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An evidence review prepared by the Sax Institute for Cancer Institute NSW and Cancer Council NSW — December 2022

Strategies to increase shade in public playgrounds: An evidence review prepared by the Sax Institute for the Cancer Institute NSW and Cancer Council NSW.
December 2022.

This report was prepared by Nick Petrunoff, Amanda Dominello and Sian Rudge with input from the Cancer Institute NSW and Cancer Council NSW December 2022

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Strategies to increase shade in public playgrounds: Evidence review

Prepared by the Sax Institute for the Cancer Council NSW and the Cancer Institute NSW. December 2022.

This report was prepared by Nick Petrunoff, Amanda Dominello and Sian Rudge from the Sax Institute with input from Nikki Woolley from the Cancer Institute NSW and Ally Hamer and Liz King from Cancer Council NSW.

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Executive summary

Background

The purpose of this evidence review is to inform a discussion paper that will be shared with the 'Shade Strategies' workshop participants, to shape discussions on increasing shade in playgrounds in NSW.

Review questions

This review aimed to address the following questions:

1. What is the evidence on shade targets or other metrics for playgrounds nationally and internationally?
2. What strategies have been used to increase shade in playgrounds?
3. What is the evidence on co-benefits of increased shade in playgrounds?
4. What barriers and enablers have been described in the implementation of strategies identified in questions 2 and 3?
5. Amongst all the key source documents and additional documents, what are the gaps in the information required to inform strategies that can increase shade in playgrounds in NSW?

Summary of methods

We conducted a realist review of shade targets and other complex strategies to increase shade which involved identification of contexts, mechanisms and outcomes for individual strategies to explain differences, intended or unintended, between them. This included:

- A review of source documents provided by project team members from Cancer Institute NSW and Cancer Council NSW
- An additional search of peer reviewed and grey literature to identify relevant studies and publications. The additional search included two databases (Medline via Ovid and Compendex via Engineering Village) and one academic search engine (Google Scholar), which represent the most comprehensive health research database, the most comprehensive engineering and related disciplines' database and a broad inter-disciplinary search engine respectively.

Key findings

Fifty-nine documents (31 peer reviewed and 28 grey literature) contributed data to address the review questions.

Question 1. What is the evidence on shade targets or other metrics for playgrounds nationally and internationally?

Shade targets for playgrounds nationally and internationally.

Six examples of targets for playground shade were found in the grey literature from Australia. Although not specifically about playground shade an example of a city-level 'vision' for tree canopy cover from Phoenix, USA was considered since it had detailed information to address other questions.

Where have they been implemented?

The review identified shade targets for playgrounds from NSW and Queensland in Australia implemented at a local government level and following state level guidance.

What are they?

Examples distinguished between the non-play areas surrounding playgrounds which had targets of >40% shade and the play areas, with targets of 50%-100% shade.

What wording was used?

Language included 'minimum' targets, or to list the target within essential and preferred criteria.

Is there evidence of acceptability?

Focus groups with industry and local government representatives in NSW indicated that having defined shade target/s would enable councils to enact advancement of shade in playgrounds. They preferred shade target percentages of 40% to 60% coverage (with 100% not preferred). In contrast, community members preferred greater shade coverage.

Who adopts them?

In Australia, local government. A qualitative study which assessed the response of planning and transport professionals to public health guidance on the built environment and physical activity found that competition with other guidance documents may threaten adoption.

What is known about the success of any targets in achieving their aims?

Evaluations are yet to describe impacts on shade. However, the integrating shade in NSW planning project initiated by Cancer Institute NSW is beginning to demonstrate adoption of shade targets amongst local governments in NSW.

Question 2. What strategies have been used to increase shade in playgrounds?

Types of strategies implemented. The five types of strategies which were identified in the literature were:

- Policies, guidelines and recommendations
- Settings-based site audits and site plans
- City-level tree and shade site masterplan
- Monetary incentives
- Multi-component interventions

Nineteen examples were summarised in Table 3 with detail on implementation, what they achieved and why.

Due to the complexity of designing and building effective shade, policies and guidelines often included technical guidance sections. Site audits for development of shade plans was one common approach for addressing this complexity. It was evident the more comprehensive strategies had long timelines.

Did strategies which were effective demonstrate increases in shade?

For the strategies themselves, the review found evidence of intermediate changes such as the adoption of the strategy rather than the outcome of increased shade in playgrounds.

The review identified three experiments which used strong study designs to assess the effectiveness of interventions which involved creating shade. **These experiments found that built shade over playgrounds and recreational areas in parks was effective for increasing use of those spaces and decreasing human exposure to UV radiation at the sites.**

Question 3. What is the evidence on co-benefits of increased shade in playgrounds?

Expert opinion from reviews suggests that shade provision for skin cancer prevention is best affected through integration with other policies. Policy paths could integrate shade with current imperatives to achieve tree canopy cover, reduce heat (e.g. urban heat island effect), create active and liveable neighbourhoods and contribute to sustainability goals.

Has the evidence on co-benefits been used in strategies to increase shade?

There were some examples emerging. It was promising that shade is now a measure in a large global study of urban environments and physical activity amongst adolescents, and this presents opportunities to assess whether street shade is associated with increases in physical activity across many countries.

Question 4. What barriers and enablers have been described in the implementation of strategies identified in questions 2 and 3?

From the literature synthesised to address question 2 and 3, five enablers, five barriers and one barrier/enabler were presented in order of the most information gathered. **Enablers:** Scientific

evidence, Building on other metrics/measures, Policies and frameworks, Public and other support, Equity considerations. **Enabler/barrier**: Relevant stakeholders to engage. **Barriers:** Competition with other policies and guidance documents, Varying and often vague description of requirements, Diversity of playground types, Cost, One-off's - disbanding of the Design and Place SEPP in NSW and other demands for public health input (e.g., infectious disease).

Question 5. Amongst all the key source documents, what are the gaps in the information required to inform strategies that can increase shade in playgrounds in NSW?

The most notable gap is **evidence of strategies leading to increased shade**. It was also noted under Question 3 that information of **integrating shade into other planning agendas** to achieve co-benefits is lacking. The article by King and colleagues [1] provided some important information to fill this gap, and more of this description of practice and its evaluation (whether in published or in the grey literature) is necessary. A road map of potential policies that can help improve the integration of shade into public spaces including parks and playgrounds would also be useful.

Background

This evidence review is one of many areas of action within the auspices of the NSW Skin Cancer Prevention Strategy (the Strategy) led by Cancer Institute NSW. As part of a revised 2016 Strategy, a Shade Working Group (SWG) developed a new work plan with three SWG strategic priority areas - awareness raising and education; advocacy and advice; and the creation of new evidence [1].

In line with generating new evidence, the Benchmarking Shade in NSW project [2] provided a baseline assessment of the amount of shade in playgrounds across NSW. This 'Shade Strategies' evidence review builds on the Shade Benchmarking Project, identifying strategies to increase shade in NSW.

The overarching **aim** of the Shade Strategies is to develop a prioritised plan of work to improve ultra-violet radiation (UVR) protective shade in NSW playgrounds that is acceptable, effective and amenable to local government and industry compliance and reporting. The **objectives** of the project are to consult and seek input from key built environment professionals and industry stakeholders regarding the:

1. opportunities to enhance natural and built shade across NSW playgrounds
2. barriers to achieving change
3. insights regarding the most strategic approaches to implementation.

This evidence summary is the foundational document in the Shade Strategies Project. Its **purpose** is to inform the discussion paper that will be shared with workshop participants to shape discussions on increasing shade in public playgrounds in NSW.

Methods

Methodological approach

The methodological approach to this 'Shade Strategies' evidence summary is a realist review to synthesise the evidence [3]. Pawson and colleagues defined realist reviews as a method for studying complex interventions which involves identification of contexts, mechanisms and outcomes for individual programs to explain differences, intended or unintended, between them [4]. They seek to answer questions like: What was involved? What did they achieve? Why? Under what circumstances? Other defining elements are: stakeholders are integral to developing the framework that guides the review and contributing to the interpretation and synthesis of the evidence; and, all types of evidence are considered, provided they stand up to the question, 'Is the evidence good and relevant enough to answer our questions?'[4]. Although a broad range of evidence will be considered, the 'good enough' component of the question will still consider the strength of the scientific evidence based on the traditional hierarchy of study designs, whilst acknowledging the limitations of this hierarchy when considering studies which involve changes to policy and built environments.

Review questions

The review questions (Table 1) were prepared in consultation with the project team and reviewed by the NSW Skin Cancer Prevention Shade Working Group (hereafter referred to as the Shade Working Group).

Table 1: Review questions

1	**What is the evidence on shade targets or other metrics for playgrounds nationally and internationally?** • Where have they been implemented? • What are they? What wording was used? Is there any evidence of their acceptability? • Who owns/develops them? Who adopts them? Who is accountable? • What is known about the success of any targets in achieving their aims?
2	**What strategies have been used to increase shade in playgrounds?** • Of interest are **strategies** implemented by governments (national, state, local) and not for profit organisations. Examples may include targets, legislation, awareness campaigns, minimum standards, recommendations/guidelines. • Describe **detail of the development of the strategy and its implementation** (where, by who, over what time, who was involved) • Did strategies which were effective demonstrate increases in shade?

	• Where there is no, or limited, evidence to address this question, in discussion with the project team the scope may be broadened, for example to search for strategies designed to increase shade in other public spaces, or other strategies which may have resulted in increased shade.
3	**What is the evidence on co-benefits of increased shade in playgrounds?** • High level summary of recent evidence • Has the evidence on co-benefits been used in strategies to increase shade? • Have strategies from working towards co-benefits been effective in increasing shade? • Which co-benefits are gaining most traction for increasing shade?
4	**What barriers and enablers have been described in the implementation of strategies identified in questions 2 and 3?** • This may include, but are not limited to: ◦ Stakeholder engagement processes and who the stakeholders were ◦ Public support; champions; professional body support ◦ Legislative capacity; political will; mechanisms for communicating policy action ◦ Resourcing.
5	**Amongst all the key source documents, what are the gaps in the information required to inform strategies that can increase shade in playgrounds in NSW?**

Source document review and additional search

(i) **Source documents**. The Cancer Institute NSW and Cancer Council NSW project team identified 80 source documents in a master list, many of which related to previous work, for inclusion in this evidence summary. These documents included those that either informed or were commissioned by the Shade Working Group and included the literature review from the Cancer Institute NSW shade benchmarking project [2].

(ii) **Additional search**. Although this is a realist review, some elements of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews are included so that it is repeatable [5]. The common Population, Intervention, Comparison, Outcomes and Study design (PICOS) lens was applied to the review questions to develop the search strategy. However, the 'C' in PICOS was adapted to context instead of the usual comparison, since location related context is an important determinant of levels of UV exposure and since the 'S' for study design may include studies without comparison groups. More specifically, context meant the setting (i.e. playgrounds) and the geographical location.

The search included two databases (Medline via Ovid and Compendex via Engineering Village) and one academic search engine (Google Scholar), which represent the most comprehensive health research database, the most comprehensive engineering and related disciplines' database and a broad inter-disciplinary search engine respectively. The search strings reflected the guiding questions under five search index terms – (1) Population, (2) Intervention (or strategy), 3. Context, 4. Outcomes and 5. Study design. A list of search terms with BOOLEAN language appropriate to each database/search engine which have been adapted from highly relevant past searches [2, 6] to suit our

project objectives, search questions and the eligibility criteria are presented in Appendix A.

Eligibility criteria and limits

Inclusion criteria for studies were agreed with the project team: 1. human populations of any age; 2. interventions could be multi-component or a single strategy which explicitly aimed to increase built and/natural shade; 3. public playground settings, but not playgrounds in schools, even if they are publicly accessible outside school hours; 4. reported on outcomes such as changes in amount of shade in the setting, stand-alone effects on UVR exposure and sunburn; 5. Broad study designs including those high on evidence hierarchies with at least one comparison group (e.g. RCTs, quasi-experiments, natural experiments and other longitudinal study designs with a control group) as well as designs which are common in evaluation of policy and environmental interventions (e.g. case studies, process evaluations, observational research and qualitative investigations). No date restriction for Medline or Compendex, a date restriction of the last two years for Google Scholar and available in the English language. Non-English articles were excluded at the stage where an English translation was not available (i.e., at title, abstract, or full paper stage). Unpublished studies were included if they met the above criteria and provided enough information for readers to interpret their results fully.

Assessment of studies to be included

After the full search from each of the searches in Appendix A was downloaded to EndNote and the ‘remove duplicates’ function was used. The titles and abstracts were screened. Due to the volume of results generated by Google Scholar, studies were sorted by relevance and the first 700 articles were screened by title and abstract before assessment of studies to be included was suspended due to no further articles of relevance being identified.

Data extraction

Data were extracted in NVivo into code containers which reflect the five search questions and the sub-questions, plus some others that were driven by the data that arose. In keeping with the realist approach, extraction was iterative initially. To refine the approach, data for guiding questions 1 and 2 from Table 1 were first exported into separate matrix tables in Microsoft Excel with columns reflecting the review questions and rows reflecting the source document. Then, for question 2, a synthesis of these data was extracted into an initial table in Microsoft Word, with headings including: **Source document** (Author, date, title); **Strategy** (e.g., Policy/guidelines, site-audits, etc.); **Where?** (Country, location); **Implementation details?** (When, over what time, ownership, language used, acceptability, context) **What was achieved?** (Impacts on shade and other outcomes)**; Why?** (Key factors to success/failure). For guiding questions 3-5, data were examined in NVivo under the codes reflecting the review questions and extracted directly into the tables and text in the report. Attention was given to the volume of source documents and references coded under each question.

Study appraisal

In keeping with realist approaches to synthesising evidence, no formal assessment of bias appraisal of the articles was conducted. Instead, we asked the question of the included evidence ‘Is the evidence good and relevant enough to answer our questions?’. The ‘good enough’ component of this question paid attention to the scientific quality of the evidence provided in relation to each study and overall. Information on this is included in the body of the results.

Findings

Flow of included studies

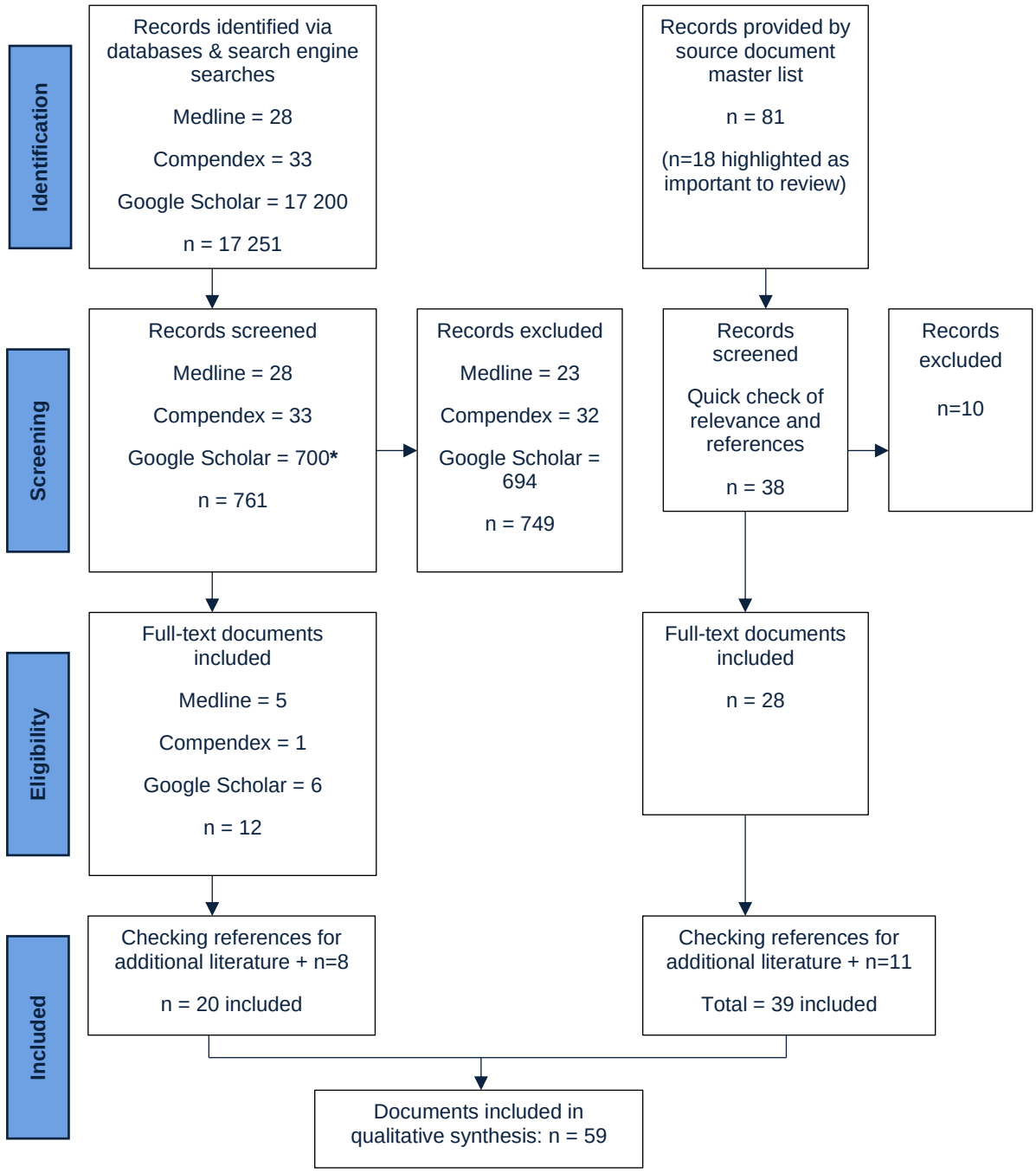

Figure 1. Flow of included studies

*For Google Scholar, articles were sorted by relevance and screening was suspended after 700 articles due to no further articles of relevance being identified.

Figure 1 shows the flow of included studies. A total of 59 documents were included in the qualitative data synthesis for this realist review, of which 31 documents were from peer-reviewed scientific literature and 28 were from the grey literature.

Question 1. What is the evidence on shade targets or other metrics for playgrounds nationally and internationally?

The review found few examples of targets for shade in playgrounds nationally and internationally, and there is no consensus for a standard metric to measure shade [2, 7-9]. Six examples of targets for playground shade were found in the grey literature, with no examples in the peer reviewed literature. The examples were: the Cancer Institute NSW's Playground shade best practice principles for action document, with targets informed by shade benchmarking research [10]; Wagga Wagga Council's reference to budgeting to upgrade parks who do not meet a minimum 40% shade [11, 12]; the Scenic Rim Regional Council's Playground Strategy [13]; the Lismore community sun protection policy (referenced in Table 4 of Benchmarking report [2], but web link no longer active); a policy and guidelines to assist councils creating shade at public facilities created by Queensland health and Stoneham and colleagues [14]; and, Government Architects NSW Draft Greener Places design guidelines [15].

Although not specifically about shade targets, published research described the city of Phoenix, USA's city-level 'vision' for tree-canopy cover of 25% as part of its tree and shade master plan [16], which is considered as parallel evidence here because it provides information in relation to several of the sub-questions. Information on Sydney and Melbourne's city-level shade targets is considered in question 3 in relation to co-benefits of shade since we could not find information on these to contribute much to the sub-questions to question 1.

These seven examples, summarised below in Table 2, provide some evidence of targets being used as a strategy for increasing shade in playgrounds which are occurring in combination with other strategies. These examples are considered in detail below to provide information relating to the sub-questions.

Table 2. Documents including shade targets, the location, the target and the language used

Authors, date (reference number)	Location	Target	Language used
Cancer Institute NSW. 2022 [10]	NSW, Australia	Play equipment and nearby seating 70%	Stated that shade should cover at least 70% of the play equipment and nearby seating, including 45% of tree shade
Wagga Wagga Council, 2022 [11, 12]	NSW, Australia	40%	Minimum 40%. Funds prioritised for playgrounds that fell below this.

Authors, date (reference number)	Location	Target	Language used
Scenic Rim Regional Council, 2019 [13]	Queensland, Australia	50%	Minimum of 50% shaded area provided by sails or mature/significant trees
Lismore Council, 1997 (in [2])	NSW, Australia	100%	All playground equipment and supervision areas to have minimum natural shade, preferred constructed shade over all (100% shade) equipment and 40% of ground shaded by natural and constructed shade
Queensland Health and Stoneham et al., 2007 [14]	Queensland, Australia	30%	Recommendations for shade at 13 priority outdoor facilities. For park design, natural shade cover 30% of ground amongst nine other essential and preferred criteria by location and type of shade.
City of Phoenix, 2010 [17]	Phoenix, USA	25%*	Vision for achieving 25% tree canopy cover for the city by 2030
Government Architects NSW, 2021[15]	NSW, Australia	Non-play areas 40%-50% and 50-80% coverage for play areas	Under specific categories of playgrounds designed for certain ages and uses, this specified 40%-50% shade coverage for non-play or open space areas and 50-80% coverage for play areas

*Refers to 25% tree canopy cover for a whole city, so not directly comparable to other examples

Box 1. Key findings related to question 1 - What is the evidence on shade targets or other metrics for playgrounds nationally and internationally?

Shade targets for playgrounds nationally and internationally. Six examples of targets for playground shade were found in the grey literature from Australia, ranging from 30% to 100%. Although not specifically about playground shade, an example of a city-level 'vision' for tree canopy cover from Phonenix, USA was considered, since it had detailed information to address other questions. It had a target of 25% tree canopy cover by 2030.

Where have they been implemented? The review identified shade targets for playgrounds from NSW and Queensland in Australia implemented at a local government level and following state level guidance.

What are they? Examples distinguished between the non-play areas surrounding playgrounds which had targets of >40% shade and the play areas, with targets of 50%-100% shade.

What wording was used? Language included 'minimum' targets, or to list the target within essential and preferred criteria for quantities of shade.

Is there evidence of acceptability? As part of the Benchmarking Shade in NSW Playgrounds study mentioned in the Background section, focus groups involving industry and local government in NSW indicated that having defined shade target/s would enable councils to enact advancement of shade in playgrounds. They preferred shade target percentages of 40% to 60% coverage (with 100% not preferred). In contrast, around half of the community members consulted indicated a preference for 75% of the seating and play equipment space be covered by shade that greater shade coverage.

Who adopts them? In Australia, local government. Another qualitative study which assessed the response of planning and transport professionals to public health guidance from the National Institute for Health and Care Excellence in the UK on the built environment and physical activity found that competition with other guidance documents may threaten adoption.

What is known about the success of any targets in achieving their aims? Evaluations are yet to describe impacts on shade. However, the integrating shade in NSW planning project initiated by Cancer Institute NSW is beginning to demonstrate adoption of shade targets amongst local governments in NSW.

Details of implementation

Where have shade targets been implemented?

The review identified shade targets which have been implemented to varying degrees in Australia and the USA. Implementation of shade targets typically occurs at a local government or city level in Australia under the remit of councils. In NSW, staff with responsibility for shade in public playgrounds include engineers, recreation and property staff and other council staff responsible for the design and provision of infrastructure that is assessed under other parts of the Environmental Planning and Assessment Act, for example works in parks and public

reserves (including playgrounds) under State Environmental Planning Policy (Infrastructure) 2007 (SEPP I) [18]. Policies and guidelines are generally developed at the state or territory level by planners employed in government or by non-profit organisations. The details of implementation are described in response to the next sub-question.

What are they? What wording was used?

We found some evidence of implementation or advice intended to prompt action amongst six of the seven documents in Table 2, the exception being the Government Architects NSW Greener Places draft design guidelines. Most playground shade examples distinguished between the non-play areas, like grassed areas and open space without play equipment, surrounding playgrounds which had targets of 40% shade or more. The play areas had targets ranging from 50%-100% shade coverage. Language included 'minimum' targets, or to list the target within essential and preferred criteria for quantities of shade in parks, as was done in the example from the source document by Stoneham and Colleagues plus Queensland Health [14] (more detail under 'Tools to assist local government implementing shade' below).

Adoption of targets by local government. A recommendation of a minimum target for playground shade of 40% arose from research to benchmark the levels of shade in playgrounds across NSW, which was commissioned by the Cancer Institute NSW and conducted by researchers from the Queensland University of Technology (QUT). The main action of this research was to conduct a virtual audit of shade in 2,592 playgrounds in 91 of 128 local government areas alongside on-site visits to audit 82 council playgrounds and 10 school playgrounds [2]. Subsequently, the Cancer Institute NSW recommended that local councils aim for 70% shade over play equipment and nearby seating. An example of adoption of a 40% minimum target was demonstrated in Wagga Wagga, where a workshop conducted for councillors shared the results of their own shade benchmarking audit of Wagga Wagga's playgrounds, and recommendations for action to increase shade in playgrounds were discussed [11]. The 40% minimum shade target was adopted by Wagga Wagga Council at their general meeting on 22 August 2022, where they resolved to allocate funds to shade improvements in parks not currently meeting this minimum 40% target [12].

Advising on adoption of shade targets with local government decision makers. During 2019 and 2020, the Cancer Institute NSW and Cancer Council NSW made submissions to most of the 128 local councils in NSW regarding the development of their Local Strategic Planning Statements (LSPSs) that guide each council's 20-year strategic plan, as part of recent amendments to the NSW Environmental Planning & Assessment Act which required all NSW local councils to develop LSPSs. To document the process of making these submissions, Cancer Institute NSW commissioned the preparation of a 'Shade and UV inclusion in NSW local government planning policy report in 2020 which summarised their approach to engaging local government [18], where a mixture of 'generic' and 'tailored' submissions were submitted based on the size and location of the council. The report highlighted that 111 submissions were made by the Cancer Institute NSW to NSW councils regarding the inclusion of shade for UV protection in their draft LSPSs during 2019-2020, with over half (59%) of the submissions resulting in increased shade related content.

The Cancer Institute NSW's Shade and UV inclusion in NSW local government planning policy report noted the outcomes in final LSPS reports varied widely from a whole Planning Priority

and accompanying actions relating to shade and UV (Upper Hunter) to no reference at all amongst 41% of councils who received submissions. Only Ryde Council referred to a target for shade, but the reference did not include a specific number [18].

The Cancer Council NSW also made submissions to local councils during 2019 and 2020 regarding the development of their LSPSs, resulting in a total of 132 submissions to 109 local councils. Some local councils received more than one submission from Cancer Council NSW, due to regional teams supporting the submission process. An analysis of these submissions was not included as part of the Cancer Institute NSW report (18).

Based on the success of the LSPS submissions outlined in the 'Shade and UV inclusion in NSW local government planning policy' report Cancer Institute NSW and Cancer Council NSW continued to communicate with councils via submissions to related exhibited documents such as draft Community Strategy Plans, and also via direct communications to Councils to share the results of the Shade Benchmarking in NSW Playgrounds research.

As an example, a letter to the CEO of Norther Beaches Council was sent as follow-up to the Cancer Institute NSW submission on 26 May 2022 to the Northern Beaches Community Strategic Plan 2040 and Delivery Program 2022 – 2026. This letter made further suggestions to increase provision for shade for UV protection, in playgrounds specifically, via a one-page summary which included infographics of the results of the shade audits of the Northern Beaches Council's playgrounds compared to NSW findings. This included a recommendation from the Institute for a combination of built and tree shade in every playground, covering at least 70% of the play equipment and nearby seating, (including 45% of tree shade), to reduce children's and caregivers' overexposure to UV radiation [19]. Follow-up communications of this type were provided to a total of 54 local councils in NSW. This follow-up advice relating to the shade benchmarking in playgrounds research findings as further evidence of the need for shade was listed as the highest priority recommendation of the report for the planning policy project [18].

The Cancer Council NSW also made submissions to local councils during 2019 and 2020 regarding the development of their LSPSs, resulting in a total of 132 submissions to 109 local councils. Some local councils received more than one submission from Cancer Council NSW, due to regional teams supporting the submission process. An analysis of these submissions was not included as part of the Cancer Institute NSW report (18).

Local governments outlining their own shade plans. The Scenic Rim Regional Council Playground Strategy 2019 from Queensland [13] outlined an approach to the future provision of playgrounds across the region and design guidelines for each of its three categories of playgrounds – destination playgrounds, community playgrounds and local playgrounds. It specified a minimum of 50% shaded area provided by sails or mature/significant trees. Lismore in northern NSW in Australia developed a community sun protection policy in 1997. It also specified that all playground equipment and supervision areas should have minimum natural shade, preferred constructed shade over all (100% shade) equipment and 40% of ground shaded by natural and constructed shade.

Tools to assist local government implementing shade. The policy and guidelines created by Queensland Health and Stoneham and colleagues [14] to assist local councils create shade at public facilities has a technical guidance section that provides detailed guidance regarding

essential and preferred natural and built shade availability for 13 priority public areas and facilities, including beaches, bikeways, child care centres, parks, sporting fields and swimming pools to name a few. The sub-section on parks on page 56 refers to parks having at least 30% ground cover from natural shade amongst seven other essential and preferred criteria for quantities of shade in park design. This document also includes three cases where councils have adopted the policy and guidelines, one of which is Lismore City Council which is listed above. The Cancer Institute NSW recently created a tool outlining best practice principles for shade implementation. The tool was designed for councils, planners, shade manufacturers, designers and the broader community[10]. Informed by the shade benchmarking research the Cancer Institute NSW commissioned [2], it stated that shade should cover at least 70% of the play equipment and nearby seating, including 45% of tree shade, to reduce children's and caregivers' overexposure to UV radiation and summarises 10 actions for increasing shade. Elements of this has been used as part of advice to 54 Councils with a significant sample of playgrounds in the playground audit sample.

Developing a vision. Although it does not include a target for shade in playgrounds specifically, the City of Phoenix's Tree & Shade Masterplan, which was developed in 2010, has a 'vision' to achieve 25% tree canopy cover over Phoenix by 2030 [17]. Its third goal for 'Sustainable, Maintainable Infrastructure' has many actions for developing built and natural shade. Additional searching on the City's website located a 'Shade Phoenix green dashboard', where some achievements from the implementation of the Masterplan in 2011 are summarised [20].

In relation to the sub-question above on what the targets are, the Wagga Wagga council has recently documented that funds will be allocated to upgrade shade in playgrounds under their council's remit which do not currently meet the minimum 40% target for shade [12], as identified via their own shade audit and corroborated by the Cancer Institute NSW and Queensland University of Technology shade benchmarking study [2, 11]. Whilst Shellharbour Council have not adopted a target yet, they refer to a target of having a minimum of 50% natural shade in a report to their Chief Executive Officer [21] which was created to respond to a resolution from Council at its meeting of 28 June 2022 where it was resolved: "That a report be prepared providing a prioritised list of playgrounds that could benefit from the establishment of shading via trees and/or built structures."

Is there any evidence of acceptability?

Phase six of the shade benchmarking In NSW playgrounds research involved focus group discussions with industry and local government stakeholders [2]. Findings indicated that having defined shade target/s would be a significant enabler for councils to shade access in community-based playgrounds, with funding allocation potentially being directed to shade as a result. Participant feedback indicated that shade targets may assist local government funding allocation, which reflects the experience of Wagga Wagga Council, where the Council's publicly available minutes from a general meeting in 2022 detailed the allocation of funds to upgrade shade in parks which were not currently achieving the minimum target of 40% shade [12]. The report [2] indicated that industry and council focus group participants did not have a consistent notion of what the shade percentage should be for community-based playgrounds. Shade target percentages ranging from 40% to 60% coverage were generally preferred (with a 100% target generally not preferred) [2]. In contrast, almost half of the community members (i.e.

Phase five of the research) shared the view that three quarters (75%) of the seating and play equipment spaces should be covered by shade.

The Phoenix Tree and Shade Masterplan document hinted at some enabling factors, such as public support for improved natural shade. In the introduction on page 7 it stated, 'Phoenix residents value natural resources and have voted repeatedly to invest in the living infrastructure. For instance, the Phoenix Parks and Preserve Initiative was passed twice with over 75 percent voter approval' [17]. Since the public and other stakeholders may find playground shade targets more acceptable if they understand that they include increases to some natural shade, communication around targets could consider this. Likewise, emphasising the co-benefits of natural shade for achieving sustainability targets, and for built and natural shade mitigating the urban heat island effect in communication around targets or metrics could be considered and the Cancer Council's co-benefits of shade fact sheet could be considered when creating this communication[22].

Who owns/develops them? Who adopts them? Who is accountable?

Development of the localised shade targets and recommendations above was by state/territory organisations as well as local councils in Australia. Adoption of and accountability for this guidance is more complicated to assess. Parallel evidence, from studies of implementing guidance documents and from implementing other built environment initiatives is presented here to address the questions of adoption and accountability.

A process and outcome evaluation of the RESIDential Environments project (RESIDE) in Western Australia assessed the implementation of 43 objectively measurable elements of 'Liveable Neighbourhood' (LN) guidelines. This compared the development of new neighbourhoods where the LN guidelines had been adopted, with those which didn't. It also measured the associations of implementation of the elements of the guidelines with walking for transport amongst residents (n=664). The main finding related to adoption from the process evaluation at follow-up 5-6 years post-commencement of RESIDE, was that **under conditions where developers were not required to implement the guidelines, there were low adoption rates by developers** of LN developments and conventional developments [23].

A qualitative study from the UK, which assessed the response of planning and transport professionals to public health guidance on the built environment and physical activity by the National Institute for Health and Care Excellence (NICE), found that stating what may be obvious to stakeholders implementing the guidance may jeopardise implementation [24]. One quote from a town planner reflected this:

> *'... a lot of this is mother[hood] and apple pie. I think this is fantastic stuff, I have got no issues with it at all, but if you just place it alongside that one and that one and that one, my projector would be slightly higher every time I give a presentation, there would be another document to lift it up a bit. But what's the added value of it?'*

It also found that since 'there is little evidence on the effectiveness of policy level interventions on policy and urban planning, it is difficult to suggest radical changes to current work'. This issue had implications for the participants' perceptions of the role of evidence-based guidance. Further, one of the strong themes identified by the study was that competition with various other guidance documents may threaten adoption. Since there are numerous co-benefits to shade creation which are outlined in response to guiding question three of this review (i.e. 3. What

strategies have been used to increase shade in playgrounds?), ultimately integration of shade targets and design guidance within other policy or guidance documents may be ideal. This will be considered further in the section on co-benefits within this review.

The parallel evidence on adoption and accountability presented here highlights a few considerations for ensuring this engagement process results in action. The section on implementation details for other strategies to increase shade which relates to guiding question 2 of this review (i.e**.** What is the evidence on co-benefits of increased shade in playgrounds?) will highlight further considerations related to adoption of and accountability for strategies to increase UV protective shade in playgrounds.

What is known about the success of any targets in achieving their aims?

The review found little evidence of targets achieving their aims. This is unsurprising given the accepted view of built environment and health researchers is there is a need for more research to evaluate government policies and their implementation to understand the impact of population-level policies on health outcomes [25].

The review identified one published study referring to shade targets [16].I It provided information on the implementation of Phoenix's Tree and Shade Masterplan, with its vision to create 25% tree canopy cover over Phoenix by 2030 [17]. The 'Shade Phoenix green dashboard' on the City's website summarises achievements under the most relevant Goal 3 'Sustainable, Maintainable Infrastructure', 2010 - 2011 Accomplishments as:

- Developed shade goals for General Plan
- Shade goals incorporated into:
  - Downtown Code
  - Green Construction Code
  - Strategic Plan
- Downtown Code: Tree Matrix developed and implemented [20]

The example illustrates that the urban tree canopy and related shade creation in public open space is a pressing focus of many cities and local government areas in response to mitigating climate change and contributing to sustainable futures. The Cancer Institute NSW prioritised this action in a recent report and detailed relevant policies, guidance documents and the premier's priority for greening our city on page 110 of the 'Shade and UV inclusion in NSW local government planning policy' report [18].

Question 2. What strategies have been used to increase shade in playgrounds?

The strategies identified in the literature are summarised in Table 3 under column headings 'Source document', 'Strategy', 'Where?', 'Implementation details', 'What was achieved?' and 'Why?'. For many of the examples of strategies identified by the review, four activities underpinned them:

(i) Intersectoral action

(ii) Awareness raising and education

(iii) Advocacy and advice

(iv) Creation of new evidence

Apart from intersectoral action, these reflected the action areas of the Shade Working Group [1]. These may be referred to in the ‘Why?’ column. Following Table 3, under the sub-questions for question 2, we drew upon the literature identified by the review to provide answers to the questions. Finally, Table 4 summarises interventions which have been conducted to test the effectiveness of creating shade in playgrounds for reducing exposure to UV and increasing playground use.

Box 2. Key findings in relation to review question 2

Types of strategies implemented. The five types of strategies which were identified in the literature were:

- Policies, guidelines and recommendations
- Settings-based site audits and site plans
- City-level tree and shade site masterplan
- Monetary incentives
- Multi-component interventions.

Nineteen examples are summarised in Table 3 with detail on implementation, what they achieved and why.

Due to the complexity of designing and building effective shade, policies and guidelines, the documentation often includes technical guidance sections. Site audits for development of shade plans was one common approach for addressing this complexity. It was evident the more comprehensive strategies had long timelines.

For the review question – *Did strategies which were effective demonstrate increases to shade?* – evidence identified to answer this question included that for the strategies themselves, intermediate changes such as the adoption of the strategy rather than the outcome of increased shade in playgrounds were documented.

The review identified three experiments with strong study designs to assess the effectiveness of interventions involving the creation of shade. They found that built shade over playgrounds and recreational areas in parks was effective for increasing use of those spaces, use of the shade and decreasing UV radiation at the sites.

Table 3. Strategies to support the creation of shade in playgrounds and other public spaces, the details of their implementation, what they achieved and why they achieved what they did

Source document (Author(s), date, title (refence number)).	Strategy (Policy, guidelines, site audits, etc.)	Where? (Location, Country)	Implementation details? (When, over what time, ownership, language used, acceptability, context)	What was achieved? (Impacts on shade and other outcomes)	Why? (Key factors to success/failure)
Policies, guidelines and recommendations					
Kapelos et al., 2014. Health, Planning, Design and Shade: A critical Review [8]. Toronto Cancer Prevention Coalition, 2010. Shade Guidelines[26].	The Shade Policy is supported by Shade Guidelines for the City of Toronto and assist all City agencies, boards, commissions and divisions (ABCDs) to provide UVR protection and Sun Safety measures for= outdoor environments. The guidelines include audit tools.	Toronto, Canada	Both source documents detail implementation. The Toronto Cancer Prevention Coalition (TCPC) was established in 1998 by Toronto Public Health. Within the TCPC, the Ultraviolet Radiation Working Group has been successful in several initiatives to promote awareness of the harmful effects of overexposure to ultraviolet radiation (UVR). Their ongoing advocacy, evidence generation and awareness raising ultimately led to policy endorsement. The timeline from establishing the TCPC in 1998 to adoption of the policy in 2007 involved many actions. A key implementation strategy was site-specific audits. The guidelines contain playground audits (section 8.2, p. 61), and a full Shade Audit Process Checklist (Appendix D). Parks and Recreation own the process.	The first city-level shade policy in North America was endorsed by the City of Toronto in 2007. Complementary guidelines for site-specific shade with an audit and plan development process were completed by the policy implementation group with Parks and Recreation and endorsed in 2010.	A key factor for the guidelines being adopted by the city was a pilot study to adapt shade audits: A 2005 report on shade-audits estimated the cost to be CAD $8,000 per site, or CAD $8 million to audit approximately 1,000 city-owned parks. To seek ways to reduce the cost of audits, a 2009 research study audited play areas and examined the application of software developed in Australia to calibrate the risk of UVR exposure in specific settings.
Stoneham M, et al. 2007. Creating Shade at Public Facilities - Policy and Guidelines for Local Government[14].	Model policy developed for local government to adapt and implement. Contains complementary guidelines, technical guidance and shade audit tools.	Queensland, Australia	Three cases of policy adoption – Lismore City Council (LCC), Nango Shire Council and Mt Isa City Council. For LCC, In January 1997, Council adopted the shade creation policy, and pledged financial support to implement it. After a presentation by the NSW Cancer Society to the Council meeting the policy was adopted. Throughout policy development, staff members commented on technical content. The Officers included the Parks and Gardens Officer, the Personnel Officer (WH&S issues), the Manager of Community Services and the Recreation Officer. Once Council adopted the policy, several initiatives occurred that contributed to the successful implementation. These initiatives included: training for Council Officers involved in implementation; the policy being a standing agenda item for Senior Officers meetings; Dividing the policy into sections relevant to specific Departments; a series of shade audits to prioritise facilities at risk; partnership and resource sharing between the local Public Health Unit and Cancer Council Office. Council offered $15 000 to assist with implementing the policy. The section on technical guidance has a subsection for Parks on page 56. The language used is evident here – ‘quantiles’ of ‘essential’ and ‘preferred’ aspects of shade linked to the development assessment process. Under preferred, it stated 30% of total ground cover should have natural shade.	For LCC, outcomes varied from “including shade and sun safe considerations on booking forms for parks” to “developing an awning policy as a lower order policy under the shade creation policy”, and “increasing tree planting at public reserves.”	Critical success factors for LCC were: A relevant and individualised policy that was developed in consultation with other staff; Political commitment to, and awareness of shade creation; Financial commitment to providing shade at public facilities; Driving force of one Department to ensure the policy became a reality; Council considered shade creation to be core business of local government; Training provided to all staff to ensure a high understanding of the policy; Community invited to provide feedback on draft policy; Including linkage groups to support the process of developing and adopting the policy; Community awareness and support for shade as a priority issue; and, the timing was considered to be well suited to the current environment.
Cancer Council NSW, 2013. Guidelines to shade[27].	Guidelines for planning and designing shade.	New South Wales, Australia	A generic approach, rather than site-specific. Sites are ranked based on use, shade coverage, etc. Then, audits are conducted before shade is designed. The whole second section is on design.	NR	NR
Cancer Council WA, 2020. A practical guide to shade development[28].	Another generic approach based on the above.	Western Australia, Australia	Follows almost the exact format and repeats the approach of Cancer Council NSW 2013 above.	NR	NR
NICE, 2011. Skin cancer prevention guidelines[29].	Skin cancer prevention guidelines cover all aspects of primary prevention.	UK	Recommendation 6: Providing shade. Who should take action? Architects, designers, developers, planners and employers. What action should they take? When designing and constructing new buildings, consider providing areas of artificial or natural shade. When developing or redeveloping communal outdoor areas, check the feasibility of providing built or natural shade. For all new developments, ensure adequate access to shaded areas for people with a disability. Note: the guidelines	NR	NR

Source document (Author(s), date, title (refence number)).	Strategy (Policy, guidelines, site audits, etc.)	Where? (Location, Country)	Implementation details? (When, over what time, ownership, language used, acceptability, context)	What was achieved? (Impacts on shade and other outcomes)	Why? (Key factors to success/failure)
			state there are no recommendations for the addition of shade structures to existing buildings as these were found to not be cost effective.		
Government Architects NSW, 2020. Draft greener places design guide[15].	Draft greener places design guidelines	NSW, Australia	The Appendix on page 56 contains information on targets for shade and guidance for implementation for categories of parks and playgrounds designed to target children of different ages and for different uses.	NR. However, the guide was intended to provide a framework to support the NSW Government Premier's Priorities: Greening Our City, seeking to increase the tree canopy and green cover across Greater Sydney by one million trees by 2022; and Greener Public Spaces aiming to increase the proportion of homes in urban areas within 10 minutes' walk of quality green, open, and public spaces by 10 per cent by 2023.	NR.
Cancer Institute NSW, 2022. Playground shade best practice principles for action [30].	Evidence informed recommendations for action to create shade in playgrounds	NSW, Australia	Developed in 2021-2022 after the 'Shade and UV inclusion in NSW local government planning policy' project, which involved submissions to local governments in NSW on inclusion of shade in their long-term strategic plans 2019-2020, and the shade benchmarking in NSW project which benchmarked the amount of shade in playgrounds across NSW 2020-2021. It integrates findings from the shade benchmarking report on targets for shade. The language used is targets and recommendations. Evidence of high acceptability from stakeholders in planning, local government and the public from focus group discussions [2]. This action tool was used in follow-up of submissions to 111 NSW councils regarding their long-term strategic plans in response to a requirement for all Councils in NSW to develop these plans [18].	Used in systematic follow-up of local government areas in NSW who received submissions related to the importance of shade for protection from over exposure to UV radiation to 111 of 128 councils in NSW. The follow-up found that 59% of councils had adopted some form of shade action in their 20-year strategic plans. Additional generic submissions were sent to 80 councils by Cancer Council NSW. The evaluation found both generic and tailored approaches were successful and 66 final long-term strategic plans had at least one reference to shade [18]. At the time of writing there was evidence of adoption of actual targets for shade in playgrounds by Wagga Wagga Council in NSW, who had committed funds for shade upgrades for all parks that did not meet a minimum 40% target [12]. Subsequently additional detailed tailored submissions including the results for their local government area's playgrounds shade benchmarking and a link to the playground shade best practice principles for action tool was sent to 54 councils by Cancer Institute NSW.	Follow-up of councils - whether generic or tailored to include results from their own shade benchmarking – advising on action related to shade following referencing it in their long-term strategic plans, was a key success factor.
Holman et al., 2018. Shade as an Environmental Design Tool for Skin Cancer Prevention[7].	Evidence informed recommendations by the US surgeon general to prevent skin cancer	USA	'In the United States in 2014, the US surgeon general issued the Call to Action to Prevent Skin Cancer, which addressed the importance of shade in 3 of the 5 strategic goals outlined. Strategic planning for and use of shade was identified in goal 1 to increase opportunities for sun protection in outdoor settings, including outdoor recreational settings…. Goal 3 encouraged promotion of policies advancing the national goal of preventing skin cancer, including shade planning policies in schools and policies supporting shade planning in land use development. Goal 5 addressed the need to strengthen research, surveillance, monitoring, and evaluation related to skin cancer prevention, including evaluating the effects of community shade policies.'	The Call to Action raised awareness about skin cancer as a major public health concern and provided a roadmap for the public health community at the national, state, and local levels to work together strategically with partners in all sectors to advance skin cancer prevention in the United States.	US surgeon general reports are disseminated widely and gain attention from public health professionals. It could be considered peak health advice, like advice from the Federal or State Chief Medical Officers in Australia.
Site audits and site-specific recommendations					
Toronto Cancer Prevention Coalition,	Shade audits and site-specific guidelines. Detailed in Toronto's shade guidelines from 2010.	Toronto, Canada	Work between 1998 and 2010 led to the development of the guidelines and audit tools. From section 7 on planning for shade: The Shade Audit is an effective evaluative tool for planning for shade provision at sites and facilities and for	Two pilot studies led to a more cost-effective and streamlined audit process.	Pilot studies and two playgrounds and eight water parks provided learnings for development of guidelines and a streamlined audit process.

Source document (Author(s), date, title (refence number)).	Strategy (Policy, guidelines, site audits, etc.)	Where? (Location, Country)	Implementation details? (When, over what time, ownership, language used, acceptability, context)	What was achieved? (Impacts on shade and other outcomes)	Why? (Key factors to success/failure)
2010. Shade guidelines [26].	These were developed to support the Toronto shade policy.		subsequently developing design solutions. It outlines a process that will allow site managers and designers to understand where there are sun exposure risks and steps to minimize them. A Shade Plan should be prepared after a Shade Audit is conducted. The Shade Inventory is a planning tool that can be used to prioritize the need for shade and as such provides a framework for decision-making and prioritising fund on a 'needs basis'. The use of software for shade should be considered when sites are complex and resources are available.		Combined efforts of the shade policy working group and parks and recreation staff to develop the guidelines and audit processes. Partnerships with academics to develop the pilot and an Australian architect to adapt the software he had previously developed.
Holman et al., 2018. Shade as an Environmental Design Tool for Skin Cancer Prevention[7].	Shade audits	Multiple tools and locations	'Shade audits can include 1 or more of the following: a visual inspection of the given area to address a set of predefined questions, interviews with potential shade users and facility managers, and the use of software to model and map the shade provided at different times of day and year.'	The review provided a list of shade audit tools and guidelines on shade development available at the time in Table A.	NR
For more examples which include shade audits and/or site-specific guidelines see the above examples: Stoneham et al., 2006. Cancer Council NSW 2013, Cancer Council WA, 2020.					
City level tree and shade master plan					
City of Phoenix, 2010. Tree and Shade Masterplan[17].	Tree and shade masterplan 2010-2030 has 3 overarching goals - 1. Raise Awareness (Educate), 2. Preserve, Protect and Increase and 3. Sustainable, Maintainable Infrastructure - to achieve its vision of achieving an average of 25% canopy coverage by 2030.	Phoenix, USA	The most relevant goal 3 includes recommendations to Revise City Ordinances. It states, items for further review and possible inclusion are: Engineered Shade Standards; Streamlined Permitting for Engineered Shade; Tree Permitting; Tree Protection on Construction Sites; Incentives and Alternatives; Planting and Irrigation Standards; Landscape Standards based on the concepts of Right Tree, Right Place. The Urban Forest Infrastructure Team and the Parks and Recreation Department are charged with coordinating and maintaining the Tree and Shade Master Plan. Many City departments will implement the plan.	The 'Shade Phoenix green dashboard' on the City's website summarises 2010 - 2011 achievements under Goal 3 as: • Developed shade goals for General Plan • Shade goals incorporated into: ○ Downtown Code ○ Green Construction Code ○ Strategic Plan Downtown Code: Tree Matrix implemented	The Phoenix Tree and Shade Masterplan document hinted at some enabling factors, such as public support. In the introduction (p. 7) it stated, 'Phoenix residents value natural resources and have voted repeatedly to invest in the living infrastructure. For instance, the Phoenix Parks and Preserve Initiative was passed twice with over 75 percent voter approval'
Monetary incentives and equipment loans					
Parisi and Turnbull, 2014. Shade provision for UV minimization: a review [31].	Awards to Local Governments who have developed measures to improve UV protection.	Queensland, Australia	The North Queensland Skin Cancer Network conducted the pilot program in 2005 to provide an award to Local Governments who developed quality sun safety initiatives. A review found that the monetary amount was insufficient for making it feasible for Local Councils to commit time to developing an entry.	A grants program was piloted with Local Governments. There were only seven entries from six Councils for the prize of $2500.	The primary barrier to involvement was Councils had other priorities. It was concluded that future initiatives should be opened to a broader range of organizations such as community groups, schools and clubs.
Parisi and Turnbull, 2014	Grants to community organizations	Queensland, Australia	SUNbusters was an initiative funded by Queensland Health to provide seeding grants of $500 to community and sporting non-profit organizations to build shade for children. The SUNbusters initiative increased shade availability and community awareness on skin cancer prevention, however, only very few structures constructed under the program provided high-quality shade.	Although the quality of shade provided was poor, a review found that there were additional benefits for UV minimization from the project. At the time, 74% of the grant recipients were developing or had already adopted policies for UV minimization. The project also increased the community awareness and action for skin cancer prevention.	If repeated, it is recommended it be expanded to provide a greater financial incentive and include a shade audit to ensure that shade structures are planned, designed and built following best practice guidelines. A strong evaluative aspect should be incorporated to demonstrate the programs' ability to produce effective shade.

Source document (Author(s), date, title (refence number)).	Strategy (Policy, guidelines, site audits, etc.)	Where? (Location, Country)	Implementation details? (When, over what time, ownership, language used, acceptability, context)	What was achieved? (Impacts on shade and other outcomes)	Why? (Key factors to success/failure)
Parisi and Turnbull, 2014	Grants program for community organisations	USA	Funded by the American Academy of Dermatology. Provided $8000 to each successful applicant for shade provision projects. Eligible applicants are non-profit organizations that provide services to people 18 years old and under, and the application must be sponsored by a dermatologist.	Shade structures built under the program must satisfy stringent specifications set out in the program guidelines e.g., documentation to demonstrate that any shade cloth used has a UPF of 30 or higher.	The provision of strong and specific criteria on the quality of shade structures built under the program.
Parisi and Turnbull, 2014	Grants to Local Governments who have developed measures to improve UV protection.	NSW, Australia	The 2005/06 Healthy Local Government Grants Program funded by NSW Health and administered by Local Government NSW provided several grants for skin cancer prevention in Local Government through shade provision and other sun protection strategies. The aim of the projects focussing on skin cancer was for prevention in the community and council staff, with a particular focus on sun protection for children and young people.	Successful Councils were also requested to meet the requirements of the NSW Cancer Council publication, Under Cover: Guidelines for Shade Planning and Design, in undertaking this project.	Cancer Council NSW advice was sought for the skin cancer prevention focussed applications during the judging phase of the grants program.
Parisi and Turnbull, 2014	Loans to borrow shade structures	New Zealand,	The Cancer Society of New Zealand has a free Shade Loan scheme that loans shade structures such as gazebos and beach umbrellas to eligible groups	NR	NR
Cancer Institute NSW, 2014 [32]	Grant schemes to support the building of shade structures.	NSW, Australia	Grant scheme for schools, local government, community groups and sporting organisations.	Report outlines 10 successful cases studies of building shade using grant funds from the scheme.	Success factors for individual cases varied case by case.
Multi-component programs					
a. King et al. Integrating shade provision into the healthy built environment agenda[1]. b. Cancer Institute NSW, 2022. Shade and UV inclusion in NSW local government planning policy [18]. c. Briant S, et al. 2021. Benchmarking Shade in NSW Playgrounds [2].	Shade provision integrated into the healthy built environment planning agenda.	NSW, Australia	Over a period of approximately four years Cancer Institute NSW and Cancer Council NSW, along with the Shade Working Group they established drove the implementation of, a. the incorporation of several modules on how to plan and deliver quality shade provision as part of continuing professional development training for landscape architects who are members of the Australian Institute of Landscape Architects (AILA) peak body, b. submissions to the development of long-term local strategic planning statements for local governments across NSW. These actions, amongst many others, integrate shade into the healthy built environment agenda. The actions and three activities underpinning them are described in detail in the source document under headings - (i) Awareness raising and education; (ii) Advocacy and advice; and, (iii) Creation of new evidence. c. benchmarking the amount of built and natural shade in playgrounds in NSW,	a. Modules in Continuing Professional Development training for Architects for incorporating shade into healthy urban design [33]. b. Distributed submissions to 111 of 125 NSW Councils. Adoption of shade into long term strategic plans of 59% of the 111[18]. The Cancer Council NSW also made submissions to local councils during 2019 and 2020 regarding the development of their LSPSs, resulting in a total of 132 submissions to 109 local councils. Evidence of Councils implementing shade is just beginning to surface (e.g., Wagga Wagga have allocated funds [12]) suggests more improvements to shade in NSW will flow from these efforts. c. Shade benchmarked in NSW playgrounds via comprehensive study.	a. The Shade Working Group's members are often the key success factor in driving many actions. In this instance, an landscape architect who was an active member of the of the peak body for landscape architects championed the action. b. Timing of a local government planning requirement. Recognising that all Councils in NSW would be required to produce long term (20 year) local strategic planning statements. c. Partnership with researchers from the Queensland University of Technology and University of Southern Queensland.
Hill et al., 2019. Interventions to lower ultraviolet radiation exposure: Education,	Victoria's SunSmart policy	Victoria, Australia	Multi-component, over several decades, a key early focus was schools, but it is much broader. *The article states, 'skin cancer prevention requires a comprehensive, multifaceted, and sustained approach.'*	*'.. 11 waves of a ...survey, marked improvements in the population's sun protective behaviour and sunburn since the launch of the program. Additional analyses have provided evidence of the positive effects of mass media campaigns. Concurrently, several studies have tracked policy development and practices in diverse settings.*	*'The benefits of establishing a written policy are that it requires recognition of the value of addressing a health promotion issue by a community or organization but also identifies ways to address it at*

Source document (Author(s), date, title (refence number)).	Strategy (Policy, guidelines, site audits, etc.)	Where? (Location, Country)	Implementation details? (When, over what time, ownership, language used, acceptability, context)	What was achieved? (Impacts on shade and other outcomes)	Why? (Key factors to success/failure)
legislation and public policy[34].			A review by Saraiya et al. from 2004 stated: *"A final category was community-wide multicomponent programs, including comprehensive community-wide interventions, which combine two or more of the other strategies [i.e. education, policy and environmental support] into an integrated effort for an entire defined geographic area." ..." In addition to education, these programs may also include significant efforts to institute sun-protection policies and structural supports. Programs like these have been in place for 2 decades in Australia, with the longest-standing and most cited ones being the Slip! Slop! Slap! and SunSmart campaigns in Victoria."*	*These have demonstrated the potential for environmental interventions to reduce exposure to ultraviolet radiation... health economic analyses show it [i.e., skin cancer prevention] is an excellent investment, and there is ... evidence of longer-term effects on incidence in younger cohorts.'*	*the local setting and helps to ensure the efforts are sustained.'*
See also Toronto Cancer Prevention Coalition, 2010, City of Phoenix, 2010 and Stoneham M, et al., 2007.					

Of interest are strategies implemented by governments (national, state, local) and not for profit organisations.

Table 3 above summarises literature on the five categories of strategies used to achieve the outcome of improvements to shade in playgrounds. The strategies which were identified in the literature have been collapsed into:

1. Policies, guidelines and recommendations
2. Settings-based site audits and site plans
3. City-level tree and shade site masterplan
4. Monetary incentives
5. Multi-component interventions.

Whilst the 'policies, guidelines and recommendations' category provided the largest volume of literature for examples of strategies, many of the source documents stressed that achieving improvements to shade in playgrounds and other public spaces will require multiple strategies to be implemented [7, 8, 34]. Policies, guidelines, recommendations, audit tools, the masterplan and multi-component interventions were generally developed at a state level in Australia and a city level in the US. However, implementation often occurred at a local government level in Australia and a city ordinance level in the US. Monetary incentives, usually in the form of grants, occurred mostly at a local government level in Australia. There were two examples of strategies developed at the national level - the NICE guidelines for skin cancer prevention in the UK [29] and evidence-based recommendations US Surgeon General's 'Call to Action' [7]. Underpinning all this action in the more developed programs of work was planned activity in the areas of - (i) Intersectoral action; (ii) Awareness raising and education; (iii) Advocacy and advice; and, (iv) Creation of new evidence[1]. The example from Cancer Institute NSW and Cancer Council NSW of integrating shade into the healthy built environment agenda in NSW under the category of multi-component interventions in Table 3 illustrates this well. Elements of this and other strategies can be considered when developing further action to improve shade in NSW.

Describe detail of the development of the strategy and its implementation (where, by who, over what time, who was involved)

The details of the development and implementation of each strategy are summarised in the 'implementation details' column in Table 3. All documents identified provided some detail on development and/or implementation. The 'policies, guidelines and recommendations' category provided the most detail of implementation overall. Many policies were complemented by technical guidance, or action documents. The setting and site-specific audits also often complemented by both policies and guidance documents. One review summarised available audit tools in a table [7]. Phoenix's Tree and Shade Masterplan approach was the only one of its kind in the included literature [17] and we were able to find some detail on its development as well as evidence of action [20] that is summarised in the table. Four of the five examples of monetary incentives involved grants and common themes from implementation were that clear technical guidance is required for the development of shade and the monetary amount needs to be adequate. Two examples of multi-strategic programs with information available on details of development and implementation were from Victoria [34] and NSW[1]. These included elements targeting behaviours, the environment and policy which were also underpinned by activities of (i) Intersectoral action; (ii) Awareness raising and education; (iii) Advocacy and advice; and, (iv) Creation of new evidence.

There were some exemplars where great detail of strategy implementation was available, including the City of Toronto's Shade Guidelines [26] (in the policy section and under site audits) which contained detail on development and some information on implementation. This is also summarised in a critical review paper by Kapelos and colleagues [8]. Queensland Health and Stoneham's Creating Shade at Public Facilities - Policy and Guidelines for Local Government [14] also included detail on development and implementation and within the section on three cases of councils who had used the model policy to develop and adopt their own policy and guidelines. The scope of these approaches to achieving improvements to shade were both broader than shade in playgrounds, and they both included **site-specific guidance** and **accompanying shade audit steps** as part of their approach to implementing improvements to shade. It is also worth noting that one of the key strategies that led to the development of the shade guidelines for Toronto was two rounds of **pilots** of using their tools to develop shade in playgrounds and other outdoor play spaces. These helped them refine their approach. Both these examples included specific information on shade in parks/playgrounds.

From reviewing this literature and the details of development and implementation it is also evident that the **timelines described are long** due to the education and advocacy required to gain ultimate endorsement of policies and guidelines that lead to action, or for adoption of any evidence-informed recommendations. Designing shade is also **highly technical**, therefore clear guidance information is required for stakeholders who design, develop and manage shade.

Where effective, what changes have been demonstrated related to increased shade?

The amount of information retrieved in relation to this question varied between each category of strategy. However, often it related to intermediate changes such as the adoption of the strategy rather than the outcome of increased shade in playgrounds. Therefore, the scope of information considered was expanded slightly to include experimental evidence where the intervention was implementing shade in recreation areas in parks and playgrounds. We also considered published evidence from combined state-level evaluation of Victoria's multi-strategic program to lower UV radiation exposure. Examples such as Victoria, Phoenix and Toronto with long histories of implementation could be contacted for more information on direct evidence of increases in shade. Literature relating to the intermediate outcomes of strategy implementation will be considered here first, before finishing by summarising the evidence found for evaluations and experiments achieving increased shade.

To complement the information in the 'What was achieved?' column in Table 3, we included a column to summarise any information provided on 'Why' the strategy achieved what it achieved. This information on "why" is summarised in the section below on "key success factors".

Key success factors

These 'key success factors' are worthy of consideration since they differed in each situation. In many cases the details of strategy development and implementation column indicated there were long time periods of sustained actions that led to implementation of these strategies. Kapelos and colleagues noted in their critical review on health, planning, design and shade:

> *'There is a need for a dynamic approach to problem solving that is responsive to new evidence and situations. The deliberate work of the Toronto Cancer Prevention Coalition since 1998 to effect a shade policy is an example of a successful collaboration among individuals from different disciplines to develop multiple strategies to address shade. The work of this group is characterized by perseverance, the capacity to take on a multitude of*

approaches, and the agility to change course to accommodate changing political exigencies. Interventions must be matched with needs and capabilities. What is good for Toronto may not necessarily be good elsewhere [8].'

There are parallels between the Toronto experience and the experience in NSW. There is a UV Working Group in Toronto and a well-established Shade Working Group in NSW, whose sustained work integrating shade provision into the healthy built environment agenda was noted in one example of multi-strategic programs from the table next to the source document by King and colleagues from 2022 [1]. This example demonstrates **perseverance and intersectoral action** whilst working with the landscape architect peak body in NSW to create modules for shade design in their professional development training. The key success factor here was timely action from a member of the Shade Working Group who was an active member of the peak body for landscape architects in NSW, who championed the action of planning and delivering continuing professional development modules on shade development i.e., the right person at the right time.

Then, in 2019-2020 Cancer Institute NSW and Cancer Council NSW recognised that all local governments in NSW would be required to develop a long-term Local Strategic Planning Statements (LSPSs) in response to changes in planning legislation. They demonstrated agility responding to the political landscape at the time quickly by developing submissions to as many councils as possible and in documenting the impact of this work through the 'Shade and UV inclusion in NSW local government planning policy' project and report. The Cancer Institute NSW engaged a Registered Planner with shade expertise to undertake this project to influence the inclusion of shade to reduce UVR overexposure in LSPSs and to write up its impact [18]. All 128 NSW councils were required by legislation to produce a LSPS to outline a 20-year vision for land use in their local government area. Actions in the LSPS are then reflected in more detail across Local Environment Plans, Community Strategic Plans and Development Control Plans. This provided a key opportunity to encourage local councils to consider shade, UV exposure, and skin cancer prevention in their land use planning within a broader approach to healthy built environments. Importantly, the project was also undertaken at a time of heightened NSW Government and local council awareness of the importance of urban tree canopy cover as part of the Greening our City Premier's Priority, designed to help ameliorate the impact of the urban heat island effect. Evaluation of the project found the following:

- n=111 submissions from Cancer Institute NSW to local councils during 2019-2020 (from a total of 128 councils in NSW);
- detailed 'tailored' submissions sent by the Cancer Institute NSW to 17 regional and 14 metropolitan councils;
- a total of 132 submissions were made by Cancer Council NSW to a total of 109 local councils during 2019 and 2020, consisting of 28 metropolitan councils and 81 regional councils;
- the submissions resulted in at least 66 final LSPSs containing at least one reference to shade and to a lesser extent protection from UV radiation; and,
- amongst the Local Government Areas who received submissions, there was evidence of some adoption of recommendations amongst 59% of them.

Results from the shade benchmarking project [2], which was conducted by the Queensland University of Technology and commissioned by the Cancer Institute NSW, have been used in follow-up communication from the Cancer Institute NSW to 54 local councils. In some cases, this communication included generic information on results of the shade benchmarking across NSW as well as tailored communication about the results of shade benchmarking in their local government area.

Evidence of effects

Whilst the review did not find evidence to support most of the strategies described in Table 3 achieving the outcome of increased shade in playgrounds, there was one exception. Although it was not related to shade in playgrounds specifically, in relation to multi-strategic programs which include environmental interventions this paper stated that in Victoria:

> '*.. several studies have tracked policy development and practices in diverse settings. These have demonstrated the potential for environmental interventions to reduce exposure to ultraviolet radiation... health economic analyses show it [i.e., skin cancer prevention] is an excellent investment, and there is ... evidence of longer-term effects on incidence in younger cohorts [34]'.'*

Considering evidence hierarchies of study-designs [35], the review found high level evidence - level II evidence from two randomised-controlled trials (RCTs) [36, 37] and level III evidence from one natural experiment [38] - described in Table 4, which demonstrated that building shade in playgrounds and parks decreased harmful UV exposure, increased shade use and increased park and playground use. Beyond providing confidence that building well designed shade for playgrounds will achieve these desired outcomes, the studies have other important implications. The natural experiment by Dobbinson and colleagues in 2020 [38] was conducted in an area with planned park refurbishments that was in one of the lowest socioeconomic areas in Melbourne, and it demonstrated that installed shade sails over the playground showed an increase in playground use. The implication is that equitable creation of shade in public parks and playgrounds may contribute to reducing socio-economic disparities in health. Since the RCTs of implementing built shade were effective in achieving increased shade use and increasing UV protection in two geographically different locations of Melbourne and Denver, this indicates the effects of built shade on reducing exposure to harmful UV radiation and increasing shaded playground usage can be generalised across geographical locations when these location and site-specific design factors are considered.

Table 4. Trials of the effects of creating shade in parks and playgrounds

Author (date). Title	Country, location, context	Study design	Participants (number, sites). Study duration	Intervention description	Outcome measures	Main findings
Buller et al., (2017) Shade Sails and Passive Recreation in Public Parks of Melbourne and Denver: A Randomized Intervention.	Melbourne, Australia and Denver, USA. Passive Recreational Areas (PRAs) in public parks (i.e., areas used for sitting or standing while socializing, preparing or eating a meal, watching or coaching sports, watching a concert, taking a class, or waiting, or areas where people stroll for sightseeing or while observing outdoor displays)	RCT. Stratified randomized pre-test to post-test controlled design.	Adults observed using PRAs in parks. Randomized a sample of 144 public parks with 2 PRAs in full sun in a 1:3 ratio to treatment or control. 2011-2014 (3 years)	Shade sails were built at 1 PRA per treatment park. At treatment PRAs, shade sails were built to similar designs in both cities, with some variation to fit the site requirements and preference of the municipalities, between pre- and post-test assessments, by working with parks department staff and shade sail vendors.	The primary outcome was any observed use of the study PRA by adults who were assessed by trained research assistants.	PRAs where shade was built were significantly more likely to be used than those where no shade was built. Adjusting for clustering of observations within parks and covariates, shaded PRAs (adjusted probability of PRA in use: pre-test = 0.10, post-test = 0.32) were more likely to be in use at post-test than unshaded control PRAs (pre-test = 0.14, post-test = 0.17), with a treatment group testing period odds ratio (OR) of 3.91 (z= 3.24; 95% confidence interval [CI] = 1.71, 8.94; P= .001)
Dobbinson et al., (2020). Examining Health-Related Effects of Refurbishment to Parks in a Lower Socioeconomic Area: The ShadePlus Natural Experiment.	Melbourne, Australia. Three intervention and three comparison parks in Brimbank City Council, a local government area with a program of planned park refurbishments and located in one of the lowest socioeconomic areas of Melbourne.	Natural experiment	Observations of people at the six parks were: T1 (2013-14), n=1670; T2 (2014-2015), n=2377; and T3 (2015-2016), n=2128. 3 years duration.	Planned refurbishments included features that might promote park-based physical activity (playground equipment and quality walking paths) and sun protection (built shade including a shade-sail for the children's playground). While comparison parks amenities remained largely unchanged across the study.	Primary outcomes: number of people observed in the park; number of people observed engaging in active recreation (defined as moderate-to-vigorous physical activity); and number of people observed using shade.	The study found more visitors used the refurbished parks than the comparison parks - from T1 to T2 124% increase in mean park use at the intervention parks relative to a 5% increase at comparison parks. Parks that installed shade sails over the playground showed an increase in shade use. It is likely that this positive effect on shade use was in-part related to the installation of shade sails over the well-designed playgrounds, in addition to providing the roofed shade at picnic areas.
Dobbinson et al., (2022). Solar UV Measured under Built-Shade in Public Parks: Findings from a Randomized Trial in Denver and Melbourne.	Melbourne, Australia and Denver, USA. Passive recitation areas (PRAs) in public parks (i.e., areas used for sitting or standing while socializing, preparing or eating a meal, watching or coaching sports, watching a concert, taking a class, or waiting, or areas where people stroll for sightseeing or while observing outdoor displays)	RCT.	UV measurements (n=1144) were conducted at the center and periphery of PRAs in a total sample of 144 public parks as part of pre-test and post-test measures of use of the PRAs by park visitors for three recruitment waves per city during 2010 to 2014.	In the intervention sites, shade structures were built to similar designs in both cities. This study quantified UV levels under built-shade relative to unshaded passive recreation areas (PRAs) over summer months in parks in two cities. Following pre-test, 36 PRAs received built-shade and 108 did not.	At the end of each observation period the research staff recorded the solar UV levels at the boundary and center of the PRA.	After adjusting for the covariates, mean UV at the center of built-shade PRAs decreased from pre-test to post-test ($x = 3.39$, $x = 0.93$ SED), a change of $x = -3.47$ SED relative to control PRAs ($p < 0.001$). A substantial reduction in exposure to UV can be achieved using built shade with shade cloth designs, offering considerable protection for shade users.

Question 3. What is the evidence on co-benefits of increased shade in playgrounds?

Box 3. Key findings for review question 3

What is the evidence on co-benefits of increased shade in playgrounds? Reviews suggest that shade provision for skin cancer prevention is best effected through integration with other policies. Policy paths could integrate shade with current imperatives to achieve tree canopy cover, reduce heat, create active and liveable neighbourhoods and contribute to sustainability goals.

Has the evidence on co-benefits been used in strategies to increase shade? There were some examples emerging. It was promising that shade is now a measure in a large global study of urban environments and physical activity amongst adolescents, and this does present opportunities to assess whether street shade is associated with physical activity across many countries.

Adopting a co-benefits approach in one area (e.g. climate change) can provide multiple benefits from a single policy or program [39]. According to the Shade Co-benefits fact sheet developed by the Shade Working Group, creating natural shade by planting trees and/or building shade can provide health, environmental and socio-economic benefits [22].

Box 4. Co-benefits of shade – health, environmental and socioeconomic

Health benefits [40, 41]	Environmental benefits [40, 41]	Social and Economic benefits [40, 41]
Reduces UV exposure and helps prevent skin cancer	Reduces build-up of heat in urban areas	Improves social and community connection
Improves thermal comfort in times of heat	Reduces air pollution	Reduces neighbourhood crime
Increases recreation and physical activity	Reduces water evaporation, soil erosion & storm water run-off	Better placemaking
Reduces obesity and risk of chronic disease	Reduces atmospheric carbon	Reduces socioeconomic and health inequities
Improves mental health and wellbeing	Maintains animal habitat and biodiversity	Increases land and property value

Health benefits [40, 41]	Environmental benefits [40, 41]	Social and Economic benefits [40, 41]
		Reduces energy usage and costs

The literature review for the Benchmarking Shade in NSW report provided an overview of how shade relates to other built environment design considerations since 'multiple planning, design and legislative considerations inform final design, construction and maintenance', and ideally shade forms an intrinsic part of such built environments. To inform future work, the review for the shade benchmarking report summarised how shade is being considered in relation to mitigating the Urban Heat Island effect; within the built environment and physical activity as well as the broader city planning and population health agendas; where shade may be integrated with other metrics/measures/indicators; and provided an overview of policies with reference to shade and in some cases targets [2]. Here in the sub-questions to question 3 we focus on evidence on co-benefits of increased shade in playgrounds that may generate discussion around action.

High level summary of recent evidence on co-benefits of increased shade in playgrounds

Whilst the rationale for co-benefits of shade in playgrounds to health and other outcomes is logical, there is a small volume of scientific evidence to support it. Considering levels of scientific evidence [35], the top level is systematic reviews and meta-analyses of appropriate level two studies. For the focussed topic of co-benefits of increased shade in playgrounds, no such reviews were identified in our search. However, expert opinion in a critical review [8] noted:

> *'The choice to focus on shade as a specific policy issue has its limitations. While success has been achieved in Toronto with regard to the specifics of shade, shade provision for skin cancer prevention is best affected through* ***integration with other policies****. Because the intent of shade policy is so specialised, it does not capture the collective imagination as much as issues of pressing concern, such as environmental sustainability and climate change. Perhaps shade would gain more traction if it were married to these larger issues and presented as a value-added.'*

The second level of scientific evidence comes from well-designed randomised-controlled trials (RCTs). In Table 4 above, the RCT conducted by Buller and colleagues [36] found provision of built shade significantly increased the use of passive recreation areas including playgrounds within parks, compared with parks and playgrounds that did not receive built shade enhancements. There is evidence that greater park use is associated with co-benefits to physical health, mental wellbeing and social engagement amongst park and playground users [42]. The second study in Table 4, which was conducted by Dobbinson and colleagues in 2020 [38] represents third-level scientific evidence from non-randomised prospective studies with a control comparison, which in this case was a natural experiment. Although not presented in Table 4, a secondary outcome was social engagement and a trend for this was detected. Combined, these studies provide evidence from high-level study designs for a co-benefit of shade increasing park use and social engagement.

The review also identified evidence from observational research on co-benefits of shade and heat mitigation. In recent research on playgrounds and climate change, Pfautsch and colleagues' [9] main hypothesis was that surface temperatures of playground equipment would reach burn threshold temperatures when unshaded. Their findings from in-situ measurements in 10 playgrounds in Sydney

supported the hypothesis since the maximum and average surface temperatures of sun exposed playground equipment and flooring surfaces were frequently above skin contact burn thresholds. Furthermore, surface temperatures were significantly reduced in the shade, where shade protected the playground equipment from ever reaching burn threshold temperatures. The same research group from Western Sydney University have also created a guide to climate smart playgrounds with research findings and applications [43]. In another study of shade provision in public playgrounds for thermal safety and sun protection they investigated the surface temperatures of installed surfacing materials and the prevalence of shade during peak mid-day hours in 103 playgrounds in the USA [44]. They found that natural surface materials resulted in moderated temperatures relative to ambient temperature, while artificial surfaces resulted in higher surface temperatures relative to ambient temperatures. Only 33% of playgrounds visited were shaded between the hours of 10:00 a.m. and 2:00 p.m. The paper called for shade to be considered in playground safety guidelines since it can prevent sunburn and temperature extremes. Together, these studies provide some evidence for shade providing co-benefits for mitigating heat, reducing the risk of soft tissue burns on play equipment and providing sun protection.

Has the evidence on co-benefits been used in strategies to increase shade?

The Cancer Institute NSW and Cancer Council NSW's efforts to integrate shade into planning are summarised under the multi-component programs category in Table 3[1]. Increasing planning sector awareness about the importance of skin cancer prevention strategies is a key goal of their Shade Working Group. So too is utilising intersectoral engagement to embed sun protection into the broad health, environmental and social benefits of good urban design. In particular, promoting the co-benefits of shade for both solar UV radiation and heat mitigation is a clear opportunity in NSW. The engagement with the planning sector and local government is starting to show evidence of impacts that will lead to increased shade in NSW, since their submissions which advocated for local councils to embed shade in local government strategic planning have demonstrated some adoption by over half of councils in NSW [18]. There is some evidence this is now flowing through to some local government areas, reflecting the need for sustained action to increase shade in playgrounds [12].

Phoenix's tree and shade masterplan [17], which aims to increase the tree canopy cover to 25% by 2030 refers to 'solution multipliers' which solve numerous problems simultaneously. They state that trees are a perfect example of a solution multiplier because when planted and maintained correctly, they can provide many economic, environmental, and social benefits. According to the US Forest Service, trees benefit the community by providing a cooling effect that reduces energy costs; improving air quality; strengthening quality of place and the local economy; reducing storm water runoff; improving social connections; promoting smart growth and compact development; and creating walkable communities. Their 'green dashboard' does show some evidence of implementation of their approach leading to increasing shade [20].

The City of Melbourne has a strategy for making the city greener with a section on Urban Heat Island Effect: Mitigation Strategies and Planning Policy Approaches. This is referred to in the NSW draft greener places design guide [15], where it states that:

> *'...the City of Melbourne has adopted a target to increase public realm trees from 22 per cent to 40 per cent by 2040. The Urban Forest Strategy cites a recent study on the urban heat island effect in Melbourne and recommends a minimum canopy cover of 30 per cent with a leaf area index (a measure of shade density) of 5.3 to achieve the most effective mitigation.'*

Sallis and colleagues [45] combined their expert opinion on co-benefits of designing communities for active living with evidence from observational research on which elements of urban design had at least “good” evidence of three co-benefits, and those that did included park proximity and greenery. Professor Sallis is one of the principal investigators of the International Physical Activity and the Environment Network (IPEN) studies. IPEN conducted a seminal study amongst adults across 10 countries, 14 cities and five continents to assess which objectively measured elements of urban environments are consistently associated with objectively measured physical activity [46]. Their work has had a strong influence on urban design for active living. Of note is that the follow-on IPEN adolescents’ study’s protocol paper describes incorporating an observational tool which includes some measures for trees and shade on streets between participants homes and commercial centres (i.e. likely walking paths towards neighbourhood destinations) [47]. It is promising that shade is now considered in a large global study of urban environments and physical activity amongst adolescents, and this does present opportunities to assess whether street shade is associated with physical activity across many countries.

Have strategies from working towards co-benefits been effective in increasing shade?

This review did not find literature to answer this question, which is consistent with a previous review by Holman and colleagues [7] who note that:

> *‘Efforts to promote shade as a skin cancer prevention tool may be most successful if they also address other benefits of shade such as aesthetic benefits, improved comfort in spaces designed for active transportation, reductions in the heat island effect, and energy conservation. Future work summarizing the latest research on shade, not only for UV protection but also regarding these other aspects of the built environment, could help to bolster understanding of the benefits of shade.’*

Whilst they do not provide information on the Liveable Neighbourhood guidelines being effective at increasing shade the studies by Hooper, Giles-Corti and others did demonstrate that trees were an element associated with walking outcomes since they included measures for elements related to street trees and street shade [23, 48]. Given these were part of the RESIDE study, which is Australia’s largest research investment in a cohort to determine the impacts of Liveable Neighbourhood design on health, opportunities to collaborate or explore the addition of shade research in indicators for and research on liveable neighbourhoods could be explored.

Which co-benefits are gaining most traction for increasing shade?

A common theme in many of the documents reviewed in relation to co-benefits was the obvious link between tree shade and climate change, and that since this is probably the most important issue of our time for the health of humans and our planet, any integration with goals to contribute to mitigating climate change are important and may be more likely to gain traction [49]. A high-level global policy document that sets goals which many countries are working towards is the Sustainable Development Goals (SDGs). The Shade Benchmarking report [2] noted Giles-Corti and colleagues [50] found limitations of the current SDG indicators included that the reporting is on outcomes only and does not include policy or interventions. The authors note, however, that the UN Habitat Framework includes intervention indicators but does not report on health outcomes. The benchmarking report stated that there remains an absence of heat and or shade indicators even in these broad international indicators.

Shade links to this in ways that humans can relate to since it will alleviate more immediate impacts on our comfort like heat and the Urban Heat Island effect. However, it provides an important co-benefit that many people will also relate to, since there is strong evidence it can contribute to reducing melanoma – a disease that has touched many families in Australia due to its high prevalence [51]. There are clear policy pathways that link shade to the sustainability agenda globally, nationally and locally. However, making shade an element within these policies and the work that flows from them to reduce carbon emissions whilst mitigating heat and reducing harmful exposure to UV radiation is the challenge.

Question 4. What barriers and enablers have been described in the implementation of strategies identified in questions 2 and 3?

Table 3 in this report summarises some of the key enablers and barriers for the strategies in question 2 in the final column 'Why? (Key factors to success/failure)', describing enablers for all categories except for two of the examples in the monetary incentives category. In the Benchmarking Shade in NSW research report, phases 5 and 6 involved focus groups with industry and consumer stakeholders, which included the questions 'What barriers exist for advancing shade for NSW playgrounds?', and 'What are the potential enablers to advance shade in NSW playgrounds?' Responses are summarised in that report [2].

From the literature identified in this review, the barriers and enablers described formed 10 categories, with five enablers, five barriers and one barrier/enabler category for stakeholders to engage, since they could be a barrier or enabler. There were more references to enablers than barriers in the literature and the box below presents both in order of the volume of references to that barrier or enabler:

Box 5. Key finding for review question 4 - enablers and barriers to implementing shade in public playgrounds

Enablers

Scientific evidence

Building on other metrics/measures

Policies and frameworks

Public and other support

Equity considerations

Enabler/barrier – Relevant stakeholders to engage

Barriers

The paper mountain - competition with other policies and guidance documents
Varying and often vague description of requirements

Diversity of playground types
Cost
One-off's – disbanding of the Design and Place SEPP in NSW, other demands for public health input (e.g., emergence of infectious diseases diverting resources)

Scientific evidence was an enabler with the largest number of references from the literature reviewed. A summary paragraph of the evidence-based argument for creating shade that could be used in future advocacy and communication for action is included in the Discussion.

The enabler associated with the second highest volume of literature reviewed is **building upon other metrics**. There are some examples of targets and a myriad of metrics, both directly related to shade in playgrounds and more broadly to other public spaces as well as playgrounds, which have been summarised in the Tables 3, 4 and 5 of the shade benchmarking report [2]. Shade for heat alleviation and UV radiation protection can also link to the sustainability agenda via the Liveable Neighbourhood design concept, and Australian research found that the metrics related to shade (Tree density along footpaths = number of trees along footpaths (within a 5 m buffer) ÷ length (km) of footpaths within the development tree canopy cover = area of footpath shaded by tree canopy cover) were associated with walking outcomes [48].

Another enabler was **policies and guidelines**, and these have been summarised in Table 5 of the benchmarking report [2]. Examples of the development and implementation of policies and guidelines have been described in more detail in Table 3 of this report. Locally, some of the relevant policy is summarised in the Government Architects NSW Greener Places draft design guide [15]. A consideration that could be deemed an enabler for addressing health equity and shade is that there is some evidence that lower socioeconomic areas in NSW may have less shade in playgrounds than higher socioeconomic areas [52]. It should be noted that the sampling of playgrounds in the shade benchmarking report was not designed for measuring these differences with confidence [53].

A possible barrier or enabler was the **engagement of stakeholders**. This was categorised as both since the time necessary to engage multiple stakeholders from different disciplines adds complexity. However, successful stakeholder engagement can lead to action. The Toronto shade guidelines [26] provided a useful listing showing who the document is for and how it can be used, which is placed in the Box 6 below.

The volume of references from the literature that related to barriers for implementing shade generally and in playgrounds was much lower than enablers. The first barrier, with references in two documents, was **competition with other policies and guidelines**. As mentioned under Question 3, Kapelos noted that focusing on shade alone may not be as effective as integrating shade actions within other policies and guidelines [8]. Although not specifically relating to shade, a qualitative investigation via interviews with the intended audiences for a policy document has provided some insights [24] including: avoiding stating the obvious; other forms of guidance may take priority unless the guidance has legislative support; and any form of guidance needs to be sensitive to the context and recommendations of other guidance within a sector.

Two barriers which were somewhat inter-related were the **varying and often vague descriptions** of shade requirement in guidance documents and the diversity of playground types. Both these themes highlight that shade development is complex. The shade benchmarking report [2] concludes that:

'...variations exist in the quality and quantity of shade in NSW council playgrounds due to the inclusion of built and tree shade, shade density due to tree coverage and placement, and the types of materials used for built shade. A key contributor to this variation is differing terminology and descriptions regarding requirements for shade and best practice shade strategies in LGA guidelines and policies.'

The introduction of standard metrics or targets is one way to address these inconsistencies, however the challenge related to this is the wide diversity of playground types. Government Architects NSW Greener Places draft design guidelines have segmented these settings, and provided individual targets which collectively do not have a broad range (50-80% shade) [15]. Another approach has been to provide guidance for audits to each site which form the basis of individual plans [26]. This has also been combined with shade guidance that includes stipulations regarding essential and desirable shade targets [14]. Actions to address both these barriers could be a discussion point for the Shade Strategies project workshop being held in March 2023.

A final barrier that is always a consideration is **cost**. However, there are learnings from pilots in Western Sydney climate friendly playgrounds [43] and Toronto shade guidelines [26] audit process pilots on cost and from scale-up in Toronto that could be considered here.

Box 6. Toronto shade guidelines example of stakeholders and their roles

Strategic and Policy Planners: Incorporate shade into strategic vision and departmental policy; Understand and confirm Public Health responsibilities; Incorporate in the Official Plan, Secondary Plans of the City of Toronto.

City Planners: Ensure shade is addressed within specific planning initiatives and within specific development applications.

Park Planners: Ensure that shade is addressed in park Master Plans and studies for parkland and facilities

Landscape Architects: Incorporate into park designs and specific projects (i.e. playgrounds, waterplays) done in-house by staff or consultants.

Architects: Incorporate into the design of outdoor areas or building edges that are part of building and facility designs

Urban Designers: Address shade within the public realm (i.e. streetscapes, public squares) in studies and specific projects

Managers and Operators of Parks, Open Spaces and Facilities: Understand municipal responsibilities for providing safe public environments to meet the needs of users; Incorporate into operational plans for parks and facilities.

Programmers and Event Planners: Incorporate into event planning, programming of public spaces and issuing permits for use; Promote shade and Sun Safety in public communications and promotion of events.

Public Health Planners: Promote shade and UV radiation protection within communities; Advocate for Sun Safety and UV radiation protection to other municipal departments as part of an overall program of Public Health objectives.

Urban Forestry Planners: Incorporate into annual planting objectives; meeting tree canopy targets; Understand specific location of plantings and species to create useful shade.

Partnership Development Officers: Include shade projects in partnerships with foundations, businesses, not for-profit organizations, community groups, residents' associations and individuals.

Product Suppliers: Understand Public Health objectives and opportunities to develop and supply structures and portable shade devices.

Community Groups: Understand Public Health objectives as part of advocacy for shade and UV radiation protection; Promote shade in specific community projects.

Question 5. Amongst all the key source documents, what are the gaps in the information required to inform strategies that can increase shade in playgrounds in NSW?

The most notable gap is **evidence of strategies leading to increased shade**. As noted above regarding the effectiveness of strategies in relation to the creation of shade, the amount of information retrieved in relation to this question varied between each category of strategy. However, often it related to intermediate changes such as the adoption of the strategy rather than the outcome of increased shade in playgrounds. More information on the latter could be explored by contacting some teams responsible for implementing the strategies and some research groups involved in testing the effects of shade. Meanwhile, action for this Shade Strategies project can progress on the understanding that it is informed by the best available evidence relating to these questions at the time and with input from key stakeholders.

It was also noted earlier that information to help **integrate shade into other planning agendas** to achieve co-benefits is lacking. The article by King and colleagues [1] provided some important information to fill this gap, and more of this description of practice and its evaluation (whether in published or in the grey literature) is necessary.

The practice-based research example from King and colleagues [1] illustrates a more general gap in information. The current evidence review included an extensive search to identify this type of practice-based research and evaluation in the literature, by reviewing an extensive list of project documents provided by the Project Team, searching databases and a search engine that include grey literature as well as including specific search terms which may be expected to identify this work (e.g., process evaluation).

Discussion and suggested next steps

A broad range of grey and published literature has been considered to provide information to address the review questions for this evidence summary. The focus was on strategies that have been implemented in real-word settings to try to improve shade availability in playgrounds since it is intended that this information will inform a discussion paper to guide the Shade Strategies workshop.

The evidence review found details of seven examples of shade targets implementation and 19 examples of strategy implementation. The suite of possible strategies presented in Table 3 can be considered for prioritisation as part of a future action plan for increasing shade in NSW. Monitoring of sun safety behaviours amongst adults in NSW supports the need for creating shade in parks, since the NSW population health survey results between 2016 and 2018 indicate that adults perceive that it has become significantly more difficult to access shade in public spaces including playgrounds [54]. With participation from inter-disciplinary stakeholders, prioritisation could be based on assessing the advantages and disadvantages of different approaches, as well as the capacity and skills of individuals and organisations involved and the political landscape at the time. It is certain that a combination of strategies will be required to increase UV-protective shade in NSW playgrounds over time [34].

Whilst evidence of these strategies had an impact on increasing shade use was lacking, past experience of comprehensive programs to prevent skin cancer which include policy and environmental change, such as access to shade, were found to be cost-effective and have coincided with reductions in skin cancer incidence amongst younger cohorts [34]. Additionally, what was evident from the two RCTs [36, 37] and one natural experiment [38] presented in Table 4 is that if shade is built in playgrounds and other recreation areas within parks it is effective for increasing park/playground use, for increasing shade use, and for decreasing UV radiation exposure. It should be noted that in the three experimental studies the authors state that the use of recreational areas and playgrounds in their studies started with a low baseline. Therefore, whilst they demonstrated statistically significantly greater odds of use of intervention playgrounds, significantly greater use of shaded areas and a significant greater decrease in UV exposure amongst participants in intervention versus control playgrounds and parks, the increases in use may be small because the baseline use was low.

These three intervention studies were focussed on built shade, so more intervention studies that include both built and natural shade in the design are needed. In addition, research to address the question of whether the investment in public playgrounds versus other spaces such as school playgrounds, community hubs, markets, performing arts sites, dining areas, and recreation spectator areas is needed [36], and consideration could be given to studies which compare the typical time people spend in these spaces along with their level of exposure to harmful UV radiation when prioritising investments to increase shade in different environments [36]. However, public playgrounds are important public spaces where children and their carers gather, and small positive impacts amongst a lot of people (i.e. large reach) is seen as promising for achieving outcomes in population health. Further, public playgrounds may be more amenable to change in the NSW context given the

actions the Cancer Institute NSW and Cancer Council NSW have already completed to benchmark current levels of shade in public playgrounds and to advise on increasing shade in public playgrounds with local government [2, 18]. This review also summarised the experience of Toronto in Table 3, which included pilot studies in playgrounds of their site-specific shade audit approach that demonstrated these could be streamlined to reduce their cost [8]. These pilot studies were noted as a key factor in their more general shade guidelines being adopted by the City.

The lack of published literature on existing targets for shade and no scientific agreement on a standard metric may be due to the complexity of the many factors that influence the benefits that shade provide in reducing UV radiation exposure, which are highly technical and often not generalisable since they are influenced by geographical location and are site specific [7]. An alternative strategy to targets and metrics that addressed this complexity, and which was prevalent in the literature identified in this review, was to conduct site-specific audits for sites which have playgrounds. These audits can also be accompanied by recommendations of 'minimum requirements' for shade [14]. Holman and colleagues provide a summary of common steps in site-audit process as well as a table summarising available audit tools up to 2017 [7].

This realist review has some strengths and limitations. The realist approach [3, 4], which considers context, mechanism and outcomes for complex interventions [4], aligned well with the review questions. Within the limits of the project, 59 source documents were reviewed which provided ample evidence to inform the discussion document. However, the review was not exhaustive since only two databases and one search engine were searched, authors of key studies were not contacted and since school playgrounds were not in our inclusion criteria this parallel evidence was not assessed. Therefore, it is possible that some information was missed. To support the Shade Strategies project, additional information could be sought from the developers, implementers and researchers involved in the included projects and policies.

Based on our findings we offer the following suggested next steps for Cancer Institute NSW and Cancer Council NSW to consider under six themes:

I. Generate evidence
II. Contact key groups involved in shade implementation and researchers globally
III. Consider documenting the evidence-informed rationale for shade targets
IV. Explore integrating shade within other metrics and policies
V. Weigh-up the best tools and approaches for action
VI. Consider the best ways to work with commercial developers

I. Generate evidence on outcomes from increasing shade in playgrounds

1. Contribute to generating new evidence on the outcome of increased shade in playgrounds via the Shade Strategies project. **Short-term options** include re-establishing (first three groups in dot points below) or making (last two groups in dot-points below) connections with key research groups and policymakers identified via this review to see if they have any currently unpublished information. These people may include:

- The QUT group who conducted the shade benchmarking research [2]
- The groups from Melbourne and Denver who were involved in the RCT measuring effects of built shade in public parks in both cities [37], and the shade sails natural experiment in Melbourne [38]

- The Western Sydney University group who have conducted research on climate-smart playgrounds [9, 43]
- The North American group of authors listed in the study by Olsen and colleagues [44]
- City staff in Phoenix who are involved in the implementation of the Tree & Shade Masterplan [17].

In the **medium-term** this could be generated by monitoring the impacts of actions that arise from the project in local government areas, as was recommended in the report for integrating shade in NSW local government planning policy [18]. In the **long-term**, a follow-up study to the shade benchmarking project could be conducted to measure the impacts on shade availability in playgrounds across the State.

II. Contact key groups involved in shade implementation and researchers globally

2. Contact those supporting Phoenix's Tree and Shade Masterplan for information of impacts [17], given it was adopted in 2010 and its vision was for 2030.

3. Maintain relationships with the groups involved directly in implementing sustained efforts of some of the comprehensive strategies e.g., Toronto and Victoria/Denver. Information on their experiences with development and implementation of their strategies, as well as the outcomes they have achieved since publication are valuable.

4. Consider collaborating with researchers to conduct secondary data analyses to assess whether street shade is associated with physical activity across many countries using IPEN adolescent study data [47].It is promising that a measure including shade is now incorporated in a large global study of urban environments and physical activity amongst adolescents.

III. Consider documenting the rationale for shade targets using evidence from this review

5. If a consistent shade target is to be documented, some information on rationale and supportive evidence should be documented. The review identified information that could inform how targets or other metrics for shade could be developed such as:

- Observational epidemiology on shade use [55, 56];
- Technical information and guidance on built and natural shade design and development [2, 7, 8, 17, 37, 44, 57];
- A summary of relevant built environment metrics which was intended to guide future efforts in developing shade targets (see Table 4 in the Benchmarking Share in NSW full report [2]);
- Existing metrics which playground shade metrics could be integrated into e.g., a trialled Liveable Neighbourhood guideline that currently includes street shade [25], and
- Playground heat mitigation metrics [9, 43, 44].

IV. Explore integrating shade within other metrics and policies

6. Building shade into other policy documents and metrics could be explored as an enabler to creating more shade in playgrounds. Since public parks are also usually incorporated in Liveable Neighbourhood guidelines metrics, playground and total shade within them could also be considered in such guidelines [48].

7. Map the policy paths and the priority stakeholders to engage with, to advocate for integration of shade in policies related to achieving sustainable development goals. This path may include more

immediate links to tree canopy targets, mitigating heat and the urban heat island effect and creating liveable neighbourhoods.

V. Weigh-up the best tools and approaches for action

8. Gain stakeholder feedback on a comparison (e.g. advantages and disadvantages) of more generic guidance documents and audit tools such as the Cancer Council's Guidelines to shade [27] to examples with highly technical setting and site-specific guidance like the Toronto shade guidelines and the Government Architects NSW Greener Places draft design guidelines and the Queensland Creating Shade at Public Facilities: Policy and Guidelines for Local Government document [14].

VI. Consider the best ways to work with commercial developers

9. Consider how to address adoption of any voluntary shade enhancement strategy by commercial developers of playgrounds in new developments.

The two previous related projects – Benchmarking Shade in NSW Playgrounds [2] and Shade and UV inclusion in NSW local government planning policy [18], should be considered as accompanying reports.

Appendices

Appendix 1—Search strategy

Medline via Ovid for no date specified, conducted 2 November 2022

Population

Select human studies filter

Intervention

1. tree
2. (built adj2 shade).tw.
3. (natural adj2 shade).tw.
4. sun protection
5. (sun adj2 protection).tw.
6. (shade adj2 sails).tw
7. (tree adj2 canopy).tw
8. Canopy
9. Awning
10. heat
11. co-benefits
12. indicator
13. GIS
14. ~~measure~~
15. target
16. metric
17. built environment
18. Built form
19. urban design
20. planning
21. intervention
22. strategy
23. (intervention adj2 component).tw.
24. legislation
25. policy
26. advocacy
27. (engagement adj2 process).tw
28. (awareness adj2 campaign).tw.
29. guideline
30. standard
31. (minimum adj2 standard).tw.

32. grant*

Context

33. Playground
34. (play adj2 space).tw.
35. Park
36. (recreation adj2 area*).tw.
37. (recreation* adj2 place*).tw.
38. outdoor
39. outside
40. (green adj2 space*).tw.

Outcomes

Primary

41. Shade

Secondary

42. 36. (sun adj2 burn*).tw.
43. 37. sunlight
44. 38. sunshine
45. 39. sun
46. 40. (Ultraviolet adj2 ra*).tw.
47. 41. ultra violet ra*
48. 42. UV radiation
49. 43. UVR
50. 44. ultraviolet light
51. 45. UVL
52. 46. burn
53. 47. burning
54. 48. reddening
55. 49. overexposure
56. 50. skin neoplasm*
57. 51. skin cancer
58. 52. skin cancer*
59. 53. melanoma
60. 54. sun-safe*
61. 55. sun safe
62. Sun smart

Study designs

63. review
64. systematic review
65. (systematic adj2 review).tw.
66. (meta adj2 analysis).tw.
67. RCT
68. randomized controlled trial

69. random allocation
70. clinical trial
71. epidemiologic studies
72. observational
73. exp cohort studies/
74. (randomly allocated or cohort analy* or longitudinal).tw.
75. (allocated adj2 random*).tw.
76. (cohort adj (study or studies)).tw.
77. (Follow up adj (study or studies)).tw.
78. evaluation
79. (impact adj2 evaluation).tw.
80. (outcome adj2 evaluation).tw.
81. (process adj2 evaluation).tw.
82. (case adj2 study).tw
83. commentary

Combine within I, C with OR

84. 1 or 2 or 3 or... 32
85. 33 or 43 … or 40

Just primary O

86. 41

Primary + secondary O

87. 42 or... 61

Combine S

88. 62 or 63 ... 80

Combine overall search with AND for primary outcome only

82. 83 and 84 and 85 and 87

Combine overall search with AND for primary plus secondary outcomes

81. 83 and 84 and 86 and 87

#	Query	Results from 2 Nov 2022
1	..nlp tree [58]	6,443
2	(built adj2 shade).tw.	12
3	(natural adj2 shade).tw.	72

4	..nlp sun protection {No Related Terms}	3,951
5	(sun adj2 protection).tw.	3,111
6	(shade adj2 sails).tw.	6
7	(tree adj2 canopy).tw.	811
8	..nlp Canopy {No Related Terms}	5,733
9	..nlp Awning {No Related Terms}	19
10	..nlp heat {No Related Terms}	17,186
11	..nlp co-benefits {No Related Terms}	562
12	..nlp indicator {No Related Terms}	8,408
13	..nlp GIS {No Related Terms}	8,986
14	..nlp target {No Related Terms}	9,614
15	..nlp metric {No Related Terms}	2,743
16	..nlp built environment {No Related Terms}	10,967
17	..nlp Built form {No Related Terms}	24,098
18	..nlp urban design {No Related Terms}	463
19	..nlp planning {No Related Terms}	11,073
20	..nlp intervention {No Related Terms}	10,461
21	..nlp strategy {No Related Terms}	18,825
22	(intervention adj2 component).tw.	1,113
23	..nlp legislation {No Related Terms}	8,791
24	..nlp policy {No Related Terms}	11,864
25	..nlp advocacy {No Related Terms}	4,620
26	(engagement adj2 process).tw.	510
27	(awareness adj2 campaign).tw.	1,067
28	..nlp guideline {No Related Terms}	9,507
29	..nlp standard {No Related Terms}	12,870
30	(minimum adj2 standard).tw.	1,269
31	..nlp grant* {No Related Terms}	5,214
32	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31	194,695

33	..nlp Playground {No Related Terms}	1,590
34	(play adj2 space).tw.	199
35	..nlp park {No Related Terms}	3,595
36	(recreation adj2 area*).tw.	264
37	(recreation* adj2 place*).tw.	95
38	..nlp outdoor {No Related Terms}	3,656
39	..nlp outside {No Related Terms}	4,942
40	30 or 34 or 35 or 36 or 37 or 38 or 39	13,966
41	..nlp shade {No Related Terms}	7,806
42	(sun adj2 burn*).tw.	74
43	..nlp sunlight {No Related Terms}	8,942
44	..nlp sunshine {No Related Terms}	2,618
45	..nlp sun {No Related Terms}	4,041
46	(Ultraviolet adj2 ra*).tw.	16,874
47	..nlp ultra violet ra* {No Related Terms}	356
48	..nlp UV radiation {No Related Terms}	5,149
49	..nlp UVR {No Related Terms}	3,131
50	..nlp ultraviolet light {No Related Terms}	6,139
51	..nlp UVL {No Related Terms}	201
52	..nlp burn {No Related Terms}	14,262
53	..nlp burning {No Related Terms}	4,128
54	..nlp skin neoplasm* {No Related Terms}	18,878
55	..nlp skin cancer {No Related Terms}	7,392
56	..nlp skin cancer* {No Related Terms}	5,510
57	..nlp melanoma {No Related Terms}	16,944
58	..nlp sun-safe* {No Related Terms}	114
59	..nlp sun safe {No Related Terms}	4,555
60	..nlp sun smart {No Related Terms}	8,531
61	(sun adj2 smart).tw.	35

62	41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61	108,273
63	..nlp review {No Related Terms}	116,629
64	..nlp systematic review {No Related Terms}	35,853
65	(systematic adj2 review).tw.	252,975
66	(meta adj2 analysis).tw.	215,401
67	..nlp RCT {No Related Terms}	10,167
68	..nlp randomized controlled trial {No Related Terms}	17,898
69	..nlp random allocation {No Related Terms}	18,960
70	..nlp clinical trial {No Related Terms}	16,390
71	..nlp epidemiologic studies {No Related Terms}	10,796
72	..nlp observational {No Related Terms}	14,604
73	exp cohort studies/	2,410,172
74	(randomly allocated or cohort analy* or longitudinal).tw.	348,973
75	(allocated adj2 random*).tw.	38,377
76	(cohort adj (study or studies)).tw.	290,023
77	(Follow up adj (study or studies)).tw.	54,688
78	..nlp evaluation {No Related Terms}	13,926
79	(impact adj2 evaluation).tw.	1,644
80	(outcome adj2 evaluation).tw.	4,343
81	(process adj2 evaluation).tw.	9,216
82	(case adj2 study).tw.	217,461
83	..nlp commentary {No Related Terms}	22,040
84	63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83	3,356,037
85	32 and 40 and 41 and 84	3
86	32 and 40 and 62 and 84	14
87	find similar to Sun-protective clothing and shade use in public outdoor leisure settings	1

	from 1992 to 2019: Results from cross-sectional observational surveys in Melbourne, Australia.	
88	find similar to Shade Sails and Passive Recreation in Public Parks of Melbourne and Denver: A Randomized Intervention.	5
89	find similar to Skin cancer prevention in outdoor recreation settings: effects of the Hawaii SunSmart Program.	5

Google Scholar - *completed 27 October 2022*

Population

(Infants OR children OR adolescents OR adults) AND

Intervention

(shade provision OR environmental exposure OR purpose built OR target OR protection OR prevention OR prevention and control OR intervention OR health promotion OR environment design OR environment and public health OR built environment urban design OR physical environment OR urban architecture OR co-benefits OR tree) AND

Setting

(playground OR play space OR park OR play OR outdoor OR outside OR recreational area OR recreation OR recreational place) AND

Outcome

shade AND

Study design

(RCT OR randomized controlled trial OR observational study OR cluster randomized trial OR experimental study OR quasi experiment OR experimental design OR group comparison OR control group OR natural experiment OR evaluation OR outcome evaluation OR case study OR commentary)

Filter for date range of past two years, English language and sort by relevance.

Results

17,200 papers

On review of the first 350 papers, 30 titles were located that were of potential relevance.

The screening was suspended after 700 titles were reviewed as no relevant titles were located after the first 350 relevant titles were reviewed.

The 30 papers of potential relevance were downloaded to EndNote and abstracts of each were reviewed:

- Five papers had been in other searches completed for the evidence review
- Twenty papers were not relevant, for example because the paper did not address playgrounds, the intervention was not pertinent to the guiding questions, etc.
- Five papers were relevant. Full text versions of these papers were downloaded and added to the EndNote library.

Reference for BOOLEAN language in Google Scholar: **BOOLEAN language guide used**: https://southern.libguides.com/google/boolean

Quotation marks were trialled for direct work matches, but this resulted in a lot of irrelevant literature.

Compendex via Engineering Village for 1884-2023:

Compendex (((((((Infants OR children OR adolescents OR adults)) WN ALL) AND (((target OR shade provision OR environmental exposure OR purpose built OR protection OR prevention OR prevention and control OR intervention OR health promotion OR environment design OR environment and public health OR built environment urban design OR physical environment OR urban architecture OR co-benefits)) WN ALL)) AND (((playground OR play space OR park OR play OR outdoor OR outside OR recreational area OR recreation OR recreational place)) WN ALL)) AND ((("Shade" "Sunburn" OR "sunlight" OR "sunshine" OR "sun" OR "sun exposure" OR "UV radiation" OR "UVR" OR "overexposure" OR "skin cancer" OR "melanoma" OR "sun safe")) WN ALL)) AND ((("RCT" OR "randomized controlled trial" OR "observational study" OR "cluster randomized trial" OR "experimental study" OR "quasi experiment" OR "experimental design" OR "group comparison" OR "control group" OR "natural experiment" OR "evaluation" OR "outcome evaluation" OR "case study" OR "commentary")) WN ALL))

Results

33 papers

After screening titles and abstracts, one paper was included.

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