impact of daylight on the physical health of older people became an area of intense interest when vitamin D was discovered as the 'sunshine vitamin'.²

Spending times outdoors provides people with direct or indirect exposure to daylight. Daylight is crucial for regulating the body's circadian rhythms and sleep/wake cycle.³ Daylight also enables critical chemical reactions in the body, such as regulating melatonin levels and supporting vitamin D

metabolism.^{4,5} In older adults, dietary intake of vitamin D from foods is modest so the major source of vitamin D comes from the action of daylight on skin.⁶ Amongst other roles, research has demonstrated that adequate vitamin D status ($>25\text{nmol/L}$ $25[\text{OH}]\text{D}$) can be an effective method for reducing fractures in older people.^{7,8} The amount of daylight a person is exposed to directly relates to the rate of production of serotonin by the brain.⁹ This is significant in relation to psychological well-being as serotonin is known to contribute to feelings of health and happiness.

Spending time outdoors can provide an opportunity for physical activity and is essential to maintaining the independence of older people.¹ Physical inactivity is a major underlying cause of morbidity and mortality, and the majority of older people in Australia do not meet the National Physical Activity Guidelines for Older Australians in order to maintain a good level of health.¹⁰ Older people who are physically inactive are at a higher risk of experiencing disabling medical conditions and chronic diseases than those who are adequately physically active.¹¹ Older people who exercise outdoors have a significantly greater number of minutes of moderate to vigorous physical activity compared to those who only exercise indoors.⁵ The ability to get outdoors has been used as a measure of functional ability and has been used to predict the rate of physical deterioration in older people.¹⁶

Sleep disorders have shown to increase exponentially with age.¹² The daily sleep/wake cycle, or circadian rhythm, is partially maintained through light exposure and especially receptive to daylight.¹³ It has been reported that older people may receive as little as one hour of daylight exposure each day and this figure is significantly reduced for older people living in residential aged care facilities.^{14,15} Therefore, it has been hypothesised that age-related changes in sleep patterns may be linked to a reduction in daylight exposure and a disrupted natural circadian rhythm. Research has shown that exposure to daylight is associated with improved sleep in older people.¹⁶

Despite the knowledge surrounding how well-designed outdoor spaces can have a beneficial effect on health and well-being studies commonly report that outdoor environments are underused by older people. This occurs especially among older people living in residential accommodation.¹⁷ Even when improvements to the outdoor built environment are made such as improving ease of access and safety of the areas, they remain under-utilized by older people unless structured activities are implemented.¹⁸ Older people often experience restricted access to outdoor areas when they are frail and housebound. Additionally, older people who live in residential accommodation may be further restricted by their care routines and physical environment which can significantly hinder their ability to access outdoors areas.¹⁹

In response to the lack of time spent outdoors and exposure to daylight in older people, the use of artificial light or bright light phototherapy has been widely adopted. The body of research surrounding bright light therapies on physical health and psychosocial well-being outcomes in older people is extensive; however it is largely inconclusive. A Cochrane Review determined there was a lack of suitable empirical evidence to discern the impact of phototherapy on sleep in older people.²⁰ Additionally, insufficient evidence was found to assess the value of light therapy for managing cognitive, sleep, functional, behavioral or psychiatric disturbances in older people with dementia due to a lack of studies with sound methodological quality.²¹ The use of artificial light has significant

practical limitations as they require the user to sit in front of a light box for one to two hours daily and are costly, especially in comparison to natural light.²²

It has been reported that manipulating the amount of natural or artificial light in indoor environments can improve physical health in older people.²³ This has been an area of intensive research, especially in residential accommodation. A review of the impact of lighting design on health outcomes for older people revealed both bright and natural environmental lighting resulted in positive therapeutic outcomes for both residents and care staff; however, there are currently an insufficient number of studies to reach a conclusion about its effects.²³ There was not convincing evidence linking the presence of sufficient interior lighting to health outcomes and studies have shown that people also prefer natural to artificial sources of light.²²

A large body of literature found that providing care to an older person impacts the physical health of a family carer.²⁴ A meta-analysis has associated caregiver burden with physical and psychological outcomes²⁴ where it was determined that if a care receiver experienced poorer physical health and greater behavioral disturbances, the physical burden experienced by a carer was significantly greater.²⁴ Therefore, it can be assumed that by improving the physical health of a care receiver, a carer would experience greater physical health.

It has been argued that in Australia, with its temperate and sunny climate, utilizing artificial light therapies and controlling the indoor environment to maximize light exposure should not become customary, as maximizing the amount of time spent outdoors is likely to provide older people with additional therapeutic benefits.²⁵ Research has also highlighted the importance of sensitively considering the time of day when access to daylight is promoted.⁷ In Australia, it is important to make use of commercial ultraviolet intensity meters to consciously measure UV exposure, as the risks associated with a lack of access to daylight must be balanced with the side effects of unsafe sun exposure. However, it should be noted that the World Health Organization estimated that excessive daylight exposure accounts for a loss of approximate 1.6 million disability-affected life years.²⁶ This number is shadowed by the 3.3 billion disability-affected life years estimated to be caused by low daylight exposure.²⁶ Hence overall, the effects of spending time outdoors on the physical health of older people and family carers need to be emphasized and more research is needed to develop safe strategies to harness this limitless and 'untapped' resource.

A review of the effects of spending time outdoors in daylight on the physical health of older people and family carers has not been completed to date, despite its significant national and international relevancy. The purpose of this review is to present all the available evidence relating to the effects of spending time outdoors in daylight on the physical health of older adults and family carers.

A preliminary search of the JBI Database of Systematic Reviews and Implementation Reports, the Cochrane Library, PubMed and CINAHL identified that there were no systematic reviews on this topic to date.

Keywords

Older adults; daylight; health; carer

Inclusion criteria

Types of participants

The review will consider studies that include all older adults aged 55 years or more, including those living in a community setting or a residential aged care facility. An age limit of 55 years or more has been selected for participants to ensure all appropriate literature relating to older people is captured. In addition, this review will consider adult family carers, who are defined as unpaid relatives or friends of an older person, who help that individual with their activities of daily living. No further exclusion criteria will be applied in order to capture all available evidence.

Types of intervention(s)

The intervention of interest is spending time outdoors in daylight. 'Outdoors in daylight' is a broad term that encompasses all outdoor environments where participants are exposed, directly or indirectly, to daylight in a natural setting while participating in any type of outdoor activity. For our review, the definition of outdoor activity is simply 'being outdoors' in order to capture all types of engagement with outdoor environments for any duration. Studies will be excluded if they utilize artificial 'bright light' sources or modify the indoor environment to improve light exposure. An absence of going outdoors or being indoors partaking in any type of activity with no exposure to daylight will be used as a comparator.

Types of outcomes

This review will consider studies that include objective and/or subjective measures of the following outcomes:

Older adults and family carers:

- o bio-makers:
 - melatonin levels
 - serotonin levels
 - vitamin D levels
- o functional ability
- o physical activity levels
- o sleep patterns.

Due to the large variety of tools that can be utilized to measure these outcomes, this review will consider all tools that have been validated and assessed for reliability.

Inclusion criteria for the melatonin, serotonin and vitamin D biomarkers are as below:

- Melatonin: plasma, urine or saliva metabolites of melatonin.
 - As melatonin is not a clinical biomarker and is highly variable, 'normal' ranges are not relevant. Therefore, the quantification of any melatonin metabolite over time (i.e. 24 hours) will be accepted in order to establish the variability of melatonin secretion throughout a circadian rhythm.
- Serotonin: plasma concentration of 5-hydroxytryptamine.
 - 101-283ng/mL indicates a normal range. The comparator for this review is <101ng/mL and >283ng/mL.
- Vitamin D: plasma concentration of 25(OH)D.
 - As <25nmol/L 25(OH)D indicates deficiency, the comparator for this review is >25nmol/L 25(OH)D²⁷.

Types of studies

As it is anticipated that a lack of high quality research is published in this area all study designs will be considered. More specifically the review will consider experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies for inclusion. The review will also consider descriptive epidemiological study designs including case series, individual case reports and descriptive cross sectional studies for inclusion. Studies published only in the English language will be included in this review due to the lack of translational resources.

Search strategy

The search aims to find published and unpublished studies from all countries through electronic databases, reference lists, key reports and the World Wide Web. A three-step search strategy will be utilised in this review. Initial search terms have been developed using MeSH terms (MH) in four broad search categories:

- population: (MH) aged, elderly, older adult, older person, geriatric.
- phenomena of interest: (MH) sunlight, daylight, sunshine, sun, natural light, outdoor, (MH) light, (MH) exercise, (MH) leisure activities, (MH) walking, (MH) environment, (MH) recreation.
- family carer health: (MH) caregivers, carer and (MH) satisfaction, and carer and (MH) stress.
- physical health: (MH) melatonin, (MH) serotonin, (MH) vitamin D, (MH) activities of daily living, (MH) mobility limitation, (MH) physical activity, (MH) sleep.

Studies will be restricted to those published from 1979 to 2013. The cut-off of 1979 was selected because that was when one of the first studies focusing on the effects of spending time outdoors in daylight for older people (measuring vitamin D status) was published.²⁸

The initial phase will consist of searches of CINAHL and MEDLINE using the initial search terms (listed above). Terms within each category will be used in combination using the Boolean term 'OR'. Then, a search will combine each category using the Boolean term 'AND'.

A second more extensive search will be undertaken using appropriate headings and keywords for the following databases:

- CINAHL Plus (includes Nursing and Allied Health Collection)
- PubMed (includes Medline with full text)
- National Health and Medical Research Council (NHMRC) guidelines
- Proquest (includes Dissertation and Thesis Abstracts)
- Scopus (includes Science Direct)
- Wiley Online Library (includes Cochrane Library).

The following web sites will also be searched:

- MedNar (includes Google Scholar)
- An internet search using the Google search engine (<http://google.com>).

The third stage will involve hand searching reference lists of articles retrieved.

Assessment of methodological quality

Papers selected for retrieval will be individually assessed by two independent reviewers for methodological validity prior to inclusion in the review using a standardised critical appraisal instrument. The Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MASARI) (Appendix I) will be used. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

Data collection

Quantitative data will be extracted from papers included in the review using the standardised data extraction tool from JBI-MASARI (Appendix II). The data extracted from all papers will include specific details about the interventions, populations, setting, study methods, limitations of the study, outcomes of significance to the review question and specific objectives, and author conclusions. The data will be individually extracted by two reviewers. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. All results will be subject to double data entry to minimise human errors. Attempts will be made to contact authors for any missing data from studies.

Data synthesis

Quantitative papers will, where possible be pooled in statistical meta-analysis using JBI-MASARI. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square. In addition, sup-group analysis may be performed based on the study population, for example, stratifying according to age. Subgroup analyses will be performed as required based on the different quantitative study designs included in this review.

Conflicts of interest

None to be declared.

Acknowledgements

None to be declared.

References

1. Sugiyama T, Thompson CW. Outdoor environments, activity and the well-being of older people: conceptualising environmental support. *Environment and Planning*. 2007;39(8):1943-60.
2. Mead MN. Benefits of Sunlight: A Bright Spot for Human Health. *Environmental Health Perspectives*. 2008;116(4):160-7.
3. Dijk D-J, Archer SN. Light, sleep, and circadian rhythms: together again. *PLoS biology*. 2009;7(6).
4. Turek FW. Role of light in circadian entrainment and treating sleep disorders--and more. *Sleep*. 2005;28(5):548-9.
5. Diehl JW, Chiu MW. Effects of ambient sunlight and photoprotection on vitamin D status. *Dermatologic Therapy*. 2010;23(1):48-60.
6. Moreiras O, Carbajal A, Perea I, Varela-Moreiras V. The influence of dietary intake and sunlight exposure on the vitamin D status in an elderly Spanish group. *International Journal for Vitamin & Nutrition Research*. 1992;62(4):303-7.
7. Dattani JT, Exton-Smith AN, Stephen JM. Vitamin D status of the elderly in relation to age and exposure to sunlight. *Hum Nutr Clin Nutr*. 1984;38(2):131-7.
8. Sambrook P, Cameron I, Chen J, Cumming R, Durvasula S, Herrmann M, et al. Does increased sunlight exposure work as a strategy to improve vitamin D status in the elderly: a cluster randomised controlled trial. *Osteoporosis International*. 2012;23(2):615-24.
9. Lambert GW, Reid C, Kaye DM, Jennings GL, Esler MD. Effect of sunlight and season on serotonin turnover in the brain. *Lancet*. 2002;360(9348):1840-2.
10. Hill RL, Brown WJ. Older Australians and physical activity levels: Do we know how many are meeting guidelines? *Australasian journal on ageing*. 2012;31(4):208-17.
11. Organization WH. Global Recommendations on Physical Activity for Health. 2010.
12. Michael W. Sleep in older people. *Reviews in Clinical Gerontology*. 2012;22(2):130.
13. Scheuermaier K, Laffan AM, Duffy JF. Light exposure patterns in healthy older and young adults. *Journal of Biological Rhythms*. 2010 Apr;25(2):113-22.
14. Campbell SS, Kripke DF, Gillin JC, Hrubovcak JC. Exposure to light in healthy elderly subjects and Alzheimer's patients. *Physiology & Behavior*. 1988;42(2):141-4.
15. Shochat T, Martin J, Marler M, Ancoli-Israel S. Illumination levels in nursing home patients: effects on sleep and activity rhythms. *Journal of Sleep Research*. 2000;9(4):373-9.
16. Hood B, Bruck D, Kennedy G. Determinants of sleep quality in the healthy aged: the role of physical, psychological, circadian and naturalistic light variables. *Age & Ageing*. 2004;33(2):159-65.
17. Cohen-Mansfield J, Werner P. Outdoor wandering parks for persons with dementia: a survey of characteristics and use. *Alzheimer Disease & Associated Disorders*. 1999;13(2):109-17.
18. Mooney P, Nicell PL. The importance of exterior environment for Alzheimer residents: effective care and risk management. *Healthcare management forum*. 1992;5(2):23-9.
19. Barnes S. The design of caring environments and the quality of life of older people. *Ageing and Society*. 2002;22(6):775-89.
20. Montgomery P, Dennis J. Bright light therapy for sleep problems in adults aged 60+. *Cochrane Database of Systematic Reviews*. [Review]. 2002(2):CD003403.
21. Forbes D, Culum I, Lischka AR, Morgan DG, Peacock S, Forbes J, et al. Light therapy for managing cognitive, sleep, functional, behavioural, or psychiatric disturbances in dementia. *Cochrane Database of Systematic Reviews*. 2009(4):CD003946.
22. Calkins M, Szmerekovsky J, Biddle S. Effect of Increased Time Spent Outdoors on Individuals with Dementia Residing in Nursing Homes. *Journal of Housing For the Elderly*. 2007;21(3):211-28.
23. Shikder S. Therapeutic lighting design for the elderly: a review. *Perspectives in Public Health*. 2012;132(6):282-91.
24. Pinquart M, Sörensen S. Associations of stressors and uplifts of caregiving with caregiver burden and depressive mood: a meta-analysis. *The journals of gerontology* 2003;58(2):112-28.
25. Bossen A. The importance of getting back to nature for people with dementia. *Journal of Gerontological Nursing*. 2010;36(2):17-22.
26. Lucas RM, McMichael AJ, Armstrong BK, Smith WT. Estimating the global disease burden due to ultraviolet radiation exposure. *International journal of epidemiology*. 2008;37(3):654-67.
27. Prentice A, Goldberg GR, Schoenmakers I. Vitamin D across the lifecycle: physiology and biomarkers. *The American journal of clinical nutrition*. 2008;88(2):500S-6S.
28. Lawson DEM, Paul AA, Black AE, Cole TJ, Mandal AR, Davie M. Relative Contributions Of Diet And Sunlight To Vitamin D State In The Elderly. *The British Medical Journal*. 1979;2(6185):303-5.

Appendix I: JBI appraisal instruments

MAStARI appraisal instrument

JBI Critical Appraisal Checklist for Randomised Control / Pseudo-randomised Trial

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not Applicable
1. Was the assignment to treatment groups truly random?	☐	☐	☐	☐
2. Were participants blinded to treatment allocation?	☐	☐	☐	☐
3. Was allocation to treatment groups concealed from the allocator?	☐	☐	☐	☐
4. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
5. Were those assessing outcomes blind to the treatment allocation?	☐	☐	☐	☐
6. Were the control and treatment groups comparable at entry?	☐	☐	☐	☐
7. Were groups treated identically other than for the named interventions	☐	☐	☐	☐
8. Were outcomes measured in the same way for all groups?	☐	☐	☐	☐
9. Were outcomes measured in a reliable way?	☐	☐	☐	☐
10. Was appropriate statistical analysis used?	☐	☐	☐	☐
	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Descriptive / Case Series

Reviewer Date

Author Year Record Number

	Yes	No	Unclear	Not Applicable
1. Was study based on a random or pseudo-random sample?	☐	☐	☐	☐
2. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
3. Were confounding factors identified and strategies to deal with them stated?	☐	☐	☐	☐
4. Were outcomes assessed using objective criteria?	☐	☐	☐	☐
5. If comparisons are being made, was there sufficient descriptions of the groups?	☐	☐	☐	☐
6. Was follow up carried out over a sufficient time period?	☐	☐	☐	☐
7. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
8. Were outcomes measured in a reliable way?	☐	☐	☐	☐
9. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Comparable Cohort/ Case Control

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not Applicable
1. Is sample representative of patients in the population as a whole?	☐	☐	☐	☐
2. Are the patients at a similar point in the course of their condition/illness?	☐	☐	☐	☐
3. Has bias been minimised in relation to selection of cases and of controls?	☐	☐	☐	☐
4. Are confounding factors identified and strategies to deal with them stated?	☐	☐	☐	☐
5. Are outcomes assessed using objective criteria?	☐	☐	☐	☐
6. Was follow up carried out over a sufficient time period?	☐	☐	☐	☐
7. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
8. Were outcomes measured in a reliable way?	☐	☐	☐	☐
9. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)

Appendix II: Data extraction instruments

MAStARI data extraction instrument

JBI Data Extraction Form for Experimental / Observational Studies

Reviewer Date

Author Year

Journal Record Number

Study Method

RCT ☐ Quasi-RCT ☐ Longitudinal ☐
Retrospective ☐ Observational ☐ Other ☐

Participants

Setting

Population

Sample size

Group A Group B

Interventions

Intervention A

Intervention B

Authors Conclusions:

.....
.....

Reviewers Conclusions:

.....
.....

Study results**Dichotomous data**

Outcome	Intervention () number / total number	Intervention () number / total number

Continuous data

Outcome	Intervention () number / total number	Intervention () number / total number