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EUROPEAN ENVIRONMENT AND HEALTH PROCESS

Urban Green Space Interventions and Health

A review of impacts and effectiveness

World Health Organization

REGIONAL OFFICE FOR Europe

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Abstract

Interventions on green space in urban settings can help address public health issues related to obesity, cardiovascular effects, mental health and well-being. However, knowledge on their effectiveness in relation to health, well-being and equity is incomplete. To explore the effectiveness of urban green space interventions to enhance healthy urban environments, the WHO Regional Office for Europe reviewed research findings, local case studies and Environmental Impact Assessment/Health Impact Assessment experiences, and assessed their impacts on environment, health, well-being and equity. This report provides the three working papers prepared for a meeting, and presents the discussion and conclusions on what intervention components have been found to be effective in maximizing the environmental, health and equity benefits derived from urban green spaces.

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CONTENTS

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Ruth Hunter, Anne Cleary and Claire Cleland (Working Paper 1: Evidence review on the environmental, health and equity effects of urban green space interventions);

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Executive Summary

There is a wide range of international agreements and commitments to enhance and support the establishment of green spaces in urban settings, as these are considered to provide a range of benefits to the urban population. WHO has recently published an evidence review on the health impacts of urban green spaces, providing indicators for the local assessment of green space accessibility. Such indicators enable local authorities and urban planners to assess in which urban areas green space accessibility should be improved, and to establish respective planning decisions.

Yet, little is known on the most effective ways to deliver urban interventions on green spaces, and how to make sure that the environmental, social and health benefits are maximized while potential side effects are prevented or reduced. To explore which green space intervention components work and deliver the best results, WHO compiled:

- available research evidence on urban green space interventions and their impacts;
- local green space intervention case studies and lessons learned; and
- existing Impact Assessment experiences on green space planning.

The results indicate that urban green space is a necessary component for delivering healthy, sustainable and liveable cities. Interventions to increase or improve urban green space can deliver positive health, social and environmental outcomes for all population groups, particularly among lower socioeconomic status groups. There are very few, if any, other public health interventions that can achieve all of this, and especially the impact on active lifestyles, mental well-being and social interaction is frequently highlighted as a key benefit. Yet, there is a need for better inclusion of health and equity outcomes in studies on green space interventions, and an improved monitoring of local green space management and related health and equity impacts. Little evidence is also available on unintended side effects of urban green space interventions.

The compiled evidence shows that multidisciplinary and cross-sectoral collaborations help to ensure that urban green space interventions deliver on multiple outcomes and provide a variety of functional opportunities that attract different population groups. Urban green space interventions seem to be most effective when a physical improvement to the green space is coupled with a social engagement/participation element that promotes the green space and reaches out to new target groups (“dual approach”).

Urban green space interventions need to be planned and designed with the local community and the intended green space users. This will ensure the derivation of benefits for the local residents and will aid the delivery of interventions that serve the needs of the community - especially in deprived areas.

As green space interventions need to be considered as long-term investments, they need to be integrated within local development strategies and frameworks (e.g. urban masterplans, housing regulations, transport policies, sustainability and biodiversity strategies). This requires continued political support within local government, and the general understanding that urban green spaces go beyond environmental or ecological objectives and also deliver social and health benefits that increase the quality of life and well-being of all urban residents.

1 Introduction

1.1 Urban green space interventions and health

In 2010, at the Fifth Ministerial Conference on Environment and Health in Parma, Italy, Member States of the WHO European Region made a commitment *"…to provide each child by 2020 with access to healthy and safe environments and settings of daily life in which they can walk and cycle to kindergartens and schools, and to green spaces in which to play and undertake physical activity*"[2]. Improving access to green spaces in cities is also included in the UN Sustainable Development Goal 11.7 ("B*y 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities*"[3]) and the New Urban Agenda adopted at Habitat III ("*We commit ourselves to promoting safe, inclusive, accessible, green and quality public spaces (…) that are multifunctional areas for social interaction and inclusion, human health and well-being"*[4]*).* Finally, the WHO Action Plan for the implementation of the European Strategy for the Prevention and Control of Noncommunicable Diseases in 2012−2016 includes a call to create health-supporting urban environments[5].

In response to these commitments, the WHO Regional Office for Europe published a review of evidence on urban green spaces and health in 2016 and suggested an indicator methodology to measure accessibility of urban green space.[6] The report provided cities with up-to-date evidence on health impacts of urban green spaces and a systematic approach to quantifying and monitoring their green space access, but did not provide practical information on how to design, implement and manage urban green spaces so that they deliver optimal benefits for urban communities.

Understanding how to design and deliver effective urban green space interventions is critical to ensuring that urban green space delivers positive health, social and environmental outcomes. The WHO Regional Office for Europe has therefore engaged both researchers and practitioners of urban green space interventions to interrogate the existing evidence base and provide orientation for practical on-ground green space interventions.

This report provides the conclusions of the project and is based on evidence and case study examples which were reviewed at a WHO expert meeting in Bonn, Germany (September 2016), for which WHO acknowledges financial support from the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.

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[2] Parma Declaration: http://www.euro.who.int/__data/assets/pdf_file/0011/78608/E93618.pdf

[3] Sustainable Development Goals and related targets: https://sustainabledevelopment.un.org/topics

[4] New Urban Agenda: https://www2.habitat3.org/bitcache/99d99fbd0824de50214e99f864459d8081a9be00?vid=591155&disposition=inline&op=view

5 Action Plan for implementation of the European Strategy for the Prevention and Control of Noncommunicable Diseases 2012−2016: http://www.euro.who.int/__data/assets/pdf_file/0019/170155/e96638.pdf?ua=1

[6] Urban green spaces and health: http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1

1.2 Definition of urban green space and related interventions

In the context of this report, "urban green spaces" are considered as urban space covered by vegetation of any kind. This includes

- smaller green space features (such as street trees and roadside vegetation);
- green spaces not available for public access or recreational use (such as green roofs and facades, or green space on private grounds); and
- larger green spaces that provide various social and recreational functions (such as parks, playgrounds or greenways).

Some of these larger green space structures (such as green belts, green corridors or urban woodlands) can actually have regional scope and provide ecological, social and recreational services to various urban communities.

Urban green space interventions are defined as urban green space changes that significantly modify green space availability and features through

- creating new green space;
- changing or improving green space characteristics, use and functions; or
- removing/replacing green space.

The interventions can be implemented in publicly accessible green space, including school yards, private parks and similar settings if they are open to the public.

The use of the term "urban green spaces" should not be considered in conflict with other commonly used terms and definitions, such as "green infrastructure", "green corridors" or "public open space" which tend to be applied in urban and regional planning.

2 Review of research on and implementation of green space interventions in urban settings

2.1 Evidence review findings[7]

2.1.1 Relevance of urban green space interventions vis a vis their effectiveness

The most promising intervention approaches are (1) park-based interventions combined with social promotion activities, and (2) greening interventions (such as street trees, greening vacant lots, green infrastructure for water management).

There is inconclusive evidence on the effectiveness of some urban green space interventions (e.g. park-based interventions involving only a change to the built environment, urban greenways and trails, or pocket parks). This is partially affected by a limited number of intervention studies carried out, and inadequate evaluations that do not provide data on health or equity outcomes.

In light of the methodological limitation to intervention studies with a pre-post design, and acknowledging that cross-sectional and observational evidence suggests green spaces to have strong benefits for health and equity, all kinds of urban green space interventions should be considered on local level to provide a diversity of green spaces that are accessible and usable for various population groups.

Considering the evidence when planning interventions may provide opportunities to strengthen the intervention design by applying intervention components that are most promising. Yet, intervention types with inconclusive evidence should still be considered and their impacts should be monitored to provide better information on their effectiveness.

2.1.2 Urban green space intervention outcomes

The intervention outcomes assessed are dependent on the specific objectives of the intervention, most often there are various or different expected outcomes. Given the range of urban green space interventions included in the review, it is not appropriate to directly compare different outcomes across different intervention approaches. Also, urban green space interventions are context-specific, resulting in different outcomes in different settings with differing populations.

Urban green space interventions have the potential to affect a range of outcomes including the exposure to environmental risks, lifestyles and behavioral aspects, health and well-being, social equity and quality of life in general. For monitoring and evaluation of urban green space interventions by local practitioners, usage of urban green space should be considered a suitable proxy measure of success even though health aspects etc. may not be directly covered. The working paper employed a systematic review methodology and included studies of at least modest quality (i.e. pre-post intervention or controlled post-intervention measurement). The

[7] See Appendix 1 for the evidence review.

relatively limited number of eligible studies per intervention category indicates that there is further need for high quality green space intervention research and the academic evaluation of natural experiments in order to add to this evidence base.

Observational and cross-sectional research suggests a wider range of outcomes and associations with urban green space that were not covered by the included studies but can help to inform local practice.

Overall, urban green space interventions can represent powerful opportunities for public health as they have the capacity to provide a wide range of environmental, social and health benefits. Even though the available information does not allow to quantify the extent and magnitude of these benefits for different intervention approaches, the expert group acknowledged that there is little evidence for other infrastructural interventions to provide a similar diversity of potential benefits as green space interventions do.

2.1.3 Good practice and design

The evidence on urban green space interventions and their outcomes informs many professionals – such as urban planners, green space managers, landscape architects, medical practitioners, public health professionals, community safety officers – as well as the local community groups engaged in urban sustainability and health protection.

Good practices derived from the urban green space intervention review with relevance for local action are listed below.

- Early engagement with user groups and the local neighbourhood community helps to assess their needs and demands (and to potentially inform evaluation procedures).
- Targeting intervention activities to specific population groups (such as children, elderly people or people with different cultural background) or urban areas can be very relevant, but requires good knowledge on what specific community groups need.
- A multidisciplinary team is needed for adequate designing, planning and managing of the urban green space interventions.
- The intervention review suggests dual approaches including both physical changes to the urban environment, and promotional/engagement activities.
- As urban green spaces develop overtime, long-term perspectives are needed for both maintenance and management, and the respective funding.

Interventions should be based on the needs of the area (e.g. flood risk management, children's play) which should guide the type of intervention, the function of the green space, and the type of vegetation applied.

2.1.4 Evaluation

Evaluation of urban green space interventions is necessary to better understand its consequences, assess whether it has achieved the objectives set, and identify whether all population groups benefit equally. It is essential to plan evaluation from the outset of the intervention, including

baseline data collection to compare the intervention effects. As urban green spaces may need time to develop, and local communities may use such areas increasingly over time, evaluations should cover at least a two year period after the intervention is implemented. Evaluation activities should be budgeted from the beginning of a project, with a suggestion of ca. 10% of the total budget.

The evaluation of outcomes must match the scale of the project and be realistic regarding expected outcomes, changes and data availability. Often, local practitioners benefit from quantitative data and it is helpful to consider early in the process what quantitative data could be obtained with reasonable effort. The use of routinely collected statistical data on local level should be maximized. Yet, the use of other types of arguments and measurements to complement the quantitative data is necessary to avoid that the lack of quantitative data is interpreted as a lack of evidence in general.

The urban green space intervention studies reviewed were almost exclusively published by academic institutions. Local practitioners and authorities should therefore consider approaching (or teaming up with) academic institutions when planning an intervention to discuss data collection, potential funding opportunities, and methods for robust evaluation etc. Similarly, the role of citizen science and participatory research in evaluation should be considered. This may aid data collection and evaluation, and would also help to increase the active uptake of the interventions.

The quality of evaluation often depends on funding requirements which may focus on a narrow range of outcomes or require an evaluation report within a short time frame. This may limit the overall value of evaluation work and potentially underestimate the intervention benefits. Also, it is important to consider evaluations as a means to improve and further develop urban green space interventions. Pioneering and innovative interventions may not achieve their expected objectives immediately but as interventions develop, lessons are learnt.

Given the range of urban green space interventions, and acknowledging the different functions green space provides to different population groups, evaluation should not only investigate population-level outcomes but also consider equity effects and impacts for specific groups – especially disadvantaged or underserved target groups.

2.1.5 Risks and unintended side effects

None of the included studies measured harms, adverse effects or unintended consequences (for example gentrification processes, property damage and health and safety considerations such as fear of crime, falling branches or injuries in general, anti-social behaviour, allergenic pollen, vector borne disease or overexposure to sunlight). However, such unintended side effects can, in most cases, be prevented or strongly reduced through good design, planning and practice. Multidisciplinary approaches throughout the process help to ensure that unintended side effects are identified and dealt with appropriately.

Another unintended impact of interventions may be the unfair and unequal distribution of benefits and risks between different population groups (e.g. socioeconomic, gender, age), one example being gentrification and rising property prices in the respective area. Such unintended effects should be documented as part of the evaluation process to inform future interventions.

2.1.6 Priority areas for further research

Compared with the body of evidence on green spaces and health based on observational and cross-sectional studies, there is a limited but growing evidence base investigating the impacts of urban green space interventions. Yet, more research on urban green space interventions and how to reach "hard to engage" target groups is needed, as indicated below.

- A key question for research, with high practical relevance for local planners, is the required dose of and exposure to urban green space – what is the minimum amount per person required, and what is the ideal type of urban green space?
- Practical research to help municipalities choose between urban green space interventions based on the evidence and outcomes would provide useful guidance for action.
- Multidimensional evaluations are needed to cover the many outcomes of urban green space interventions, with a special focus on health and equity aspects.
- The development of alternative and innovative evaluation methodologies (e.g. application of realist approaches – 'what works, in which circumstances and for whom?') would be useful to enable appropriate evaluation on the local level. In this context, it would also be relevant to ensure that studies are measuring net benefits and not potential displacement effects.

2.1.7 Funding of green space research

Funders need to become more aware of the relevance of urban interventions in general, and especially the impacts of green spaces. When funding green space interventions, the budget should enable robust evaluation studies to inform further work and prevent negative outcomes.

Urban and green space interventions often fall between disciplinary boundaries and therefore need multidisciplinary funding streams.

2.2 Findings from the review of local intervention case studies[8]

2.2.1 Good Practice Component on "dual approaches" – incorporating physical features and engagement activities

All urban green space interventions should apply a dual approach where physical changes (e.g. creating new or improving existing green space) are accompanied by social changes (e.g. social

[8] See Appendix 2 for the case study review.

activities and programs to promote the green interventions). Social activities can be diverse and may occur at all phases of the intervention (e.g. design, implementation and evaluation phases), these include aspects such as:

- community participation in the design or implementation phase of the intervention or in the green space maintenance post-implementation;
- facilitated activities within the completed urban green space intervention, for example, family days, festivals and markets or smaller scale group activities such as guided walks, which can be particularly effective for engaging with underrepresented user groups of green space; and
- promotion of completed urban green space intervention through park web site, onsite signs etc.

2.2.2 Good Practice Component on stakeholder collaboration

It is important to create diverse, multidisciplinary and cross-sectoral collaborations to ensure that urban green space interventions are integrated within both urban planning and health sectors and are designed and delivered with multiple outcomes in mind. This could be achieved through the following actions:

- Develop, with the community, a clear vision for the green space that can be shared and supported by all stakeholders, including politicians.
- Support key actors within local organizations and sectors to advocate for urban green space interventions.
- Secure leadership among decision-makers for the urban green space intervention.
- Work with academic institutes and research centres, where possible, in order to aid effective monitoring and evaluation of the intervention.

2.2.3 Good Practice Component on community engagement

Local municipalities need to be clear and firm in fulfilling their responsibility of providing adequate green space access for all residents. Community engagement can help decide how the urban green space intervention should be designed and delivered, enabling municipalities to take informed decisions reflecting the needs of the community. The steps listed below could be considered to engage the community.

- Engage with the intended users when designing and developing the urban green space intervention. Not designing for people, but designing with people. This requires that all local residents have access to information about a potential intervention project and have the opportunity to participate and engage in the project design.
- Support local champions to advocate for and promote urban green space as well as to help with engaging the local community.
- Continuously communicate with the community in a clear and effective way that includes building their environmental awareness and knowledge of the environmental characteristics and roles of the urban green space.

- Engage children and young people with the urban green space as they are the future user and carers of the urban green space.

2.2.4 Good Practice Component on place-making and creating identity

Creating public places that are meaningful for residents is a key to success. For urban green spaces, this means that a distinctive and unique character of the green space is expressed within the design. Where possible, the design should acknowledge the local characteristics and historical and cultural setting of the green space. This helps to create a sense of purpose and identity for (different parts of) the green space and can be achieved through engaging with the community during the design phase and/or through applying place-making principles.

Urban green spaces should provide opportunities for meaningful activities such as play, leisure, recreation or relaxation. These meaningful activities will be dependent on the needs and demographics of the users and could range from providing facilities for play or urban gardening to providing areas for social interaction or relaxation and reflection.

Yet, too much planned design of public spaces may increase the risk that the green spaces become too "structured", predicting and limiting its functional use and providing insufficient space for unplanned or unstructured activities. Urban green spaces should therefore incorporate open spaces to enable flexible use or allow for unplanned functions.

2.2.5 Good Practice Component on long-term perspective

Green space areas are a long-term investment and often need time to fully develop their functions and benefits. It is therefore necessary to have a long term perspective (various decades and beyond, depending on the green space component) when planning, designing and implementing urban green space interventions, and to embed the urban green space objectives within other local planning frameworks (especially for spatial planning, but also in relation to financial or health plans).

The demographics and needs of the community, and how they interact with and use the green space, may change over time. Urban green spaces need to be able to cater for this change through adaptive and flexible design.

To optimize the benefits of a new urban green space, it will be important to continue promoting, developing and improving it after implementation. Laying the last stone is not the last but the first step – urban green space interventions are long-term commitments.

2.2.6 Good Practice Component on planning and design

The case studies and qualitative interviews with the case study leaders and local authorities revealed a wide range of valuable experiences and lessons learned on planning and designing urban green spaces. Across the case studies and local experiences, the following conclusions emerged and may inform local action.

- Establish many urban green spaces throughout the city and avoid focusing major investments on one or very few green spaces only – the demand placed upon them may be to the detriment of their quality and the benefits they provide. The same may happen if too many functions are embedded in an urban green space setting that does not provide the necessary size or quality, leading to potential conflict between users and functions.
- Design the urban green space intervention within the context of the whole urban area and surrounding environment. For example, consider the connectivity of the intervention with other green spaces (e.g. green trails or biodiversity corridors) and urban destination points (e.g. city centre or local points of interest).
- Avoid species of trees or types of vegetation that are known to produce allergenic pollen or block cross-ventilation in streets and public places.
- Provide practical design of urban green spaces. Enhanced and visible access points (e.g. improved entrances and paths) and use features (e.g. resting areas, trash bins, orientation signs) can be highly effective and cost-efficient for improving use of the green space.
- Consider the role that urban green space may play in delivering ecosystem services (such as flood mitigation, air pollution reduction and climate change adaptation) and how the green space can be designed to optimize these services and avoid unintended consequences.
- Consider how seasonal variation may affect the use of the urban green space and integrate design features to mitigate this (e.g. adequate lighting for reduced daylight hours during winter or adequate drainage from paths during the wetter seasons.
- Be diverse in the provision and rehabilitation of urban green spaces. Urban communities are a complex combination of diverse cultures and subgroups with varying needs. Hence the type of urban green space as well as the uses and activities provided for within these spaces needs to be diverse reflecting the make-up of the local communities.
- Consider the cultural and historical context of the urban green space. Where possible, acknowledge through the design any unique local historical and/or cultural significance of the site.

2.2.7 Good Practice Component on accessibility

All urban green space should be physically accessible within a short distance of local residences[9], with obvious and safe entrance points as well as safe and pleasant access routes (e.g. not having to walk across busy roads or through dangerous areas).

[9] Often, a 5 minute walk or a distance of up to 300m are defined as an acceptable distance.

Also, urban green space should be designed for universal access, with wheelchair friendly access points and trails and braille information signs. Municipalities need to further ensure that the urban green space is also socially accessible –free of charge and welcoming and inclusive for all community groups.

2.2.8 Good Practice Component on maintenance

Management and maintenance of urban green space is paramount so that users perceive it as safe, clean and cared for. Negligent management and maintenance sends a signal that nobody takes care of the area and thus can encourage anti-social behaviour.

Maintenance measures that will increase the perception of comfort and safety and deter anti-social behaviour are, for example:

- Managing vegetation so that it doesn't block the line of sight on pathways or doesn't block the view of security cameras;
- Ensuring that trash bins are provided and emptied regularly;
- Implementing anti-vandalism measures such as anti-graffiti paint on art installations;
- Combating vandalism persistently and fixing vandalism (e.g. burnt park bench or broken glass bottles) as quickly as possible; and
- Considering ´Crime Prevention Through Environmental Design´ principles.

Responsibility and ownership among users and local residents can be enhanced by involving them in the maintenance of the urban green space. This should be done in collaboration with the organization responsible for the urban green space to avoid any potential liability issues/disputes.

During the design phase, maintenance-friendly design choices should be applied that won't result in expensive and/or complex maintenance requirements. Ecological maintenance measures can help to reduce the use of chemical agents (e.g. pesticides) and associated adverse health impacts.

Successful green space policies and interventions can lead to increased use of the green spaces. To avoid degradation of the green areas, such increased use should be reflected by upscaled maintenance work.

2.3 The role of Impact Assessments in urban green space planning

2.3.1 Identifying good examples[10]

Identifying good examples for the role of impact assessments (Health Impact Assessment (HIA), Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA)) in urban green space interventions for health is a challenging task. Often, it is not possible to

[10] See Appendix 3 for the review of Impact Assessment projects.

identify a neat overlap of these various components and there are different types of documents which label themselves as HIA (see section 3.1 in Appendix 3).

Health is often a fuzzy, broad concept and many of the reviewed impact assessment projects are examples of advocacy documents (they make the case for health); they do not represent real impact assessments but rather examples of 'Health in all Policies' approaches. Thus, there is a need to redefine HIA and distinguish between those cases which are examples of HIA (as commonly understood) and cases representing 'health in all policies'.

Future research should go beyond identifying good practices through internet search engines and investigate beyond impact assessment reports. This is especially because it was difficult to locate good examples of the overlapping concepts through search engines. Furthermore, the findings of the Working Paper were dominantly based on the IA reports and therefore could not reflect on the procedures and communications that preceded them.

2.3.2 Closer integration of HIA and EA

Based on the practices that were looked at on HIA, it was realized that HIA served more as a communication and advocacy tool. This had its own merits but the need to actually look at specific impacts was undermined as a consequence.

The environmental assessments did mention health and green space but the relation was more implicit rather than explicit. Generally speaking green space interventions were usually associated with activities related to cycling, walking paths or cleaner air. Though generally speaking these are associated with enhancing health, the reports didn't further elaborate on how such enhancement would lead to better health or such a relation would be monitored.

Many of the reported impact assessment projects included both health impact and environmental assessments but on closer inspection revealed that these assessments are not integrated or connected. Following on from the two previous points, it was therefore felt that health impact and environmental assessments could be used to complement each other. However, more research is needed to explore how a meaningful integration can be done.

2.3.3 Monitoring

The HIAs served more as advocacy tools and therefore monitoring was a deficient component in these. HIAs could play a more effective role in future by actually assessing impacts of the activities and including a monitoring plan within.

With regards to the environmental assessments for the purposes of routine monitoring: where particular health pathways are well established it may be satisfactory to monitor these pathways or determinants (e.g. physical activity levels), rather than monitor specific health outcomes (e.g. obesity). Future longitudinal research is needed to explore direct evidence (for example, construction of a park will lead to measurable increase in life expectancy).

The discussions further recognized the need to position ‘people’ at the heart of the monitoring, for example, focus should not simply be on monitoring green space usage but also on understanding which user groups are using (and not using) the green space (equality and equity).

Monitoring and follow-up activities are usually challenging in the long run due to inadequate funds. Innovative approaches need to be devised engaging user groups to enhance ownership and duration of these activities.

2.3.4 Enhancing the role of impact assessment

The difficulties for identifying good examples of urban green space interventions within impact assessments was also attributed to the limited role that impact assessments were playing. Most of the time, impact assessments are being used as a tick-box exercise only adding moderate value to the planning issues regarding green space and health. The interviews conducted as part of this study further revealed that there is a lack of ownership of the impact assessments conducted, for e.g. they were usually prepared by third party consultants.

Time constraints were identified as a major factor for planners as well as consultants which refrains them from presenting a refined version of the impact assessment reports. For planners, impact assessment is only a part of the bigger picture and therefore, they may feel less inclined to focus on it. Furthermore, in attempting to contact people who were involved in the preparation of the impact assessments, it was soon realized that the institutional turnover was high and most people had left their positions. This made it difficult to gain a better insight into the impact assessment process. Based on these experiences the working group felt that dedicated people were required for the environmental assessments.

Furthermore, some awareness needs to be created in terms of how health considerations can be taken into account and related with the greening interventions. It was concluded that the impact assessments studied do not necessarily make the most of the methodologies that may be available for developing evidence and monitoring these.

3 Practical considerations on delivering healthy and equitable green space interventions in urban settings

3.1 Integrating health aspects in urban green space interventions

3.1.1 Integrating health during the planning phase

Integration into planning frameworks

The first step of planning urban green space interventions is to ensure that green space is integrated into and supported by the relevant planning frameworks. Existing tools, such as impact assessment, can be used as a way to achieve this. The below considerations can aid the integration of green space objectives within relevant frameworks.

- *Build relationships and collaborations* – Invest time and effort to build effective relationships and collaborations with key actors and organizations from all municipal sectors relevant to green space (e.g. urban planning and health sectors).
- *Understand the key 'decision points'* – Understand the systems and frameworks relevant to green space and identify where the key 'decision points' are within these systems. Focus your effort on influencing and informing these points. For example, integration of green space may start by informing key components at the master plan level and hence could take years before the on-ground outcomes are realized. For this, it is also important to involve as early as possible the local actor or division that will be responsible for creation and maintenance of the green space.
- *Communicate effectively* – The simple message of green space health benefits should be communicated clearly, consistently and concisely across all relevant sectors and with all relevant stakeholders.

Broad understanding of urban green space

The literature reports on positive health associations for a diverse range of intervention types such as street trees, green space establishment on vacant lot, greening school playgrounds and creating trails. Hence, it is important to think 'beyond parks' when planning urban green space interventions. This broad thinking may present opportunities for collaboration with institutes such as schools, universities and health services which may enable access to relevant data sets and help with informing the design of the intervention. Also, broader interventions (such as urban extensions, large infrastructure projects or masterplans for residential areas) could consider and include urban green space and be informed by the benefits of such provisions.

Identifying the pathway

It is important to understand the aims and objectives of the intervention and to clearly identify the pathway through which the intervention aims to achieve its main expected outcome. This understanding will help identify relevant indicators for establishing the baseline data for the intervention. For example, if the intervention aims to deliver improved physical health among

local residents then indicators such as Body Mass Index and current levels of physical activity among local communities would be relevant health baseline data for informing the intervention.

Making use of existing, routinely collected data sets

When considering relevant data for informing the planning and design of the intervention, think first of existing data sets and how these might be utilized. Some national or local municipality surveys may already have baseline information on how people currently use and value local green spaces.

Understanding the local demographics

Good demographic data on local residents and intended users of the green space is critical for informing the planning and design of the intervention. The size, quality and functions of urban green space and features, and the types of amenities provided and activities facilitated within green space, should reflect the make-up and needs of the local community. For example, safe social engagement areas for older population groups (e.g. boules court) or creative and active spaces for younger groups (e.g. skate parks). Dog-ownership is another key demographic consideration for green space users.

Understanding the user

All the needs of the varying community subgroups need to be captured. Qualitative data, such as interviewing the intended users of the intervention, is a good way to gain understanding of these needs. Various techniques can be used to collect these data such as using maps during interviews to gain a robust understanding on how people use and move in and around local green space.

Resolving user conflicts

Given the varying needs and uses of green spaces among diverse local urban communities, as well as visiting users (e.g. tourists), it is common for conflicts among users and competition for space to arise. This should be considered at the planning phase and tools such as local community forums and engaging with local 'on-the-ground' organizations and networks can be used to address these potential conflicts from the start. This will also be a good way to collect data from community on their needs and expectations of the intervention. It is important to note that it is unlikely that all expectations will be equally satisfied.

3.1.2 Integrating health during the implementation phase

Identifying potential adverse outcomes

It is important to think about possible negative effects beforehand and then monitor accordingly to see if the intervention results in these adverse outcomes. Although difficult to monitor for, it is also important to be mindful of potential unexpected negative outcomes and implement strategies to try and identify these.

Community feedback systems

During implementation, concerns and issues can arise (e.g. disturbance to local community). There needs to be a complaints or feedback system with the community to ensure that such issues can be promptly identified and effectively resolved.

3.1.3 Integrating health during the evaluation/assessment phase

Evaluation efforts should be proportionate to the scale of the intervention

Costly before-after, control-impact evaluation designs or epidemiological studies may not be supported by the local authority owing to resource constraints. Some large scale interventions implemented in priority areas may receive support for such monitoring programs but mostly it will be important to be practical and fit-for-purpose when designing the intervention's evaluation.

Evaluating the identified and targeted pathway(s)

The evaluation should be measuring the effectiveness of the pathway targeted by the intervention. The pathway should be identified during the planning phase and the intervention designed to specifically target that pathway.

Be realistic

Within limited resources only certain data can be collected (e.g. observational count data on use). If there is a need to understand more complex relationships such as physical activity displacement from one site to another, a stronger commitment of time and budget is required. Also, it must be acknowledged that health outcomes are affected by many determinants and therefore, green space interventions may benefit health and well-being but not automatically lead to significant improvement of health status indicators.

Considering the non-users

In addition to monitoring the use of the green space and the satisfaction among users it is also important to collect data from people who aren't using the green space and to understand what the related causes and potential barriers are.

Practical tips

A number of tips for effective indicators and relatively simple data collection methods were identified based on the review of evidence and the case studies.

- Use observational data of green space use as a relatively simple and cost-efficient way to assess how many people are using the green space, what types of people are using it, who they are using it with and for what purposes.
- Use existing audit and observational tools to collect information on play and recreation in public areas.

- Consider simple and innovative monitoring techniques (e.g. user satisfaction counters like seen in public facilities).
- Engage with local networks and organizations as a way to collect feedback from community and green space users (e.g. engage with community councils or watchdog committees).
- Ensure that monitoring is considered from the start and that budget is allocated.
- Collaborate, where possible, with academic institutes and research centres which can aid with delivering effective monitoring and evaluation for the intervention as well as cost-efficient monitoring (e.g. through developing student research projects around the intervention).
- Consider proximity and accessibility of the intervention with regards to local residences, particularly in the context of park-based interventions.

3.2 Integrating equity aspects in urban green space interventions

3.2.1 Integrating equity aspects in the planning of urban green space interventions

Understanding and measurement of equity

A key issue to be clarified during the planning process is the understanding of "equity" within the planning group and other relevant actors. Different professions may have different perception of equity and equity-related objectives, and it would be useful to develop a common understanding.

Equity is a concept and it is important to acknowledge that different cities have different starting points and the definition of equity may therefore vary. What matters is that any intervention does not aggravate existing inequity, but instead contributes to reducing equity gaps.

Equity considerations tend to look at disadvantages and deprivation levels, but the spatial distribution of local benefits and resources within the community should also be considered to enable an assessment of both needs and resources.

Available equity data with relevance to the urban green space intervention must be compiled and the objectives of the intervention in terms of equity need to be defined. If specific equity objectives are not defined, or no data is available, then no assessment of equity impacts can be carried out.

Often, socioeconomic status data but also other data (e.g. on environmental risk exposure, age and sex, or ethnic and other sociocultural parameters) are available through standard processes on local level. Such data may often be available for an urban/neighbourhood area rather than as individual data, in such cases the smallest-possible spatial unit should be considered. Understanding the population profile is important to define equity issues.

If data on green space availability and accessibility are available, information on its use and quality could provide useful information to assess potential equity effects of urban green spaces.

Involving the local community

Community participation – and specifically the involvement of vulnerable or disadvantaged groups – in the planning process may provide an effective way to increase the success of the intervention for these groups and generate benefits to different user groups, and also to avoid social conflicts regarding the future use of the area. The engagement of the community is not an easy task and needs time for understanding and trust to be established. Site visits and proactive approaches using different methods are needed to bring the consultation process to the local community, and language issues need to be considered.

Engage with community right from the start but be clear that community participation will not lead to each individual expectation being served. The use of "local champions" – ambassadors, peers or mediators from local community groups etc. – could be considered to support community engagement particularly among disadvantaged groups.

Various green space interventions may provide opportunities to actively involve local residents in the building or implementation phase, which would enable the community to influence the outcome and also increases the level of local responsibility and the perception of ownership.

The new establishment of larger parks and green spaces is often preceded by a design competition. In such cases, it is important that the competition brief includes information on potential equity aspects within the community to be considered for the green space design.

3.2.2 How to target the interventions to reach best equity outcomes?

Urban green spaces should be equally accessible and available for all residents and population groups and this is a basic feature that all urban green space interventions should consider. If further targeting is required to address and attract specific user groups, it can be done through different approaches as described below.

- Spatial targeting: the intervention is implemented in a selected area where the demand for green space functions is high, or specific outcomes and benefits can be expected. This could be the case in socially deprived areas (where disadvantaged populations reside), in districts with insufficient green space, or in urban regeneration areas (or brownfield developments) where large-scale urban renewal takes place.
- Spatial targeting combined with user targeting: for specific areas with specific demands or needs, respective green space design, equipment and functions can be identified so that the green space would especially attract or benefit certain user groups. In this context, it is important to still enable other functions so that other user groups can also use the green spaces – which will help to avoid social conflicts.
- Target group promotion activities: irrespective of the design and functionality of the urban green space, social campaigns and community events can support outreach and promote the green space within specific target groups. Depending on the local situation, individual aspects and user groups may be prioritized. Yet, it is important to always

consider urban green spaces as a local resource for the whole community and not exclude user groups through monofunctional green space design.

3.2.3 Equity aspects in the evaluation/assessment of urban green space interventions

Data and indicators

Equity data are very important for monitoring and evaluation to assure that interventions do not have negative or unintended side effects for specific groups. Key parameters for the evaluation of equity impacts for specific population subgroups relate to age and sex, socioeconomic status, ethnicity or place of residence. The equity dimensions to be monitored and evaluated depend on the type of survey, the outcomes expected, and the potential target groups that should benefit most.

A baseline overview (based on existing data sources or new survey) before the intervention is needed to enable comparison of the situation after the intervention, i.e. the outcomes of the intervention with the situation before the intervention.

Evaluation data is often collected from the persons using the respective green space. However, more interesting from an equity perspective is the question which persons are not using it, and why. The type of data to evaluate the equity effects of urban green space interventions must be considered and selected appropriately.

Quantitative data and qualitative data provide different type of information on the impact of an intervention. Both types of data are relevant and the use of already existing local data sources (from all kinds of different sectors) should be emphasized.

Obtaining impact data

A budget for monitoring and evaluation must be clarified before the intervention starts. Still, it is often difficult to collect quantitative or measured data on the impacts of intervention projects. Although such data would be often preferred by policy-makers and funders, observational studies and self-reported data can still be useful to document the impact of urban green space intervention projects. Different types of collaboration could support this task:

- Collaboration with research institutions and universities could provide opportunities for improved impact assessment surveys.
- Citizens and residents can be involved in documenting the impact of local interventions (“citizen science”, “lay knowledge”).

Covering unintended side effects

It is difficult to identify unintended side effects in “universal” green space interventions without a specific equity objective. If an intervention is expected to benefit the whole population, equity aspects should still be considered to make sure that such unintended side effects harming a specific population group are still captured.

The most fundamental considerations that affect and improve monitoring and evaluation of equity impacts are listed below in Table 1.

Table 1. Considerations for monitoring and evaluation

Conceptual clarity	*Make sure that the planning team has a common understanding of equity.*
Early planning	*Have a plan and a separate budget for monitoring and evaluation before starting the intervention.*
Equity indicators	*Be clear on what will be monitored (and why), and what the respective indicator will be.*
Tracking inequalities	*Use different scales (city versus neighbourhood) and different methods (quantitative and qualitative).*
Long-term thinking	*Plan for several rounds of evaluation, not just once. Often, it takes time for the intervention impacts to evolve.*
Local input	*Make use of knowledge of various actors and local agencies to assess the diversity of outcomes.*
Capacity building	*Document and disseminate your approach and lessons learned to exchange experiences.*

4 Conclusions

Urban green space is a necessary component for delivering healthy, sustainable and liveable cities. Urban green space interventions can deliver positive health, social and environmental outcomes for all population groups, particularly among lower socioeconomic status groups. There are very few, if any, other public health interventions that can achieve all of this.

Green space should be available to all residents as a part of their daily surroundings. This applies to both small-scale and large-scale green spaces, irrespective of categorizations into private or public spaces or functionalities. Be it the remote view of green space within the neighbourhood, the passive exposure to green space by having a walk by the river or taking a break in a park, or the active use of green spaces through e.g. play, leisure or gardening – all kinds of urban green space should be promoted through urban planning and governance across all sectors.

Multidisciplinary and cross-sectoral collaborations will help to ensure that urban green space interventions deliver on multiple outcomes. Urban green space interventions are most effective when a dual approach is adopted where a physical improvement to the environment is coupled with a social engagement/participation element promoting the use of the green space.

Urban green space interventions need to be situated within the overall context of the urban area and integrated within the relevant strategies, frameworks and plans (e.g. urban masterplans, health and transport policies, sustainability and biodiversity strategies). Good design, implementation and maintenance of urban green space interventions will mitigate any potential adverse outcomes from the intervention and maximize their benefits.

Urban green space interventions need to be planned and designed with the local community and the intended green space users. This will ensure the derivation of benefits for the local community and will aid the delivery of interventions that serve the needs of the community - especially in deprived areas.

Appendix 1:
An evidence review on the environmental,
health and equity effects of urban green space interventions

An evidence review on the environmental, health and equity effects of urban green space interventions

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Rationale: Despite the potential from cross-sectional evidence, we know little about how to design new or improve existing urban green space for various benefits.

Objectives: To review the evidence on the environmental, health and equity effects of urban green space interventions.

Methods: Eight electronic databases were searched using search terms relating to "urban green space" and "study design" in August 2016. Eligibility criteria included: (i) a physical change to urban green space; and (ii) health, social or environmental outcome(s). The PROGRESS-plus tool was used to explore equity effects of the interventions.

Results: Of the 6997 studies identified, 38 were included. There was promising evidence to support park-based interventions that also included a promotion/marketing programme (7/7 studies), greening of vacant lots (4/4 studies), provision of urban street trees (4/4 studies) and green infrastructure for storm water management (6/7 studies). There was inconclusive evidence for the provision of greenways/trails (3/6 studies). We could draw little conclusions regarding the equity impact of urban green space interventions.

Conclusions: Robust evaluations of urban green space interventions are urgently required. The findings provide a platform to inform the design, implementation and evaluation of future urban green space intervention research.

CONTENTS

List of tables and figures

Abbreviations

BMI	body mass index
MET	metabolic equivalent of task
PA	physical activity
$PM_{2.5}$	particulate matter with diameter less than 2.5µg
RCT	randomized controlled trial
SOPARC	Systems for Observing Play and Recreation in Communities
UGS	urban green space

1 Introduction

1.1 Urbanization

Few question the intimate connections between the health of the population and the environment. More than half of the world's population lives in urban areas (towns and cities), and this number is projected to increase to two in three people by 2050 (Revi et al, 2014). As populations in both developing and developed countries become increasingly urbanised, the preservation of urban green space (UGS) becomes paramount. Urban green space is not just dedicated recreational space such as public parks, but other types of informal green space are important, for example, street trees, roof gardens and gardens. However, as towns and cities grow and develop there is competition for adequate UGS with housing density, retail and commercial developments, transport infrastructure, and considerable environmental challenges created by impervious surfaces from roofs, driveways, and sidewalks.

Further, urbanization creates a number of health, well-being and social problems caused by widening social and health inequalities, high density substandard housing, limited public amenities and relative disregard for the environment. Also, mass migrations typical in urban areas can cause gradual erosion of cultural and supportive norms that traditionally sustain people in their own communities. These issues are particularly felt by vulnerable groups, among them older people (i.e. aged ≥50 years). Though health and well-being have complex life-course social determinants, a central hypothesis is that older peoples' well-being will be improved by helping them become more active and socially connected in their local communities and by enhancing their ability to participate in society. Problems (such as loneliness and physical frailty) may be prevented by improving the mobility and social networks of older people by designing better social and physical infrastructure and interventions in the urban setting.

Across Europe, an already crowded continent, urbanization is accelerating and the consequences for green space are unknown but under threat (Barton and Grant, 2013). Given the different rates in which towns and cities are developing, James et al (2009) suggests that there are opportunities to redesign UGS in order to improve liveability and sustainability where populations are decreasing, and an urgent need to address issues of loss of green space where populations are growing and urban areas expanding spatially. The demographic transition and the ageing of the populations, particularly in low-middle income countries add a sense of urgency to the need for solutions to rapid urbanization. Maintaining (and in some cases increasing) green space quantity and quality in the face of increasing urbanization is therefore a pressing global challenge.

1.2 Challenges to urban green spaces

Urban green space (UGS) will inevitably be challenged where urban space is limited. Lee et al (2015) described three main challenges to UGS. First, where UGS is rundown it may be at greater risk of being developed rather than refurbished and improved. Environmental decay can negatively affect residents' sense of security and increase perceptions of crime (Branas et al, 2011). Second,

resource constraints and reductions in public spending will have a disproportionate impact on UGS as it has to compete with other public services. This is further accentuated as UGS is costly to maintain. It is difficult to make the case for allocating scarce public resources in the absence of a robust scientific evidence base for UGS. Third, UGS initiatives to make more deprived neighbourhoods healthier and more attractive can drive up property values and displace local residents (i.e. gentrification).

1.3 Health, Social and Environment Effects of UGS

Urbanization causes a decrease in per capita space (Fuller and Gaston, 2009) and subsequently a loss of per capita UGS (James et al, 2009). Due to densification tendencies in Western cities, large green spaces are a limited resource and many people live in city areas where long distances to large green spaces reduces the possibility for frequent use. Such decreases and densification in UGS inevitably cause a decrease in daily exposure to green space and natural environments with numerous health, social and environmental consequences (Barton and Pretty, 2010).

The World Health Organization (WHO) define health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO, 1948). Research examining the health and public health benefits of access to green space is extensive and persuasive (Kuo, 2015). In particular, UGS has an important contribution to make to public health with potential physical, psychological, social, economic and environmental benefits (Bedimo-Rung et al, 2005; Bowler et al, 2010; Lee and Maheswaran, 2010; Lachowycz and Jones, 2011; Song et al, 2016). A growing body of evidence shows a relationship between levels of green space in the local neighbourhood and people's health and well-being, especially for low-income and deprived urban populations (Mitchell and Popham, 2008; Maas et al, 2009; Mitchell et al, 2015). Lower exposure to green space has been associated with a number of lifestyle diseases such as obesity, Type II diabetes, osteoporosis and stress-related illnesses such as depression, heart diseases and mental fatigue (Ulrich, 2006; Mitchell and Popham, 2008). Evidence also shows that access to green space can promote physiological effects such as lower concentrations of cortisol, lower pulse rate and blood pressure, greater parasympathetic nerve activity and lower sympathetic nerve activity compared to urban environments (Park et al, 2007; Park et al, 2010; Lee et al, 2011; Song et al, 2016). These studies suggest that green space may offer opportunities to buffer or mitigate health outcomes for urban populations.

Proximity to parks has been associated with greater frequency of physical activity (e.g. Cohen et al, 2007), reduced weight (e.g. Ellaway et al, 2005), lower coronary heart disease (e.g. Maas et al, 2009) and social cohesion (e.g. Cattella et al, 2008). Although the strength of these associations varies based on park facilities (e.g. Cohen et al, 2010; Schipperijn et al, 2013) and by characteristics of the potential park users, for example sex, race/ethnicity, and age (Cohen et al, 2010; Lachowycz and Jones, 2011).

A number of studies also link exposure to green space with mental health benefits operating independently to physical activity, through mechanisms such as visibility of UGS for rest and restitution (e.g. Peschardt et al, 2012; van Dillen et al, 2012). These include improved mood, self-

esteem, reduced stress, reduced cognitive fatigue and greater attentional capacity and well-being, and promoting emotional recovery (e.g. Hartig et al, 1996; Astell-Burt et al, 2014).

Social contact is considered to be one possible mechanism behind the relationship between green space and health by promoting social interaction between neighbours (e.g. Cattella et al, 2008; Maas et al, 2009). Participation in activities in these spaces encourages social interaction and physical activity, alleviating stress, anxiety and improving mood and attention (e.g. Maas et al, 2009). By providing protected space for social interactions to take place, can lead to reduced social isolation, generate social capital, increase social cohesion, provide a sense of belonging and improve levels of neighbourhood trust. Therefore urban green space has a direct relationship with the quality of life of urban dwellers (Lee et al, 2015).

In contrast, neglected, unmaintained UGS can have negative health consequences. Repeated exposure to such environments can cause the stress response to trigger inflammatory changes and dysregulation of cardiovascular, neurological, and endocrine systems (South et al, 2015). In addition, unmaintained green space may discourage use and promote illegal activities, increased injuries, crime and anti-social behavior (e.g. Branas et al, 2011; Garvin et al, 2013); therefore further increasing health and life inequalities and inequities. Concepts such as the "broken windows" theory and the "incivilities" theory suggest that vacant lots and decaying UGS visibly symbolize that a neighbourhood has deteriorated, is unsafe and promotes weak ties among the community (Branas et al, 2011; Garvin et al, 2013). Urban Green Space interventions, such as "greening" vacant lots, offers a promising and sustainable solution.

Usually considered quite apart from the health and social benefits are a number of environmental benefits of UGS. The physicality of UGS covers ecological, microclimate, soil, air and water quality functions (i.e. provisioning and regulating services). Urban green space performs a number of functions in the city. It provides a habitat for urban wildlife, reduces flood risk by decreasing impervious surface area (e.g. Shuster and Rhea, 2013), removes air pollution and improves air quality (e.g. Nowak et al, 2006), and relieves urban heat island effects and reducing energy costs through cooling buildings (Bowler et al, 2010). However, there are also potential pathogenic effects to increased exposure to UGS, including increased exposure to air pollutants, risk of allergies and asthma, exposure to pesticides and herbicides, injuries and excessive exposure to UV radiation (WHO Regional Office for Europe, 2016). For a comprehensive overview of the proposed mechanisms for UGS on health, social and environmental benefits see WHO (forthcoming).

In summary, UGS has an important role to play in creating a "culture of health", including the social health, of our neighbourhoods and communities. A "culture of health" has been broadly defined as a culture that supports health improvement by fostering healthy, equitable communities that enable everyone to make healthy lifestyle choices (Robert Wood Johnson Foundation, 2016), mindful of locality, race and ethnicity (Roe et al, 2016). However, in light of the numerous benefits of UGS, we know relatively little about what 'dosage' of green space is required to infer such health, well-being, social and environmental benefits (Ward Thompson et al, 2016). This concept of dosage not only refers to quantity of green space, but also accessibility and quality. However,

we know that accessibility and availability does not necessarily equate to use and subsequent health and well-being benefits.

1.4 Environmental Justice and UGS

Of course such benefits are not equitable across all in society. Provision of UGS has also been associated with widening health and social inequalities. Whilst there is a body of literature on inequities of access to urban parks and recreational facilities by race/ethnicity particularly in the US, the focus has largely been on income inequalities (Roe et al, 2016). Research from Commission for Architecture and the Built Environment (CABE) (CABE, 2010) indicates that inequalities in green space provision in ethnic minority populations may account for lower usage, i.e., less and poorer quality UGS. Further, the social dynamic of utilizing and experiencing UGS varies by different communities and cultures. Roe et al (2016) suggested that the provision of UGS interventions in economically deprived, ethnically diverse urban communities needs to be culturally sensitive.

1.5 UGS Interventions

Much of the previous research has focused on the characteristics of UGS that are more likely to influence usage e.g. accessibility, quality, facilities, attractiveness, security. This assumes a causal relationship when in reality the relationship is more complex and multifactorial. It is more likely that it is the functionality of the UGS, be it for exercise or sociocultural activities, rather than its character, which translates to the reported benefits (Lee et al, 2015). The availability and accessibility of UGS, particularly across the socioeconomic spectrum, offers the opportunity for recreation and active travel for little or no cost to the individual. Attributes of UGS that might stimulate and encourage use include walking/cycling paths, wooded areas, open spaces, water features, lighting, pleasant views, bike racks, parking lots, and playgrounds (Schipperijn et al, 2013). However, to date much of the research in this area has been observational and shows that many UGS are underutilized (Hunter et al, 2015).

Despite the potential from cross-sectional evidence and the attention given to the importance of built environments (WHO, 2006; NICE, 2008), the evidence for the effectiveness of creating supportive built environments, particularly UGS is inconsistent and of modest quality (Hunter et al, 2015). Many policy-makers are beginning to advocate changing the built environment to support healthy populations (WHO, 2006; NICE, 2008; Gebel et al, 2012). For example, the World Health Organization recommends that national physical activity policies should include the creation of environments that increase access to, and use of, suitable facilities for physical activity (WHO, 2006).

Urban green spaces receive significant investment for modifications and programming, particularly from local authorities. There is a need to identify if such investments are effective, and subsequently determine how to make best use of our limited UGS. However, providing more UGS is challenging in increasingly dense cities, and finding space for new UGS is often difficult and expensive. Urban green space is not just about dedicated recreational space (e.g. parks) but other

types of informal green space are important, for example, street trees, roof gardens etc. Examples of interventions might include improving access to UGS, improving walking/ cycle paths, and modification of playground/park facilities in UGS, and innovative approaches are being found through non-traditional locations such as roof gardens, green walls, greening of vacant lots and urban agriculture. The utility of UGS can be viewed through many lens, such as social spaces and areas for recreation, culture and, rest and restitution, and how people 'use' UGS needs to be considered when designing interventions. For example, visibility of UGS (linked to stress reduction and other physiological and cognitive benefits); perceptions of UGS (provide a sense of belonging and safety); and usage of UGS (for physical activity and facilitation of social interaction).

Utilizing the UGS as an intervention for health, social and environmental benefits offers many advantages. Unlike individual-level approaches, developing a supportive environment has the potential to achieve the biggest reach for long-term, population-wide improvements in health, and facilitate long-term effects. The WHO (2006) and Maes et al (2015) encouraged local authorities to increase and improve the provision of UGS. However, there is little information about how this should be actioned. A recent review by Hunter et al (2015) suggested that there was promising evidence for UGS interventions that combined a change to the physical green space with a promotion/marketing programme for increasing park usage and physical activity levels. However, this review solely focused on physical activity behaviour. Therefore, there is a need to conduct a review to extend the current evidence base of UGS interventions for other health, social and environmental benefits in order to make recommendations regarding future approaches.

1.6 Aims and Objectives

The aim of this study was to conduct an evidence review on environmental, health and equity effects of UGS interventions.

Specific objectives include:

1. To investigate the effects of UGS interventions on environmental factors, such as, air, noise, water, temperature, green space characteristics;
2. To investigate the effects of UGS interventions on health and well-being benefits, such as, physical activity behaviour, mental health, quality of life, disease reduction (e.g. cardiovascular), social cohesion, injuries;
3. To investigate the equity effects of UGS interventions using the PROGRESS-plus tool (O'Neill et al, 2014). (Place of residence, Race/ethnicity, Occupation, Gender/sex, Religion, Education, Socioeconomic status, and Social capital);
4. To identify gaps in the evidence and make recommendations for future research and practice.

2 Methods

2.1 Search Strategy

Eight electronic databases (Medline, PsycINFO, Web of Science (Science and Social Science Citation Indices), PADDI (Planning and Architecture), Zetoc (Transport), Scopus, Greenfiles (Urban Planning) and SIGLE (grey literature)) were searched for articles, and reference lists of included studies and relevant reviews were hand searched for further relevant studies. Keywords relating to 'urban green space', 'intervention types' and 'study design' were searched (see Annex 1).

2.2 Eligibility Criteria

Studies were included if they met the following five criteria:

(i) UGS intervention (defined below) to affect environmental conditions, promote/encourage health and well-being or tackle inequalities. Interventions must have involved a:

(a) physical change to the UGS in an urban-context including improvements to existing UGS or development of new UGS;

Or

(b) combination of physical change to the UGS supplemented by a specific UGS awareness, marketing or promotion programme to encourage use of UGS.

In order to ensure inclusion of comparable studies we have broadly defined UGS as all publicly or privately owned and accessible open space with a high degree of cover by vegetation, e.g., parks, woodlands, nature areas, and other green space within the town or city boundary area (Schipperijn et al, 2013). This definition includes areas such as public open space, street trees, private and semi-private gardens and other residential/commercial open space, roof gardens, rain gardens, vertical walls, urban greenery, urban agriculture, vacant lots. Such areas consist predominantly of unsealed, permeable, 'soft' surfaces such as soil, grass, shrubs and trees. This also includes 'green/blue' space, reflective of the fact that UGS can include 'blue'/water features such as ponds, rivers, which may be valued and used for health benefits by urban dwellers. However, this review does not include studies solely focused on blue space/water only interventions. In summary, this definition is aligned to the broad definition used in a forthcoming WHO report providing an overview of the evidence on the health effects of UGS (WHO, forthcoming), and encompasses the different ways in which UGS has been defined in different studies and in different contexts.

For the purposes of this review, UGS interventions were defined as interventions that explicitly involve a physical change to the built environment in a predominantly urban-context including improvements/modifications to existing UGS or the development of new UGS. Examples include development of new walking/cycling trails, creation of rain gardens and green roofs, greening of vacant lots and urban streets, provision of outdoor gyms in local parks, new bridges to improve physical access, modifications of a playground in a park. Interventions that involved a combination

of physical change to the UGS supplemented by a specific UGS awareness, marketing or promotion programme to encourage use of UGS were included. Interventions which solely involved an awareness or promotion program with no actual change to the physical environment were excluded.

(ii) A measure of environmental, health and well-being or social outcomes.

Relevant environmental outcomes included measures of water quality and quantity, noise pollution, ambient temperature, temperature of buildings, air quality and biodiversity measures (e.g. abundance and diversity of bird species).

Relevant health and well-being measures included physiological changes (e.g. aerobic fitness, BMI, blood pressure), mental health (e.g. levels of depression, stress, anxiety), mental well-being, number and types of injuries, and disease reduction in, for example, cardiovascular disease, cancers and diabetes. Studies measuring changes in total physical activity behavior or domain-specific physical activity levels (e.g. active travel or recreational physical activity) were also included. The health benefits of physical activity are well documented. Therefore, physical activity behavior is a commonly used proxy measure of health benefits.

Measures of the social environment such as social capital (or specific constructs of this multifactorial concept), social cohesion, perceptions of safety, number of crimes or arrests were included. In addition, outcomes such as economic (e.g. cost effectiveness and cost–benefit analyses), and adverse effects and unintended consequences were recorded.

(iii) A control/comparator group or pre/post design or any other design that allowed identification of intervention impacts. Cluster randomized controlled trials (cRCTs), randomized controlled trials (RCTs), quasi-experimental designs that used a control group or population for comparison, interrupted time-series, and prospective controlled cohort studies were included.

(iv) English language

(v) Full-text available

2.3 Evidence Synthesis

Studies were categorised according to the main intervention approach, including:

(i) Park-based: including those which involved change to the physical environment only, or those which utilized a dual approach combining a change to the physical environment with programming or marketing events in order to promote use of the UGS;
(ii) Greenways/trails: including the development of new greenways and walking/cycling trails, or the modification of existing greenways and trails, for example, through the addition of signage;
(iii) Greening of urban/suburban areas: typically aesthetic-based interventions including greening of vacant lots, provision of street trees;

(iv) Green infrastructure for storm water management, cooling urban/suburban areas.

Where appropriate, key characteristics and outcomes of the studies were extracted and tabulated including study design, country, population, description of intervention and control/comparator group, outcome measures, duration of follow-up and summary of study findings. The evidence was summarized regarding (a) methods and main areas of studies identified, (b) the environmental, health and equity effects of the interventions and (c) constraints and limitations in terms of the evidence and what suggestions can be drawn to improve future interventions and their evaluation.

2.4 Assessing Impact on Equity Factors

The Cochrane and Campbell Equity Methods group advocate the use of a guidance framework known as 'PROGRESS-Plus' (O'Neill et al, 2014). This acronym summarizes a number of evidence-based determinants of health, including place of residence, race or ethnicity, occupation, gender, religion, education, social capital, socioeconomic status (SES), plus age, disability and sexual orientation. Studies were classified based on their treatment of PROGRESS-Plus factors. Annex 2 details the working definitions of each of these factors. Similar to Attwood et al (2016), studies were categorised as differential intervention effects where interaction or subgroup analyses for at least one PROGRESS-plus factor were performed. Subgroup analyses were defined as separate significance tests conducted of an intervention effect in each level or category of a PROGRESS-Plus factor. Interaction analyses were defined as an overall test to directly compare differences in intervention effects across categories of a PROGRESS-Plus factor.

3 Results

Annex 3 shows the results of the literature search. Briefly, 6997 studies were initially identified, 224 full-text articles screened, and 38 studies included in the evidence review.

3.1 Study Characteristics

Annex Tables 1-4 present a summary of the included studies. Fourteen of the studies were park-based interventions, six of the 38 involved the development or improvement of urban greenways or walking/cycling trails, 10 involved greening interventions, seven involved implementing green infrastructure (e.g. rain gardens, roof garden) for storm water management, one investigated the effects of green roofs for cooling a suburban area, and there were no green wall-based interventions that met the pre-defined eligibility criteria. Given the heterogeneity in target populations, interventions and outcomes it was not appropriate to pool results in a meta-analysis.

The majority of the studies were natural experiments employing a quasi-experiment, controlled pre-post design (n=21), uncontrolled pre-post design (n=6) or controlled post-design (n=8). Two studies used a difference-in-difference design (Branas et al, 2011; Kondo et al, 2015), and two employed a RCT design (Cohen et al, 2013; Garvin et al, 2013). There was a relative dearth of well-designed, robust intervention studies that measured environmental effects. Further research of more environmentally tailored UGS interventions, require, at a minimum, a BACI (Before-After Control Intervention), therefore, moving beyond observational and experimental studies. Studies were mainly implemented in the US (n=22), Australia (n=4), the United Kingdom (n=3), New Zealand (n=2), China (n=2) and the rest were single studies in South Africa, Canada, Denmark, South Korea and the Netherlands.

Twenty studies were set in socially-disadvantaged areas where the majority of the population were of low Socioeconomic Position which are typical of inner-city, urban areas (NSW Health, 2002; Evenson et al, 2005; Cohen et al, 2009a; Cohen et al, 2009b; Tester and Baker, 2009; Fitzhugh et al, 2010; Branas et al, 2011; Cohen et al, 2012; Veitch et al, 2012; Bohn-Goldhaum et al, 2013; Garvin et al, 2013; Strobach et al, 2013; Ward Thompson et al, 2013; Anderson et al, 2014; Cohen et al, 2014; Clark et al, 2014; Droomers et al, 2015; King et al, 2015; South et al, 2015; Slater et al, 2016).

The majority of studies measured health or a health-related behaviour. Measures included park/green space usage as a proxy measure of physical activity (NSW Health, 2002; Burbidge and Goulias, 2009; Cohen et al, 2009a; Cohen et al, 2009b; Tester and Baker, 2009; Fitzhugh et al, 2010; Cohen et al, 2012; Veitch et al, 2012; Bohn-Goldbaum et al, 2013; Cohen et al, 2013; Ward Thompson et al, 2013; Cohen et al, 2014; Clark et al, 2014; Peschardt and Stigdotter, 2014; Ward Thompson et al, 2014; King et al, 2015; Cranney et al, 2016; Slater et al, 2016), and direct measures of physical activity (e.g. Actigraph accelerometer; Quigg et al, 2011) and self-report scales (Evenson et al, 2005; Branas et al, 2011; West and Shores, 2011; Goodman et al, 2014; Droomers et al, 2015).

A few studies used measures of general health (Evenson et al, 2005; Ward Thompson et al, 2014; Droomers et al, 2015), quality of life (Ward Thompson et al, 2013; 2014) and BMI (Evenson et al, 2005; Quigg et al, 2011). Physiological measures such as blood pressure, heart rate and blood cholesterol were undertaken in two studies (Kondo et al, 2015; South et al, 2015), and two studies measured stress (Branas et al, 2011; Kondo et al, 2015).

From a broad social environment aspect, crime and safety were measured in seven studies (Evenson et al, 2005; Branas et al, 2011; Garvin et al, 2013; Kondo et al, 2015; Cranney et al, 2016; Slater et al, 2016).

Environmental measures included biodiversity such as bird species (Strobach et al, 2013) and flora and fauna (Anderson et al, 2014), illegal dumping (Joo and Kwon, 2015) and particulate matter (Jin et al, 2014). Storm water management interventions included a range of measures such as number, precipitation and duration of storm water events, peak discharges and total run-off generated (hydrology), water quality, and aquatic biology (stream macroinvertebrate and periphyton) (e.g. van Seters et al, 2009; Carpenter and Kaluvakolanu, 2011; Mayer et al, 2012; Roy et al, 2014).

Due to the limited number of follow-up periods, we were not able to rigorously assess the longer term effectiveness of UGS interventions much beyond 12 months. Of the limited number of studies that did include follow-up periods beyond 12 months, there was a trend towards positive benefits (e.g. Goodman et al, 2014 showed positive outcomes at 2 years).

We did not find any reports of possible adverse effects or unintended consequences in the included studies.

3.2 Evidence Synthesis

Detailed tables in Annex 1 present a summary of the key characteristics and results of the studies categorised according to the intervention approach.

3.2.1 Park-based Interventions (Annex 1 – Table 1)

Sixteen studies involved UGS interventions in parks; nine undertook a change to the physical environment either via improvements to existing UGS or creating new UGS, and seven combined a change to the physical environment with specific promotion or marketing activities to encourage use of the park. In summary, there was promising evidence to support the use of park-based interventions that specifically combined a physical change to the green space and promotion/marketing programmes, particularly for increasing park use and physical activity (7/7 studies showing a positive intervention effect). There was inconclusive evidence regarding park-based interventions that only involved physical change to the green space (i.e. there was no programmes to promote the use of the green space) (2/9 studies showed a positive intervention effect). Interestingly, the majority of these studies measured park usage and physical activity behaviour using Systems for Observing Play and Recreation in Communities (SOPARC) methodology (McKenzie et al, 2006), with the exception of, for example, Ward Thompson et al

(2013) who measured broader outcomes such as quality of life and perceptions of the environment. These findings are consistent with conclusions from a recent review by Hunter et al (2015).

Two studies showed a positive outcome with increases in physical activity and park usage (Cohen et al, 2009b; Veitch et al, 2012). Cohen et al (2009b) investigated the impact of two interventions that saw renovations made to a skate park and the green space surrounding a senior centre. Results showed a significant increase in skate park use but substantially fewer users of the green space surrounding the senior centre. There was also a significant increase in the perception of safety in both of the renovated green spaces ($p<0.001$). An Australian study by Veitch and colleagues (2012) showed significant increases in the number of park users and number of people walking and being vigorously active after major park improvements (i.e. fenced leash-free area for dogs, playground, walking track, barbeque area, landscaping, fencing).

Seven studies (three of which were by the same first author) showed no significant impact on physical activity, park usage or general health for UGS interventions involving change to the built environment only (Cohen et al, 2009a; Quigg et al, 2011; Cohen et al, 2012; Bohn-Goldhaum et al, 2013; Cohen et al, 2014; Peschardt & Stigsdotter, 2014; Droomers et al, 2015; Gubbels et al, 2016). Cohen et al (2009a) showed that park use and physical activity (PA) declined in parks that underwent major improvements including new/improved gyms, picnic areas, walking paths, playgrounds, watering and landscaping. However, during the study period the Department of Recreation and Parks suffered budget cuts that led to reduced programming and the authors suggested that 39% of the decline was directly attributable to fewer scheduled organized activities. A study by Quigg et al (2011) investigated the impact of upgrading two community parks on children aged 5-10 years (PA was measured using accelerometers). Upgrades involved installation of new play equipment, seating, additional safety surfacing, and waste facilities. The study found no evidence that the intervention community had a statistically significant difference in total daily physical activity compared with control. Another study, which targeted children (aged 2-12 year olds), found no significant effects for park usage and children's physical activity compared to the control group following major park renovations involving development of three children's playgrounds within a larger park complex (Bohn-Goldhaum et al, 2013).

A number of analyses were undertaken to investigate the impact of changes in the quality or quantity of green space in different populations in 24 severely deprived neighbourhoods in the Netherlands. The intervention involved a suite of park-based and greening interventions (costing 5 million euros) to ameliorate problems with employment, education, housing, social cohesion and safety. The range of interventions involved provision of new public parks (from pocket parks up to 250 acres; n=9), refurbishing existing parks (n=9), improving the paths, drainage, landscaping and maintenance; planting flower bulbs in front yards; constructing wall gardens; greening streets, and developing a greenway. Investments were made in green space that could be utilized by residents for recreation ('green to be used') and improvements of the green appearance of the neighbourhood ('green character'). Eighteen neighbourhoods improved their green space to be used (parks), in half of the cases in combination with investments in the green character of the neighbourhood. Nine of these neighbourhoods invested in new public parks. The other 9 neighbourhoods redeveloped and refurbished existing parks. Another 6 neighbourhoods improved

only their green character (no parks). Repeated cross-sectional surveys from 2004 until 2011 yielded self-reported information on leisure time walking, cycling and sports, perceived general health, and mental health, of over 48,000 local residents. Outcomes included physical activity (Droomers et al, 2015; Gubbels et al, 2016). Results showed that the intervention sites did not show more favourable changes in physical activity and general health compared to all the different groups of control areas (Droomers et al, 2015). In a subset of these neighbourhoods, additional data were collected from the same individuals before and after the interventions (Gubbels et al., 2016). In this study no significant health-related improvements were associated with the interventions, with two exceptions. Objective improvements in greenery were associated with a smaller decline in adolescents' leisure time cycling, and improvements in perceived greenery were related to a decrease in adults' depressive symptoms.

There was no evidence to support the provision of pocket parks for usage and physical activity (Cohen et al, 2014; Peschardt & Stigsdotter, 2014). Cohen and colleagues (2014) investigated the impact of the creation of three pocket parks on the number of park users and physical activity. This involved installation of playground equipment and benches, development of walking paths, and all areas were fenced and enclosed by lockable gates. Results showed that pocket parks were used as frequently or more often than playground areas in neighbourhood parks (control areas); however, they were vacant during the majority of observations. The authors concluded that pocket parks may act as catalysts for physical activity, however additional marketing and programmes may be needed to encourage usage. Similarly, Peschardt & Stigsdotter (2014) found no significant change in number of park users for the creation of a pocket park (932 m^2) in a dense urban area which was redesigned to increase seating areas and walking trails. The demographics of park users did change slightly with more men, people aged 15-29 years old and more educated people using the park.

Two studies specifically evaluated the effects of installing or improving outdoor gyms/fitness zones in green space (Cohen et al, 2012; Cranney et al, 2016). Cohen et al (2012) found that park usage increased by 11% compared to control parks (not statistically significant) following the installation of Family Fitness zones (i.e., outdoor gyms) in 12 parks. Cranney et al (2016) investigated the effects of the provision of an outdoor gym in Sydney alongside hosting exercise sessions and targeted marketing and promotional strategies to engage older adults with the outdoor gym. There was a small but significant increase in senior green space users engaging in moderate-vigorous physical activity at follow-up (1.6 to 5.1%; $p<0.001$). There were significant increases from baseline to follow-up in the outdoor gym area for: moderate-vigorous physical activity (6 to 40%; $p<0.001$); and seniors' use (1.4 to 6%; $p<0.001$). The proportion of outdoor gym users decreased at follow-up but remained significantly higher compared to baseline for seniors and male children.

In addition to Cranney et al (2016), six other UGS interventions involved a combination of change to the built environment and promotion/marketing activities to encourage use of the modified, improved or new UGS. All seven studies (NSW Health, 2002; Tester and Baker, 2009; Cohen et al, 2013; Ward Thompson et al, 2013; King et al, 2015; Cranney et al, 2016; Slater et al, 2016) showed significant increases in park usage and physical activity levels post-intervention.

An intervention in Western Sydney (NSW Health, 2002) involved three core elements: 1) park modifications including signage, greening, improved paths and a new playground; 2) promotion of physical activity and park use via advertisements and walking maps; and 3) the establishment of walking groups. Results showed that the Intervention Group was more likely to have walked in the two weeks prior to follow-up than the Control Group. Males in the Intervention Group were 2.8 times more likely to walk than males in the Control Group whereas females in the Intervention Group were only 0.2 times more likely to walk than females in the Control Group.

Tester and Baker (2009) evaluated the effects of major renovations to playfields of two public parks as well as physical activity programmes, and training and skills development for park and recreation programme staff. Results showed that park playfield renovations, with and without family and youth involvement initiatives, significantly increased visitation and overall physical activity (4-9 fold increase) compared to the Control Group.

Cohen et al (2013) investigated the impact of physical activity promotion programmes including minor park modifications such as implementing signage using a RCT design. Fifty-one parks were randomly allocated to one of three groups: 1) Park Directors only; 2) Park Directors and Park Advisory Boards; or 3) Control Group (measurement only). Park Directors received five training sessions from a marketing consultant regarding outreach, customer service, promotion events, improving park image and building the customer base. Further, the intervention groups used the baseline data collected regarding park use and characteristics of park users from SOPARC to inform decisions regarding development of park programs to increase park use and physical activity. Each park received $4,000 to spend on park programs which included signage (e.g., banners, walking path signs), promotional incentives (e.g., water bottles, park-branded key chains, individually targeted e-mails), and outreach activities (e.g., hiring additional instructors, buying activity materials). Results showed a significant increase in physical activity and number of park users for both intervention groups, generating an estimated average of 600 more visits/week/park, and 1830 more Metabolic Equivalent of Task (MET)-hours of PA/week/park. The primary mediator of change was investment in signage which explained 37% of change in park users and 39% increase in MET-hours.

Ward Thompson et al (2013) investigated the impact of regeneration of urban and suburban areas with high socioeconomic deprivation in Glasgow, United Kingdom. Woods and green spaces within 500 m of the local community were refurbished through clearing rubbish and signs of vandalism; construction of improved footpaths, signage and entrance gateways; improved appearance and safety of trees and vegetation; and publicity and group activities to encourage opportunities for use. Quality of life significantly increased in both neighbourhoods (more in the Intervention Group) over time. There were also significant differences in woodland use ($p<0.001$) and in perceptions of safety ($p<0.05$) in the intervention site over time, compared with no significant change in the comparison site.

King et al (2015) investigated the transformation of 2-acres of undeveloped green space into a recreational park and community garden in an area of transitional housing (homeless and refugees). The new park had clearly defined recreational spaces including a multipurpose playing

field, playground equipment, basketball courts, benches, a large community garden and a walking path. Pre- and post-comparisons of people observed using park zones showed a 3-fold increase in energy expended within the park (p= 0.002) compared to non-park zones (e.g. streets). There were also significant increases in the total number of people observed using the park post-intervention (p=0.004), proportion of users engaged in moderate (p=0.007) or vigorous activity (p=0.04), and increased average monthly visitors (n=180-651; p=0.002).

In a recent study by Slater et al (2016), 39 intervention parks undertook major renovations including replacement of old playground equipment and ground surfacing, coupled with extensive community engagement activities to encourage and promote park usage. Thirty-nine control parks were matched on size, proximity, neighbourhood socioeconomic status, and race/ethnicity. The study showed significant increases between baseline and 12-month follow-up for park utilization and the number of people engaged in moderate-vigorous physical activity, and an increase in park use over time in intervention parks compared with control.

3.2.2 Greenways and Trails (Annex 1 – Table 2)

There was mixed evidence (3/6 studies showed a positive intervention effect) to support the use of new or modified trails or greenways for promoting health benefits.

Fitzhugh et al (2010) investigated the impact of an urban greenway trail designed to enhance connectivity of pedestrian infrastructure with nearby retail establishments and schools. The study showed significant changes between the intervention and control neighbourhoods for total physical activity (p=0.001), walking (p=0.001) and cycling (p=0.038). However, there was no significant change over time for active transportation to school.

A study in the US (Clark et al, 2014) showed significantly positive effects for a marketing campaign and addition of signage for trail use. Usage of ten urban trails (6 intervention and 4 control trails) were monitored following a marketing campaign promoting trail use and the addition of way-finding and incremental distance signage to selected trails. The distance markings were embossed into the surface of the trails at 0.25 mile interval, and way-finding signs were placed on the trails at major access points and were mounted on square metal posts. Each side of the post was marked with a trail map, the name of the trail, the logo of the responsible jurisdiction, and icons for acceptable and unacceptable uses. Infrared monitors were placed on the trails and data were collected before, during and after the intervention for 7 day periods. Significant pre-post increases were found for both comparison (31% increase) and intervention (35% increase) trails (p<0.01).

A large multisite natural experiment in the United Kingdom (n=1796 participants) investigated the impact of new walking and cycling routes on physical activity (Sahlqvist et al, 2013; Brand et al, 2013; Goodman et al, 2014). New infrastructure involved traffic-free bridges (Cardiff and Kenilworth) and an informal riverside footpath was turned into a boardwalk (Southampton). Those less-exposed to the intervention acted as a comparison group to those more exposed to (i.e. living closer) to the new infrastructure called Connect2. Proximity to the intervention was strongly associated with greater use of the new infrastructure (32% reported using Connect2 at one year

follow-up; 38% reported at two year follow-up). At two year follow-up individuals living nearer the intervention versus those living further away did report significant increases in walking and cycling (effect of 15.3 minutes per week per km closer to the intervention after adjustments for baseline variables). Proximity was also associated with a comparable increase in total physical activity (effect of 12.5 minutes per week per km closer to the intervention). Secondary analyses investigated the effect of the intervention on reduction in CO_2 emissions through increased active transport and reduced car use. These analyses showed that the effects of the intervention on active travel and reduced car use did not translate into sizeable CO_2 effects as neither living near the infrastructure nor using it predicted changes in CO_2 emissions from motorised travel (Brand et al, 2014).

Similarly, three studies showed no significant impact for the provision of new trails/greenways on usage or physical activity. Evenson et al (2005) found no significant effect for usage and PA on a new 2.8 mile multiuse trail in the US. Burbidge & Goulias (2009) found a negative significant effect on active travel behaviour and walking. The intervention involved the construction of a multiuse trail separated from existing roads and sidewalks and designed for both active transport and recreational use. A study by West and Shores (2011) found no significant effect on physical activity behaviour for five miles of greenway developed and added to an existing greenway along a river.

Interestingly, none of these interventions included any promotion or marketing campaign of the new trails/greenways. Both studies by Evenson et al (2005) and Burbidge & Goulias (2009) employed quasi-experimental, pre-post designs with no control/comparator group. West and Shores (2009) comparator was randomly selected households (n=591) living 0.5-1 mile radius from the greenway.

3.2.3 Greening Interventions (Annex 1 – Table 3)

In many cities, green space is concentrated in large areas, while the rest is dispersed in small patches like pocket parks, gardens or street trees. Such small-scale green space is often the target of greening initiatives but little is known about their value. In summary, eight interventions investigated the effects of greening on health, well-being, social and environmental outcomes. Four interventions involved greening of vacant lots and four investigated the impact of street trees/greening. There were no interventions that met the eligibility criteria for green walls, allotments/community gardens or urban agriculture-based interventions, mainly due to the lack of robust study designs.

There was promising evidence (4/4 studies showed significant positive effects) to support the use of greening of vacant lots for physiological, psychological and improved social environment outcomes. Vacant lots were defined as abandoned parcels of open land with overgrown vegetation, rubbish, and other illegal activities. A decade long study using a difference-in-difference design by Branas et al (2011) showed that greening of vacant urban lots resulted in reductions in gun assaults ($p<0.001$), vandalism ($p<0.001$), and residents reporting less stress and more exercise ($p<0.01$). Greening of vacant lots (> 725,000 m^2) from 1999 to 2008 involved removing trash and

debris, grading the land, planting grass and trees, installing low wooden fences around perimeter, and maintenance activities performed multiple times/year.

In the first (pilot) RCT of vacant lot greening, Garvin et al (2013) found a decrease in the number of total crimes and gun assaults around greened vacant lots compared with control ($p>0.05$). In a half-mile buffer around the vacant lot sites, the proportion of all crimes across sites taking place at the intervention site before greening and after greening was 31.2% and 33.8%, respectively. People around the intervention vacant lots reported feeling significantly safer after greening compared with those living around control vacant lots ($p<0.01$). Overall, greening was associated with reductions in certain gun crimes and improvements in residents' perceptions of safety but this needs to be tested in a fully-powered RCT.

Anderson et al (2014) investigated the impact of a range of indigenous greening interventions in three low-middle income urban areas in Cape Town, South Africa on flora and fauna measures. Biodiversity in the greening intervention sites was higher than the vacant lot and comparable to the conservation sites (control sites).

South et al (2015) found that heart rate lowered significantly in greened compared to non-greened vacant lots (-5.6 beats per minute (Standard Error = 0.27; $p<0.001$ for the greened site). Being in view of a greened vacant lot decreased heart rate significantly more than did being in view of a non-greened vacant lot or not in view of any vacant lot. The intervention involved a randomly selected cluster of vacant lots receiving standard greening treatment involving cleaning and removing debris, planting grass and trees, and installing a low wooden post-and-rail fence compared to vacant lots that received no greening intervention.

Four (out of four) studies showed positive impacts on health and environmental factors for interventions involving greening of urban streets.

Ward Thompson et al (2014) found evidence to support the provision of 'Do it yourself streets' in urban areas in the United Kingdom. Streets were made safer, more attractive (e.g. by planting trees and plants), and traffic calming measures were added at nine different sites. Longitudinal data showed that participants perceived they were significantly more active post-intervention ($p=0.04$) than the comparison group, and there were significant improvements in perceptions of the environment for the intervention compared to the control group. Street greening interventions can also reduce anti-social behaviour such as illegal dumping. Joo and Kwon (2015) found that illegal dumping of household garbage occurred at 55.4% of greened sites ($n=74$) compared to 91.9% of sites without greenery ($n=74$).

A range of environmental benefits were evident for street tree interventions. Strobach et al (2013) investigated 12 community driven greening projects involving tree plantings carried out in deprived areas. Results showed a difference between greening projects and random urban sites ($p=.049$). For eight out of the twelve site-pairs, the greening projects had more bird species than the random urban sites in their vicinity. Jin et al (2014) investigated the provision of street trees treated with different pruning intensities (strong, weak and null) which provided different canopy

coverage across the four seasons (n=6 streets), compared to nearby street segment controls which had similar features but contained no trees (n=2 streets). Pruning regimes with increased street tree canopy was positively associated with $PM_{2.5}$ concentrations owing to reduced air circulation.

3.2.4 Green Infrastructure for Storm Water Management and Cooling Urban/Suburban Areas (Annex 1 – Table 4)

There are numerous management opportunities to mitigate runoff in residential areas where there is a mixture of impervious and pervious areas, and a potential to change the routing of runoff from connected impervious areas (e.g. rooftops) to pervious areas (e.g. rain gardens). For urban and suburban areas where storm water infrastructure is insufficient, parcel-scale retrofits (e.g. green roofs, bio-swales, rain gardens) may be a practical solution for adding sufficient green infrastructure that in turn manages adverse effects from storm water.

In summary, seven studies investigated the effects of UGS interventions for managing the impact of storm water. There was promising evidence to support the provision of rain gardens (3/4 studies showed significant positive effect) and roof gardens (3/3 studies showed significant positive effect) for managing the adverse impact of storm water, mainly in suburban areas. It is important to note that while the majority of studies investigating rain gardens showed a significant effect, this was a relatively small effect. Mayer et al (2012) concluded that storm water management interventions needed to be at a certain scale, inter-connected and have long-term monitoring periods in order to realize their full potential.

Mayer et al (2012) explored whether voluntary incentives were effective at distributing storm water management throughout a small suburban catchment, and whether the number and placement of rain gardens and rain barrels were sufficient to alter the hydrology, water quality, and aquatic biology of the catchment. Retrofit management practices offered in the auction were up to four 284-litre (75 gallon) rain barrels and a single 16 m^2 rain garden per property. In total 83 rain gardens and 176 rain barrels were installed onto more than 30% of the 350 eligible residential properties in a 1.8 km^2 suburban catchment area in Ohio, US. The intervention had an overall small but statistically significant effect of decreasing storm water quantity at the subwatershed scale.

In a similar study in the same area (Shuster and Rhea, 2013; Roy et al, 2014), the installation of 81 rain gardens and 165 rain barrels at four experimental areas was compared to two control areas. In contrast, results showed no significant difference between control and intervention sites with regards to stream water quality, periphyton, and macroinvertebrate metrics. However, it did show a small significant decrease in runoff volume in intervention areas.

Kondo et al (2015) investigated the effects of a range of green storm water infrastructure across 52 sites in Philadelphia on health and social outcomes using a difference-in-difference analytical approach. Installed infrastructure included 152 tree trenches, 46 infiltration or storage trenches, 43 rain gardens, 29 pervious pavement instalments, 20 bump outs, 14 bio-swales, 5 storm water basins, 1 wetland, and 12 classified as other. The comparator groups were matched control sites where no construction took place. Results found significant reductions in narcotics possession (18%–27% less; $p < 0.01$), narcotics manufacture and burglaries. There were non-significant

reductions in homicides, assaults, thefts and public drunkenness. In addition, there were negative, non significant effects on stress levels and increased reporting of high blood pressure and cholesterol.

Jarden et al (2016) found a significant reduction in storm water flow at the intervention sites with reductions of up to 33% of peak discharge and 40% of total run-off volume. The intervention involved provision of 91 rain gardens (< 25 m^2), street-connected bio-retention cells (~ 26-44 m^2) and rain barrels on two streets. Each intervention street had a matched control street (n=4) of similar size, drainage area and characteristics.

Van Seters et al (2009) found that the green roof on a university building in Toronto, Canada (241 m^2) retained 63% more rainfall than the conventional (bitumen) roof over an 18-month monitoring period. In a similar study in Michigan, US, Carpenter & Kaluvakolanu (2011) investigated the effects of an extensive green roof (325.2 m^2 and 929 m^2) on a university building compared to a stone-ballasted roof and an asphalt roof. Results showed that the green roof retained 68% of rainfall volume and reduced peak discharge by an average of 89%. Also, there were significantly higher total solids concentration (p=0.045) for the green roof than the asphalt roof. Finally, Fassman et al (2013) found that a green roof (500 m^2 on a council civic centre) retained 57% of rain water in comparison to control (bitumen roof). All of these studies were quasi-experiments which collected post-implementation data only.

Green infrastructure (e.g. green roofs, green walls) is one potential solution to mitigate the health consequences of increased temperatures resulting from climate change and urban heat island effect. However, only one study met the eligibility criteria for investigating the effects of green infrastructure for thermal regulation of buildings. Peng and Jim (2015) found that a green roof displayed significant cooling effects in spring, summer, and fall, with slight warming effects in winter in a suburban area in Hong Kong China, compared to a bare roof control site. These findings are similar to the conclusions from a review by Bowler et al (2010) which investigated the impact of urban greening for cooling towns and cities. They concluded that the evidence for the cooling effect of UGS is mostly based on observational studies, and called for further empirical research in order to allow specific recommendations to be made on how best to incorporate UGS interventions for cooling urban areas.

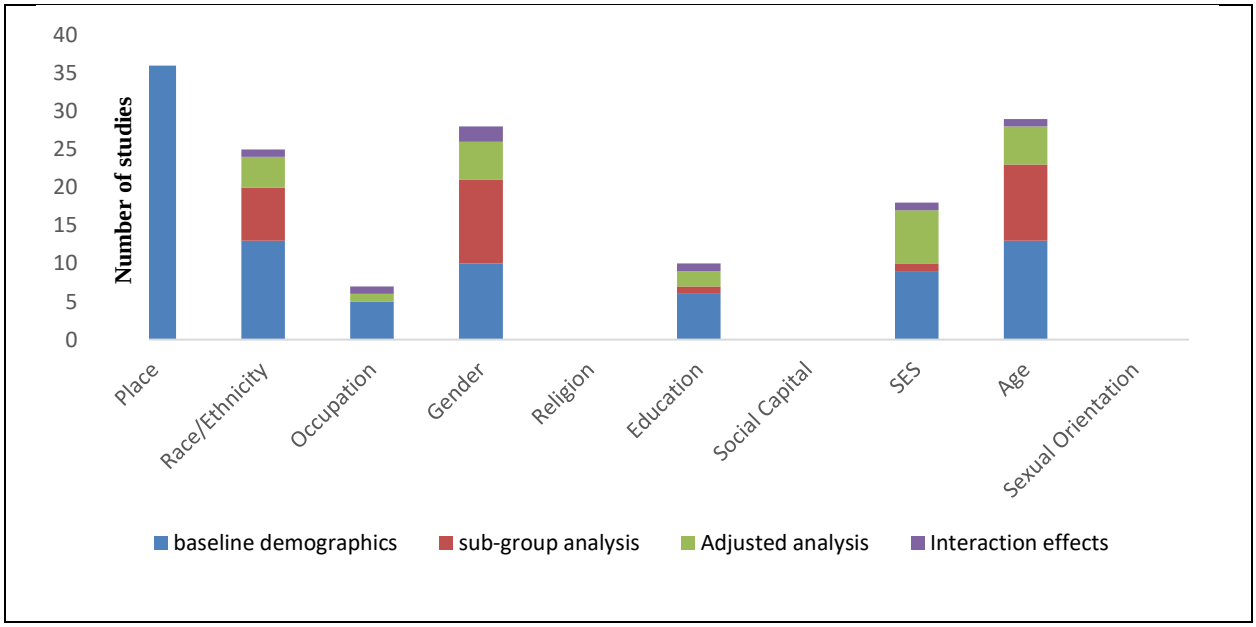
3.3 Impact of UGS Interventions on Equity Factors

Fig. 1 presents the reporting of PROGRESS-Plus factors in the included studies. Twenty studies were based in disadvantaged neighbourhoods, with relatively mixed supporting evidence for UGS interventions. For those studies that did show a positive intervention effect in disadvantaged neighbourhoods there is, however, insufficient reported information on whether the community used, or indeed, benefitted from the UGS interventions. Four studies targeted specific age groups; children aged 5-10 years (Quigg et al, 2011), adolescents (Cohen et al, 2009b; Gubbels et al, 2016) and seniors (Ward Thompson et al, 2013). Most studies reported the gender (n=17), age (n=21) and race, ethnicity or language (n=21) of participants.

Ten studies did not report any information on the PROGRESS-plus indicators (van Seters et al, 2009; Carpenter and Kaluvakolanu, 2011; Mayer et al, 2012; Fassman et al, 2013; Clark et al, 2014; Jin et al, 2014; Roy et al, 2014; Joo & Kwon, 2015; Peng and Jim, 2015; Jarden et al, 2016). Also, there were no studies that reported any information regarding religion, social capital and sexual orientation. No study reported powering their analysis of outcomes for these equity variables.

In summary, there is currently too little evidence to enable us to draw firm conclusions regarding the impact of UGS interventions on a range of equity indicators.

Fig. 1. PROGRESS-Plus reporting in included studies



Note: Studies may report PROGRESS-Plus factors in more than one way. The figure shows that the majority of studies, if they reported any equity indicators, mainly did so using baseline demographics to describe the population sample. A limited number of studies undertook any subgroup analysis, adjusted analysis or interaction analysis which greatly limits our ability to draw any firm conclusions about the impact of UGS interventions on equity factors.

3.4 Cost–effectiveness of UGS Interventions

Built environment interventions, in particular those that undertake a physical change to the built environment are expensive and present significant investment, mainly by local authorities. Studies investigated interventions that ranged from $45,000 per park (Cohen et al, 2012) to $3.5 million per park (Cohen et al, 2009b) to 5 million euro (Droomers et al, 2015). In summary, four studies undertook preliminary economic evaluations and found that UGS interventions were relatively cost-effective (Cohen et al, 2012; 2013; 2014; Bird et al, 2014).

Cohen and colleagues (2012; 2013; 2014) estimated cost–effectiveness based on increased METs/year. Each MET-hour gained is equivalent to a person engaging in moderate-vigorous physical activity for approximately 15 minutes, and suggested that physical activity-based interventions would be cost effective if the cost was less than $0.50– $1.00 per MET-hour. The

three park-based interventions showed purported cost–effectiveness between $0.14-$2.40 cents per MET (Cohen et al 2012; 2013; 2014).

Preliminary evidence suggests that investment in trails for walking and cycling indicate benefit-cost ratios in a range (>4-1):1 as a result of increases in walking and cycling attributable to use of Connect2 infrastructure (Bird et al, 2014). The study suggests significant financial savings could be made as a result of increased numbers of people walking and cycling. Similarly, a recent modelling study suggested that effectiveness estimates as low as a 2% gain in population physical activity levels would be cost-effective (£18, 411/disability-adjusted life year) (Dallat et al, 2014). Although the direct health gains are predicted to be small for any individual, summed over an entire population, they are substantial.

There was no evidence investigating the economic implications of other types of UGS interventions.

4 Discussion

4.1 Summary of Findings

The aim of this study was to conduct an evidence review on environmental, health and equity effects of UGS interventions.

In summary, there was ***promising evidence*** for:

1. Park-based interventions that specifically combined a physical change to the green space and promotion/marketing programmes, particularly for increasing park use and physical activity;
2. Interventions that involved greening of vacant lots for health and well-being (reduction in stress) and social (reduction in crime, increased perceptions of safety) benefits;
3. Greening of urban streets particularly for environmental benefits (increased biodiversity, reduced air pollution, reduction in illegal dumping);
4. Green infrastructure for managing storm water impacts in urban and suburban areas.

There was ***inconclusive evidence*** (i.e. a mix of positive and negative results, or a limited number of conducted studies to enable a form conclusion to be drawn) for:

1. Park-based interventions that only involved physical change to the green space (i.e. they did not include programmes to promote the use of the green space);
2. Urban greenways/trails regardless of whether there was promotion and/ or marketing activities to encourage use of the greenway/trails;
3. Pocket parks for health and well-being benefits;
4. Green infrastructure for cooling urban/suburban areas;
5. Long-term impact of UGS interventions;
6. Economic benefits of UGS interventions;
7. The differential impacts of UGS interventions on various equity indicators;
8. The provision of UGS interventions for health, social and environmental benefits in the European context.

There was ***no evidence*** (i.e. an absence of studies) for:

1. Green walls, allotments/community gardens and urban agriculture-based interventions;
2. Adverse or unintended consequences of UGS interventions.

4.2 Translation/Generalisability of Findings to a European Context

Only a limited number (n=5) of the UGS interventions included in this evidence review were conducted in Europe. Given the stark differences in urban planning, climate and culture, the generalisability of our findings and translation to a European context are unknown. Although external validity was not the focus of the present review, it is worth highlighting that most of the included studies were conducted in the US, which is common in research on the built environment. This is an issue because there are numerous factors that often vary between different countries that

can affect findings. For example, there are huge variations in climate across different parts of the world that influence how people might use UGS, for example, for being physically active. Many cities in Europe also have higher population density and more mixed land use than is typical of cities in the US, many of which were more influenced by car usage. Thus, whist natural experiments offer the advantage of high levels of external validity for the setting and population that is affected, more research outside of the US, and particularly in Europe, is needed so that findings may be generalised to other countries.

4.3 Recommendations for Designing UGS Interventions

These findings highlight that multifaceted UGS intervention strategies are likely to have a more significant impact than changes to the built environment in isolation. However, these results should be interpreted with caution given the relative dearth of intervention-based research for each particular approach and further work is urgently required.

There is a need to understand how UGS interventions might be designed to encourage use in order to promote health, social and environmental benefits. Several studies adopted a suite of approaches alongside the actual physical change to the UGS which made it difficult to 1) derive the 'active' or effective components of the UGS intervention, and 2) disentangle the actual contribution of the physical change to the built environmental component. Future studies should include a more complete description of their intervention strategies. Common Behaviour Change Techniques evident in UGS interventions include prompts/ cues, material incentive (behaviour), restructuring the physical environment, restructuring the social environment, avoidance/reducing exposure to cues for the behaviour, and adding objects to the environment.

Based on findings from the current evidence review, the following section builds on the previous recommendations by the WHO (2006) and NICE (2008), Public Health England (2014) and Institute for European Environmental Policy (IEEP), and also broadens these recommendations to incorporate other health, social and environmental outcomes.

The following factors should be considered when designing UGS interventions:

1. Given the complex social and economic dynamics that occur at scale, implementation of green infrastructure requires a multidisciplinary approach;
2. Urban planning can and should have a public health component;
3. UGS interventions should be designed with foreseen long-term, maintained impacts from the outset. Intervention developers should 'design-in' components that specifically focus on long-term health, social and environmental effects. This includes long-term management and maintenance plans of the green space itself;
4. Local communities, and indeed different subgroups within these communities, use UGS in a variety of ways. Future interventions need to consider how the green space may be used and what the needs of the local community are;
5. Need to design UGS interventions that incorporate and maximize health, environmental and social effects;

6. Need to incorporate promotion and marketing of UGS as well as changing the physical environment (i.e. more complex than "build it and they will come"), particularly for health and social benefits;
7. Ensure that the local community are engaged throughout the design process to ensure that their needs are incorporated into the intervention;
8. Not all green space is the same – factors such as type of green space, maintenance of green space and users of green space play a role. Therefore, the context of green space should be considered when designing UGS interventions.

4.4 Recommendations for Evaluating UGS interventions

Given the overall limited evidence to support a range of UGS interventions, particularly for certain UGS intervention approaches such as provision of greenways/trails, opportunities to robustly evaluate the impacts of future UGS interventions should be sought. Undertaking UGS research requires multicomponent studies which incur considerable costs. In addition, the undervaluation of the health, social and environmental benefits derived from UGS may also explain the relative lack of societal investment in research on UGS. Based on this evidence review and building upon previous recommendations on UGS and physical activity outcomes (Hunter et al, 2015; Benton et al, 2016), we have highlighted methodological considerations to help inform the evaluation of future UGS interventions. However, the implementation of specific recommendations is contingent on the research question.

The following factors should be considered:

4.4.1 Study Design

Natural experiments are defined as observational studies that resemble true experiments, but lack random assignment of participants to intervention groups. This is because the intervention is naturally occurring or unplanned and so the researcher does not, and usually cannot, manipulate the intervention exposure (Craig et al, 2012). Accordingly, many researchers are now increasingly using and recommending natural experiments when evaluating population-level interventions where an RCT is not feasible, such as in UGS interventions (Hunter et al, 2015). However, natural experiments present a number of challenges including the need for effective partnerships, flexibility in study design, development of contingency plans to cope with any delays in intervention construction, and flexibility of funding cycles (Ogilvie et al, 2011). These are particularly complex interventions with multiple interacting factors at the individual, community and population level, and considerable variation in the quality and types of UGS. Studies of this kind raise a number of scientific and evaluative challenges, for example, aligning research timetables with the intervention timelines, rapidly recruiting and conducting a baseline assessment prior to implementation of the intervention and, measuring confounders and levels of exposure.

4.4.2 Sample Size

Few of the included studies provided details of a sample size calculation to inform their study population, with most of the included studies employing a small sample size for research of this

nature. Without an appropriate sample size calculation, studies are at an increased risk of type II errors due to an inappropriately small sample size to detect an effect. Alternatively, studies may have larger numbers of observations than is required to adequately power a study, resulting in overly expensive studies. Future studies must perform a fully justified sample size calculation to improve the rigor of this body of research. Indeed, more recent, ongoing natural experiment studies have included rigorous sample size estimations in their study protocols (e.g. Tully et al, 2013; Goodman et al, 2014).

4.4.3 Appropriate Control/Comparator group(s)

Control groups typically involved matched control UGS which did not undergo any intervention. UGS were typically matched on the following criteria: size, features, amenities and served a similar population that did not undergo any improvements. However, there are inherent difficulties in identifying such adequate control sites. As well as matching on population demographics, future research should attempt to match control sites using objective measures of the built environment, such as land use, population density, street connectivity, and physical infrastructure (Benton et al, 2016). Considering the difficulties associated with identifying suitable comparison groups, it is unlikely that a single control site is sufficient to reduce confounding from demographic and environmental variables. Using multiple control sites (including different types of control sites e.g., graded exposure, pre-intervention condition, matched control, synthetic control) offsets the variation in confounding variables across control sites and thus increases the likelihood of finding well balanced comparison groups.

Guidance from the Medical Research Council suggests that graded measures of exposure (e.g. Goodman et al, 2014), such as distance from the intervention, can provide appropriate comparison groups in natural experiments (Craig et al, 2012). However, this assumes that proximity to exposure means real exposure to the intervention, which of course may not be the case. Future research should aim to develop more specific distance-based intervention and comparison groups that take into account differences in exposure between individuals who reside within the same geographical area (see Humphreys et al. (2016) for a detailed discussion of potential approaches to graded exposure).

4.4.4 Outcome Measures and Follow-up Assessments

In order to capture all purported benefits of UGS interventions, future studies should include a range of measures for health, social and environmental outcomes. A large number of park-based intervention studies used SOPARC methodology for assessing usage and deriving changes in physical activity. While SOPARC has a number of strengths it does not capture whether new users are using the park, where park users have come from (local residents or visitors), socioeconomic characteristics of park users or individual level change. Future studies should triangulate SOPARC data with Intercept Surveys and household interviews with local residents in order to provide a more in-depth investigation (Cohen et al, 2009a; 2009b; 2012; Bohn-Goldhaum et al, 2013; Cohen et al, 2013; 2014).

Due to the limited number of follow-up periods, we were not able to rigorously assess the longer term effectiveness of UGS interventions beyond 12 months, and our synthesis of effects was limited by intervention heterogeneity. The timing of follow-up assessments ranged from immediately post-intervention (Veitch et al, 2012) up to two years (Goodman et al, 2014). Indeed, Mayer et al (2012) suggested that the length of their study (six years) may have precluded observation of treatment effects on water quality and aquatic biological communities as these factors respond more slowly to environmental changes, and hence calling for much longer term follow up studies to capture full benefits of such studies. Given the relative "permanent-ness" of UGS interventions, usage over time will change and this needs to be captured by employing a number of follow-up assessment points from immediately post-construction to longer term follow-up.

4.4.5 Target Populations

Targeting of interventions can be done through spatial considerations or through identifying target groups. A number of studies targeted low socioeconomic position groups and ethnic minority groups which are typical of inner-city areas. There was also a paucity of evidence related to the influence of UGS interventions on children and older adults. A unique aspect of UGS is that it is a resource for people of all ages and backgrounds; therefore, future research should target all groups.

4.4.6 Economic evaluation

Much more research is required to investigate the economic implications of UGS interventions. Future research should also consider the wider economic impact of such interventions, including health and societal costs, for example, health care costs, reductions in carbon emissions, improvements in safety, and reduced crime.

4.4.7 Social Environment

There is a need to move beyond individual level approaches and towards broader population interventions that provide a supportive social and built environment. Future research would be enhanced through incorporating measures of the social environment in order to further understand the role that it plays in UGS research, and how it might be influenced, in association with the built environment (Hunter et al, 2015).

4.4.8 Understanding Causal Mechanisms

Natural experiments provide more appropriate study designs for investigating causal effects of UGS interventions. Findings from natural experiments lead to stronger inferences about causality than cross-sectional studies because of the temporal order of changes in environment and behaviour. Future studies should include a more complete description of their intervention strategies and logic models that describe the assumed causal pathways by which they affect the outcomes.

Future studies should also measure a range of purported mediators and moderators to test the hypothesized pathways of effect. Examples include perceived and objective measures of UGS safety, distance from UGS, awareness of UGS, barriers to UGS use, motivators for UGS use, weather, exposure to UGS, quality of UGS environment, neighbourhood built environment features and, community level social measures such as sense of community, social support and social capital. In addition, researchers should include measures of the implementation of the intervention (e.g. fidelity, dose). This information will help unpack contextual factors that might influence whether the intervention will work when employed in other situations. This requires the use of multilevel conceptual models and statistical methods, and the triangulation of data, both quantitative and qualitative.

4.4.9 Adverse Effects and Unintended Consequences

It is well established that complex, public health interventions can sometimes have unintended negative consequences. However, evaluating adverse effects and unintended consequences is a neglected area in UGS interventions. For example, it is conceivable that UGS interventions that promote and increase physical activity and active travel (i.e. cycling, walking) may increase the intake of air pollution. Indeed, a recent study by Tanio et al (2016) found that harms would exceed benefits after 90 minutes of cycling per day or more than 10 hours of walking per day. However, this study concluded that the health benefits of active travel/physical activity outweighed the harm caused by air pollution in all but the most extreme air pollution concentrations.

Bonell et al (2015) argue for the importance of evaluations of public health interventions to 1) examine potential harms, adverse effects and unintended consequences; and 2) examine the mechanisms that might underlie these harms so that they might be avoided in the future. Bonell and colleagues (2015) have developed the concept of detailing ‘dark logic models’ to help guide the evaluation of potential harms and underlying mechanisms.

4.4.10 Equity

Our results show that little is known about equity effects in UGS interventions. This review explored whether differences in intervention effects are evident across various indicators of equity beyond deprivation using the PROGRESS-Plus tool. The majority of the included studies record information on a number of the PROGRESS-Plus factors. However, very few actually report details of relevant analyses to determine which population subgroups may stand to benefit or be further disadvantaged by UGS interventions. In order to fully understand the equity impacts of UGS interventions, we recommend that subgroup and interaction analyses are conducted in future studies.

4.5 Unanswered Questions

In addition to detailing a number of methodological considerations, this evidence review has also highlighted gaps in the literature. The following unanswered questions will help focus future research on UGS interventions:

1. Do specific UGS interventions result in benefits among specific groups (e.g., low socioeconomic position, different age groups, gender)?
2. Is it possible to design multiuse and multipurpose UGS that facilitates health, social and environmental benefits for a wide number of user groups, for example different age groups, in different climates, cultures and countries?
3. Do improvements to UGS of varying sizes and/or functions result in similar health, social and environmental benefits?
4. What types of urban green space are needed and how much is enough/sufficient for health, social and environmental benefits?
5. To what extent do UGS interventions actually capture new users or do they simply displace users from other areas?
6. What are the economic implications of UGS interventions?
7. What are the underlying causal mechanisms of different UGS interventions for a range of populations and outcomes?
8. When, how and why people use UGS in order to inform intervention design?

4.6 Strengths and Limitations

This evidence review employed key elements from systematic review methodology, such as, a comprehensive search across a range of public health, social sciences and urban planning databases; and, screening of titles/abstracts and full texts by two independent reviewers. In an attempt to negate publication bias, we searched for studies in grey literature. However, included studies were mostly from high income countries, particularly the US, which limits the generalisability of the findings, particularly to a European context. There was also large heterogeneity across the included studies, including target populations, settings, interventions approaches, study design and outcome measures, which limits the conclusions that can be drawn from this review.

5 Conclusion

In summary, UGS has an important role to play in creating a "culture of health" including the "social health" of our neighbourhoods and communities. Results from this review show promising evidence to support the use of certain UGS interventions for health, social and environmental benefits. However, for other UGS interventions the evidence is inconclusive. None of the studies included in this review considered a holistic approach, measuring health, social and environmental outcomes. We argue that the true potential of UGS has not been realized as studies have typically underevaluated the intervention. Rather, the findings from the present review highlight the need for researchers to conduct better natural experiments to inform policy and practice, especially in light of the growing policy response in this area.

Urban Green Space – and urban planning in general – cannot be seen in isolation from other local government priorities such as transport and housing. It must be framed holistically and viewed as a complex system in which the interplay between physical, economic, social and natural ecosystems affects health, behaviours and communities. The growing diversity of our towns and cities is transforming how green space is required and negotiated for health, well-being, social and environmental benefits. Significant UGS investment is made worldwide, and many researchers and policy-makers alike have gradually shown increased support to implement expensive UGS interventions to improve population-level health, well-being, social and environmental factors. Thus, more effective strategies are required to enhance opportunities for delivering multiple benefits from the valuable resource of UGS. We argue that methodologically stronger future study is required to underpin policy and practitioner recommendations (Benton et al, 2016). Indeed, a number of these methodological aspects are being addressed in the 'next generation' of natural experiments which are currently in progress (Ogilvie et al, 2010; Smith et al, 2010; Tully et al, 2013; Benton et al, 2016; Ogilvie et al, 2016). Focused attention to the issues raised in this review is likely to lead to more robust evaluations of UGS interventions. This review provides a platform for guiding the design, implementation and evaluation of future research investigating UGS interventions.

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Annex 1 – Detailed tables

Table 1. Park-based Interventions (n=16)

Study Descriptor						Results	
Reference	**Study Design**	**Urban Area**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Interventions involving change to the physical UGS only (n=9)								
Cohen et al, 2009a	Quasi-experiment: controlled, pre-post design	Urban area; Los Angeles, US	Predominantly Latino and African-American and low-income neighborhoods (mean 31% of households in poverty)	5 parks (mean 8 acres) underwent major improvements including new/improved gyms, picnic areas, walking paths, playgrounds, watering and landscaping (cost: >$1m each) Parks ranged from 3.4 to 16 acres (mean 8 acres) and served an average of 67,000 people within a 1-mile radius. Parks contained multipurpose fields; playgrounds; gymnastics areas; and picnic and lawn areas.	Each intervention park had a matched control park (n=5) of similar size, features, amenities and served a similar population that did not undergo any improvements	-ve: Overall park use and PA declined in both intervention and control parks	Baseline (Dec 2003-Nov 2004); follow-up (Apr 2006-Mar 2008) Follow up measures were initiated at least 3 months after construction (range 3-14 months post construction)	SOPARC: 4 time points over 7 days Intercept surveys Interviews with residents within 1-2 miles from each park: use of park and PA levels
Cohen et al, 2009b	Quasi-experiment: controlled, pre-post design	Urban area; Los Angeles, US	Youths and seniors living within 2 mile radius of parks; 10.5% households in poverty; 21% residents aged > 60 yrs; 17.5% Hispanic	2 parks (48-67 acres) underwent renovations: (1) improvements to skate park surfaces only (cost $3.5m) (2) improvements to entrance, courtyard areas and gymnasium of senior center (cost $3.3m)	Control skate park and control senior center that did not have any improvements Matched on neighborhood characteristics (demographics and economic distribution) and physical features (size and type of facilities)	+ve: 510% increase in skate park use compared to 77% in comparison skate park Substantially fewer users of senior center	Baseline and follow-up 1-3 months following opening of renovated areas	SOPARC: 4 timepoints over 7 days Face to face interviews with park users and residents (age 18+) living within a 2-mile radius of park Perception of safety; park proximity
Quigg et al, 2011	Quasi-experiment: controlled, pre-post design	Urban area; Dunedin, New Zealand	n=156 Children aged 5-10 years from the local community	Upgrade 2 community playgrounds: 1) playground had 10 new components installed, including play equipment, seating, additional safety surfacing, and waste facilities; 2) playground had 2 new play equipment pieces installed	Broadly similar community to form the control community	-ve: No statistically sig. difference in total daily PA compared with control.	Oct-Dec 2007 and follow up was completed Oct-Dec 2008 (Spring in the Southern Hemisphere)	Actigraph accelerometer (primary outcome: mean total daily PA); BMI; questionnaire (child, family structure and neighbourhood scale)
Cohen et al, 2012	Quasi-experiment: controlled, pre-post design	Urban area; Los Angeles, US	Residents within 1 mile radius of intervention parks (mean 29% of households in poverty, 59% Latino population)	12 parks (mean 14 acres) involving installation of Family Fitness zones (outdoor gyms), 8 pieces of equipment at each park (average cost $45,000 for each park) Mean park size 14.4 acres (range, 1-29 acres); served an average of 40,964 individuals within 1-mile radius	10 matched control parks that did not install Family Fitness zones Mean park size 12.4 acres (range 0.5-46 acres); served an average of 33,226 individuals in a 1-mile radius	-ve: Park usage increased by 11% compared to control parks (not sig.)	Baseline (winter of 2008-2009); 1st follow-up 1 year later during winter 2009-2010; 2nd follow-up a few months thereafter (Spring 2010)	SOPARC 3 times per day for 4 days Intercept survey: use of park, use of fitness equipment, perceptions of park, distance travelled to park

	Study Descriptor					Results	
Reference	**Study Design**	**Urban Area**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Veitch et al, 2012	Quasi-experiment: controlled, pre-post design	Urban area; Victoria, Australia	Most disadvantaged decile in state of Victoria	1 park (size 25,200m^2): involving establishment of a fenced leash-free area for dogs (12,800m^2); an all-abilities playground; a 365m walking track; BBQ area; landscaping; fencing to prevent motor vehicle access to the park	1 matched control park (size 10,000m^2) located in same neighborhood as intervention park and having similar features at baseline	+ve: Sig. increase from pre to post-improvement in number of park users for intervention park (T1=235, T3=985) and number of people walking (T1=155, T3=369) and being vigorously active (T1=38, T3=257)	Baseline (Aug-Sept 2009), immediately following park improvement (Mar-Apr 2010) and 12 months after baseline (Aug-Sept 2010)	SOPARC: 7 times each day on 9 days (over 4 weeks)
Bohn-Goldbaum et al, 2013	Quasi-experiment: controlled, pre-post design	Urban area; Sydney, Australia	2-12 year olds and their parents or care givers; low socioeconomic neighbourhood	1 park underwent renovations: new children's play equipment, upgrading paths, adding new greenery, lighting and facilities (e.g., park furniture), green space was created by opening the adjacent sports field to public use	Control park of a similar size and type which did not undergo any improvements	-ve: No sig. difference between parks for usage or the number of children engaging in MVPA at follow up. In the intervention park the number of girls engaging in MVPA significantly decreased (p=0.04) between baseline and follow up	Baseline (May 2007) and follow up 9 months after the upgrade (May 2009)	SOPARC: 3 timepoints over 14 days Intercept surveys with park users who were accompanied with a child under 13 years (demographics, park usage & PA behavior). Face-to-face interviews: playground use, perceptions of park features, PA behavior of eldest child.
Cohen et al, 2014	Quasi-experiment: post data only	Urban areas; Los Angeles, US	Residents living within 0.5 mile radius of parks (n=392 pre; n=432 post) 30-41% household poverty; minority populations (70-80% Latino, 3-17% African-American, 0-16% Asian)	Creation of 3 pocket parks (0.15-0.32 acres) from vacant lots and undesirable urban parcels; playground equipment and benches installed, walking path developed around the perimeter, all fenced and enclosed by lockable gates (average cost $1m funded by local non-profit groups)	15 playground areas in neighborhood parks (15-50 times larger than pocket parks) matched to each pocket park by% of households in poverty	-ve: Pocket parks were used as frequently or more often than playground areas in neighborhood parks. However, they were vacant during the majority of observations	Baseline (Jul-Aug 2006) and follow-up (Jul-Aug 2008) and comparison parks in 2008-2009	SOPARC: 4 times per day over 7 days Surveyed park users and residents about park use Random sample of household addresses (n=824) within 0.25 miles of pocket park and another between 0.25-0.5 miles of the park was selected, field staff went door to door to conduct the surveys (adults 18+yrs)

Study Descriptor						Results		
Reference	**Study Design**	**Urban Area**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Peschardt & Stigsdotter, 2014	Natural experiment: pre-post design	Urban area; Copenhagen, Denmark	52% male; 88% Danish; 21% < 10 yrs education; 10% > 65 yrs	A pocket park (932 m^2) in a dense urban area was redesigned to increase seating areas and walking trails	No control	-ve: No sig change in number of park users but demographics of park users changed slightly with more men, people aged 15-29 and more educated people using the park	Baseline (Apr-Oct 2011) and after redesign (May-Aug 2012)	Questionnaires (before n=48, after n=45) and interviews (after n=6) with park users collecting data on park use (reasons for visiting and frequency) and perceptions of redesign
Droomers et al, 2015; Gubbels et al, 2016;	Quasi-experiment: controlled, pre-post design	Urban areas; 24 most deprived neighbourhoods, Netherlands	Adolescents (12-15 yrs) and adults in severely deprived neighbourhoods Droomers et al (2015): 48 132 local residents Gubbels et al (2016): n=401 Adolescents (12-15 years) and n=454 adults	Dutch District Approach (5 million euros): new public parks replacing vacant land (n=9), refurbishing existing parks (n=9), n=6 improving paths, drainage, landscaping, planting flower bulbs in front yards; constructing wall gardens; greening streets, developing a greenway	Various control areas similar with regard to living circumstances, physical and social neighbourhood characteristics and safety	-ve: Droomers et al (2015): Intervention areas did not show more favourable changes in PA and general health compared to all the different groups of control areas for adults Gubbels: Leisure time walking (decrease 89.2 mins per week) and cycling (decrease 62.7 minutes per week) significantly decreased and depressive symptoms significantly increased in adolescents	Repeated cross-sectional data collected 2004-2011 as part of the Dutch National Health Interview Survey and other publicly available data	Droomers et al (2015): PA (SQUASH questionnaire); single item self-reported general health Gubbels et al (2016): perceived greenery (NEWS); PA (SQUASH questionnaire); depressive symptoms (CES-D); perceptions of greenery improvement and use

Reference	Study Design	Urban Area	Population	Intervention	Control	Outcome	Follow-up (months)	Outcome Measures
				Study Descriptor			**Results**	
Interventions involving a physical change to UGS and promotion/marketing programme (n=7)								
NSW Health, 2002	Quasi-experiment: controlled, pre-post design	Urban area; Western Sydney, Australia	Residents aged 25-65 years living in Lachlan Macquarie ward intervention group) and Caroline Chisholm ward (control group)	3 types of interventions in 3 parks: promoting PA and park use (via advertisements, walking maps), park modifications (signage, greening, improved paths, new playground) and the establishment of walking groups	2 parks similar in demographic profile of residents, climate, geography, surrounding features, proximity to major centres, transport and other services	+ve: Intervention group more likely to have walked in the 2 weeks prior to follow-up than control. Sig group by gender interaction indicated Intervention males were 2.8 times more likely to walk than were males in the control ward	Baseline and at follow-up 12 months later	Telephone survey, direct observation and infra-red counter estimation: PA participation rates, proportion of people adequately active and use of local parks
Tester & Baker, 2009	Quasi-experiment: controlled, pre-post design	Urban area; San Francisco, US	Resource poor neighbourhoods ; primarily Latino, African-American and Asian; median household income $34-56,000	Major renovations to 2 parks: lighting, fencing, artificial turf, landscaping, picnic benches, goal posts, walkways	Park had similar socioeconomic and racial/ethnic demographics of nearby residents and its features	+ve: Sig increases of greater than 4-fold magnitude among children and adults of both genders at the intervention park playfields, but not in the control park; Sig park use in non-play fields	May-Jun 2006 and follow up in summer 2007	SOPARC 8 times per day during observation period.
Cohen et al, 2013	RCT: parks randomized to 3 study arms (17 parks per study arm)	Urban area; Los Angeles, US	Parks users and residents living within 1 mile radius of park	2 intervention groups: 1) Park Director only; 2) Park Advisory Board-Park Director Involved in all aspects of research and in using baseline results to design park-specific interventions to increase park use and PA; Park Directors received 5 training sessions from a marketing consultant Each park received $4000 to spend on signage; promotional incentives; outreach and support for group activities	17 control parks: measurement only Parks randomized based on park size, number of facilities and programmes offered by the park and socio-demographic characteristics of the population within 1-mile radius	+ve: In both intervention parks, PA increased, generating an estimated average of 600 more visits/week/park, and 1830 more MET-hours of PA/week/park	Baseline (Apr 2008-Mar 2010) and in same season at follow-up (Apr 2010-Apr 2012)	SOPARC (4 times per day over 7 days) (Primary outcome: change in number of park users and change in the level of park-based PA (MET-hours) Survey of random sample of residents living within 1 mile of park

	Study Descriptor					Results		
Reference	**Study Design**	**Urban Area**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Ward Thompson et al. 2013	Quasi-experiment: controlled, pre-post design	Urban and suburban areas; Glasgow, United Kingdom	N=215 high Socioeconomic deprivation (within top 15%) and with woods/green space within 500m of the community	Regeneration of local community: construction of improved footpaths; clearing rubbish and signs of vandalism; signage and entrance gateways; silvicultural work to improve appearance and safety of trees and vegetation (improve views and visibility); publicity and group activities to encourage knowledge of woodlands and opportunities for use.	No environmental intervention within the green space	+ve: Quality of life sig increased in both neighborhoods (more in intervention) over time and a sig difference in quality of the physical environment between sites in 2006 but not 2009. Sig differences in perceptions of safety ($p<0.05$) in the intervention site over time, compared with no sig change in the control	Baseline (Nov 2006); follow up a minimum of 12 months post intervention (Nov 2009)	Questionnaire to assess differences in perceptions and behavior relating to local neighbourhood, environment and woodlands. Environmental assessment to record environmental quality and change.
King et al, 2015	Quasi-experiment: pre-post design	Urban area; Denver, US	Residents of transitional housing (homeless and refugees from Burma, Somalia, Afghanistan, Iraq, and Nepal)	Transformation of 2-acres of undeveloped green space into a recreational park and community garden The new park had clearly defined recreational spaces including a multipurpose playing field; playground equipment; basketball court; benches, a large community garden; a walking path alongside a creek	No control	+ve: Sig increase in total number of people observed using the park post-intervention ($p=0.004$); Increase in proportion of users engaging in moderate ($p=0.007$) or vigorous PA ($p=0.04$). Post-intervention average monthly visitors sig increased ($p=0.002$)	June-October 2010 and again June-October 2012	SOPARC – 4 one-hour non-continuous observations per day, on 4 days per month including at least 1 weekend day including non-park zones (i.e., adjacent streets, alleys and parking lots) and park zones

Study Descriptor						Results		
Reference	**Study Design**	**Urban Area**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Cranney et al, 2016	Quasi-experiment: pre-post time series design	Suburban area; Eastern Sydney, Australia	Beachside suburb comprising relatively high socioeconomic status neighborhoods, with some pockets of disadvantaged suburbs	Outdoor gym installed (60,000 Aus $), targeted marketing and promotional strategies to engage older adults and hosting exercise sessions by a professional Park is 16.08ha, picnic shelters, barbecues, drinking fountains, toilets and change facilities, a skate park and children's playground	No control	+ve: Small but sig increase in senior park users engaging in MVPA at follow-up (1.6 to 5.1%; p<0.001); sig increases from baseline to follow-up in the outdoor gym area for MVPA (6 to 40%; p<0.001); and seniors' use (1.4 to 6%; p<0.001)	9 data collection periods: 3 at baseline, 3 immediately post-installation and 3 12 months follow up	SOPARC 4 days (2 weekdays and 2 weekend days) during the first week of each data collection period; 4 data collection shifts each day Interviews with park users >18 years (demographics, PA, park use, outdoor gym use (post-installation)). Environmental audit at baseline and follow-up
Slater et al, 2016	Quasi-experimental: prospective, controlled, longitudinal design	Urban area; Chicago, US	Predominantly African American and Latino neighborhoods; household income range US$12,333-US$121,541	Park renovations and community engagement (39 intervention parks) Renovations involved replacing old playground equipment and ground surfacing Mean park size 3.86 sq. acres (range 0.09-40.48)	No renovations performed (39 matched control parks) in first instance but then by spring 2014 9 control parks were exposed to the intervention and renovated and were classified as intervention parks at follow up Parks were matched on size, proximity, neighborhood socioeconomic status, and race/ethnicity	+ve: Sig increases between baseline and 12-month follow-up for park utilization and the number of people engaged in MVPA; increase in park utilization over time in intervention parks compared with control	Baseline (Jul-Oct 2013) and follow up (Jul-Oct 2014)	SOPARC: At baseline 1 weekday and 1 weekend day; At follow up 2 weekdays and 1 weekend day; 4 scans per day Park incivilities; neighbourhood safety, weather, distance and park size

BMI=Body mass index; MVPA=Moderate-vigorous physical activity; PA=physical activity; RCT=Randomized Control Trial; SOPARC=Systems for Observing Play and Recreation in Communities; US=United States; +ve=positive intervention effect; -ve=no intervention effect

Table 2. Greenway and Trail Interventions (n=6)

Study Descriptor						Results		
Reference	**Study Design**	**Country**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Evenson et al, 2005	Quasi-experimental: pre-post design	Urban area; North Carolina, US	Adults aged >18 years living within 2 miles of the trail; approx.. 66% females; 33% non-Hispanic black	A railway was converted to a multiuse trail Trail 2.8 miles/10 feet wide with 2 mile spur (of 23 mile trail; trail passed by 2 schools, shopping areas, apartment buildings and neighbourhoods	No control	-ve: Those who had never used the trail had sig declines in median time spent in MVPA, vigorous PA and bicycling for transport. Those who had used the trail also had sig declines in median time spent in vigorous PA.	Baseline (Jul 2000-Apr 2001) and follow up (Nov 2002)	Telephone survey: BRFSS (leisure activity, walking and bicycling, MVPA); transportation activity; trail use; trail and neighbourhood characteristics; neighbourhood safety; general health; BMI
Burbidge & Goulias, 2009	Quasi-experiment: longitudinal design	Suburban area; Utah, US	N=290 households/796 individuals residing near the new trail	Construction of a trail (2-way multiuse trail separated from existing roads and sidewalks) for both transportation and recreation. The trail created a 2.5 miles loop connecting two currently existing sidewalks	No control	-ve: Negative sig effect on PA and walking between baseline and follow-up; 18-64 yr olds sig increased number of PA episodes between baseline and follow-up (p=0.024)	Baseline survey (Oct 2007); 3 activity diaries (Feb 2007 prior to construction; Oct 2007 immediately after construction; Feb 2008 5 months after construction	Household Survey (demographics, lifestyle and travel preferences); 3 activity diaries (activity type, timing, duration, interpersonal interactions, travel and travel distance)
Fitzhugh et al, 2010	Quasi-experiment: controlled, pre-post design	Urban area; Tennessee, US	Children, adolescents and adults in neighborhood (10.9% elderly (aged ≥65 yrs; 17.7% ethnic minority; 32.2% living in poverty)	Retrofit of an urban greenway (2.9 miles long; 8-foot wide) to enhance connectivity of pedestrian infrastructure with nearby retail establishments and schools (cost: $2.1m)	2 control neighborhoods with similar socioeconomic dimensions and 2 elementary and 1 middle control schools	+ve: Pre and post intervention changes between experimental and control neighborhoods were sig different for total PA (p=0.001); walking (p=0.001) and cycling (p=0.038) There was no sig change over time for active transport to school	Baseline (Mar 2005) and follow-up (Mar 2007) 14 months after construction complete	Pedestrian count surveys at school and neighborhood areas (2 hours on 2 days) for 1-week at baseline and follow-up

Study Descriptor						Results		
Reference	**Study Design**	**Country**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
West and Shores, 2011	Quasi-experiment: controlled, pre-post design	Urban area; North Carolina, US	N=597 residents living within 0.5 mile radius of greenway	5 miles of greenway developed and added to existing greenway along a river	N=591 randomly selected households living 0.5-1 mile radius from greenway	-ve: No sig difference between intervention and control group	Baseline and follow-up (conducted 11 months after the opening of the greenway)	Household survey included self-report question of PA levels
Clark et al, 2014	Quasi-experiment: controlled, pre-post design	Urban area; Southern Nevada, US	2 of the trails (commuter trails) were in lower SES neighbourhoods	6 intervention trails: after a marketing campaign promoting PA and trail use (2012), signage was added/altered including: distance markings, way-finding signs, trail maps, trail names, and icons for acceptable uses	Comparison trails matched on length, trail environment, amenities, and neighborhood demographics as closely as possible Mean length of trails 3.96 miles (range 0.9-8.7 miles); 70% were lit; 70% had landscaping	+ve: Sig increases for both control and intervention, pre–post for trail usage per day; 31% increase for the control trails and 35% for the intervention trails (p <0.01); non-sig difference between the intervention and control group (p=0.32)	Baseline (Fall 2011), mid-intervention (Spring 2012), post-intervention (Fall 2012)	Infrared sensors on each trail access point (hourly totals). Sensors were triggered when a trail user moves past it, breaking its infra-red beam
Brand et al, 2013; Sahlqvist et al, 2013; Bird et al, 2014; Goodman et al, 2014	Quasi-experimental, longitudinal design	Urban and Suburban areas; Cardiff, Kenilworth and Southampton, United Kingdom	N=1796 adults living within 5 km by road of the core Connect2 projects	Building or improvement of walking and cycling routes across the United Kingdom including a traffic-free bridge over Cardiff Bay; a traffic-free bridge over a busy trunk road; an informal riverside footpath turned into a boardwalk	Pre-specified intervention exposure to the interventions sites with less exposed people living farther away and acting as a comparison group for the more exposed people living closer to intervention sites	+ve: Proximity to Connect2 associated with greater use of Connect2; 32% reported using Connect2 at 1 yr and 38% at 2 yrs; at 2 yrs, those nearer the intervention sig increased walking and cycling (15.3 mins/wk/km) and total PA (12.5 mins/wk/km)	Baseline surveys (Apr 2010); 1 and 2 yr follow-up surveys (Apr 2011; Apr 2012)	Baseline survey: demographic, socioeconomic and health characteristics Follow-up surveys: use of Connect2 project, walking or cycling on Connect2 for recreation, health, or fitness; past-week walking and cycling for transport; past week recreational PA using adapted short version of IPAQ

BMI=Body mass index; BRFSS= Behavioral Risk Factor Surveillance System; IPAQ=International Physical Activity Questionnaire; MVPA=Moderate-vigorous physical activity; PA=physical activity; SOPARC=Systems for Observing Play and Recreation in Communities; US=United States; +ve=positive intervention effect; -ve=no intervention effect

Table 3. Greening Interventions (n=8)

Study Descriptor						Results		
Reference	**Study Design**	**Country**	**Population**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Greening of vacant lots (n=4)								
Branas et al, 2011	Quasi-experiment: difference-in-difference design	Urban area; Philadelphia, US	Cohort of 50,000 Philadelphians from household survey	Greening of vacant urban land (n=4436); (> 725000m^2) from 1999 to 2008 involving removing trash and debris, grading the land, planting grass and trees, installing low wooden fences around perimeter	Matched control vacant lots (n=13,300) randomly selected and matched to intervention lots at 3:1 ratio	+ve: Greening associated with reductions in gun assaults ($p<0.001$), vandalism ($p<0.001$), residents reported less stress and more exercise ($p<0.01$)	Household Health Survey (every 2 years to a new cohort of 50000 Philadelphians) using waves 1998-2008	Self-report question of physical activity levels, stress, and number of crimes/arrests
Garvin et al, 2013	Pilot RCT: difference-in-difference analytical approach	Urban area; Philadelphia, US	People living approx 2 blocks surrounding the randomly selected vacant lots; 97% African-American; median income $15,417- $17, 743	Greening of vacant lots (4500–5500 square feet); removing debris, grading the land and adding topsoil, planting grass and trees, building a wooden fence	No greening intervention	+ve: Non-sig decrease in the number of total crimes and gun assaults around greened vacant lots compared with control; people around the intervention lots reported feeling sig safer after greening compared with control lots ($p<0.01$)	Baseline (n=29) and 3-month (n=21) follow-up	Police reported-crime: within half mile buffer of vacant lots for 3.5 months before and 3.5 months after the intervention; self-reported neighbourhood disorder (physical and social)
Anderson et al, 2014	Quasi-experimental, controlled (post data only)	Urban area; Cape Town, South Africa	Spectrum of socioeconomic neighbourhoods, ranging from middle to lower income areas	Civic-led greening interventions implemented via 3 sites	3 control sites: one vacant lot and two conservation sites	+ive: biodiversity in the greening intervention sites was higher than the vacant lot and comparable to the conservation sites	No baseline monitoring; monitoring completed post-project completion	Flora and fauna biotic measures
South et al, 2015	Quasi-experimental, controlled, pre and post	Urban area; Philadelphia, US	N=12 participants completed pre- and post-intervention walks; all were African-American, 8 male; majority had household income < S15, 000	Randomly selected cluster of vacant lots received standard greening treatment involving cleaning and removing debris, planting grass and trees, and installing a low wooden post-and-rail fence	Randomly selected cluster of vacant lots did not receive the greening treatment	+ve: difference-in-difference estimates between greened and non-greened vacant lots was sig lower for heart rate ($P<.001$) for the greened site; being in view of a greened vacant lot decreased heart rate sig more than a non-greened vacant lot	Baseline 3 months pre intervention; follow-up 3 months post intervention	During each walk the participants' heart rate was continuously measured

Reference	Study Design	Country	Study Descriptor: Population	Intervention	Control	Outcome	Results: Follow-up (months)	Outcome Measures
Provision of trees in urban streets (n=4)								
Strohbach et al, 2013	Quasi-experimental, controlled (post data only)	Urban area; Boston, US	Low SES areas; 617,594 inhabitants; population density of 4939 inhabitants per km2; tree canopy covers 29% of the city area	12 community driven greening projects in low SES areas including creation of a small park (424 m^2),tree plantings in an existing park (4377 m^2) and tree plantings at residential houses 859 m^2)	Randomly selected urban sites	+ve: Sig difference between greening projects and random urban sites (p=.049); most greening projects had more species than the random urban sites in their vicinity	No baseline data, bird counts during early and late June 2010 and 2011	Abundance and diversity of bird species
Jin et al, 2014	Quasi-experimental, controlled (post data only)	Urban area; Shanghai, China	Area of 6340.5 km2, 23.5 million population	Street trees 6 streets (length 205-223m; width 15.2-17.5m) were treated with different pruning intensities (strong, weak and null) which would result in different canopy coverage across the four seasons	Each of the sampling streets were paired with nearby street segment controls which had similar features but contained no trees (2 streets: length 160-165m; width 15.5-17m)	+ve: Increased street tree canopy was positively associated with $PM_{2.5}$ concentrations owing to reduced air circulation	No baseline data, monitoring once every four months (i.e. every season)	$PM_{2.5}$ data
Ward Thompson et al, 2014	Quasi-experiment: controlled, pre-post design	Urban areas; England, Scotland and Wales, United Kingdom	Mean age 75 yrs; 44% male; 22.5% non-white British	n=56 residents pre and n=29 post intervention 'DIY Streets': 9 intervention streets located in urban areas in United Kingdom. Streets were made safer, more attractive and add traffic calming measures.	n=40 residents pre and n=32 post intervention Each intervention street was paired with a comparison street that had no intervention	+ve: Sig positive perceptions of intervention streets post-intervention (p=0.04); longitudinal participants perceived they were sig more active post-intervention (p=0.04) than the control group	Baseline (May-Sept 2008); and 2 years later between 3-6 months post-intervention	Surveys (cross-sectional with a longitudinal subset) including general health, quality of life, activity levels, frequency, type and location of activity
Joo & Kwon, 2015	Quasi-experimental, controlled (post data only)	Urban area; Suwon, South Korea	Population 1.2m	N=74 sites installed street greenery by the city council (e.g. planter boxes) located in low-rise residential areas to reduce illegal dumping of household garbage	N=74 non-street greenery sites in low-rise residential areas which are vulnerable to illegal dumping of household garbage	+ve: Illegal dumping of household garbage occurred at 55.4% of sites with installed greenery compared to 91.9% of sites without greenery installed	No baseline data, one off site visits prior to weekly collection of illegal dumping	Presence of garbage-filled bags generated from the individual household at monitoring sites

NEWS=Neighbourhood Environment Walkability Survey; PM = Particulate Matter; SES=Socioeconomic status; SQUASH=Short Questionnaire to Assess Health; US=United States; +ve=positive intervention effect; -ve=no intervention effect

Table 4. Green Infrastructure for Storm Water Management and Cooling Urban/Suburban Areas (n=8)

Study Descriptor						Results	
Reference	**Study Design**	**Country**	**Intervention**	**Control**	**Outcome**	**Follow-up (months)**	**Outcome Measures**
Green infrastructure for storm water management (n=7)							
Van Seters et al, 2009	Quasi-experiment, controlled (post data only)	Urban area; Toronto, Canada	A 241 m^2 green roof vegetated with wildflowers installed on a multistory, university building	A 131 m^2 shingled, modified bitumen roof	+ve: the green roof retained 63% more rainfall than the conventional roof over the 18 month monitoring period	No baseline data, green roof installed in 2002; monitoring from May 2003-Aug 2005	Precipitation, flow, water quality, soil moisture, relative humidity, air temperature, and the temperature of the growing medium as well as water quality parameters (total suspended solids, alkalinity, phosphorus and nitrogen compounds, metals, bacteria)
Carpenter & Kaluvakolanu, 2011	Quasi-experiment, controlled (post data only)	Urban area; Michigan, US	Extensive green roof of 10.16 cm depth applied to the roof of a building on a university campus; a green roof section of 325.2 m^2 and 929 m^2 were monitored	Compared with a stone-ballasted roof with an area of 84.7 m^2 and an asphalt roof with an area of 153m^2	+ve: Sig higher total solids concentration (p=0.045) for the green roof than the asphalt roof; lower total phosphate concentrations for the green roof (non-sig); green roof retained 68% of rainfall volume and reduced peak discharge by an average of 89%	No baseline data; 6 month follow-up post-installation (Apr 2008-Sep 2008	Rainfall, runoff retention, peak discharge attenuation, and water-quality parameters including total phosphate, nitrate and total solids
Mayer et al, 2012	Before-after-control-intervention (BACI) experimental design	Suburban area; Ohio, US	Retro-fit storm water management: Installation of 83 rain gardens and 176 rain barrels onto more than 30% of the 350 eligible residential properties through an incentivised auction (2007-2008)	No control	+ve: Intervention had an overall small but sig effect of decreasing storm water quantity at the sub watershed scale	3 yrs before and after treatment implementation	Monitored hydrologic and ecological variables: discharge (spring 2011); water quality (monthly base-flow and opportunistic storm-flow sampling spring 2010); aquatic biota (stream macroinvertebrate and periphyton sampling every 6 weeks, Apr-Oct 2010); dissolved oxygen, water temperature, and photosynthetically active radiation; air-water gas exchange rate (from 2007)
Fassman et al, 2013	Quasi-experiment, controlled (post data only)	Urban area; Auckland, New Zealand	A 500 m^2 extensive green roof installed on a council civic centre	An adjacent bitumen roof on a building that was one story higher	+ve: 57% retention of rain water in comparison to control	No baseline data; post installation monitoring for 8 months (Aug 2010–Mar 2011)	Rainfall and runoff water quality parameters including Total Suspended Solids, Total Dissolved Solids, Nitrate and Nitrite Nitrogen, Total Kjeldahl Nitrogen, Soluble Reactive Phosphorus and Total Phosphorus, dissolved and total Zinc, dissolved and total Copper

Reference	Study Design	Country	Study Descriptor Intervention	Control	Outcome	Results Follow-up (months)	Outcome Measures
Shuster and Rhea, 2013; Roy et al, 2014	Before–after–control–intervention (BACI) experimental design	Suburban area; Ohio, US	Retro-fit storm water management: Installation of 81 rain gardens and 165 rain barrels onto 30% of properties through an incentivised auction (2007-2008) at 4 experimental subcatchments	Two control subcatchments	-ve: No sig difference between control and experimental sites with regards to stream water quality, periphyton, and macroinvertebrate metrics +ve: Small sig decrease in runoff volume in treatment subcatchments	Sites were sampled 5 times per year from 2003 through 2010 (3 yrs before and after treatment implementation)	Monthly baseflow water quality, and seasonal (5x per year) physical habitat, periphyton assemblages, and macroinvertebrate assemblages in the streams
Kondo et al, 2015	Quasi-experiment: difference-in-difference design	Urban areas; Philadelphia, US	Installation of green storm water infrastructure at 52 sites: 152 tree trenches, 46 infiltration or storage trenches, 43 rain gardens, 29 pervious pavement installments, 20 bumpouts, 14 bio-swales, 5 storm water basins, 1 wetland, and 12 other	Matched control sites where no construction took place	+ve: Sig reductions in narcotics possession (18%–27% less) (P <.01), (P <.01) at varying distances from treatment sites; sig reductions in narcotics manufacture and burglaries; non-sig reductions in homicides, assaults, thefts, public drunkenness, stress levels, blood pressure and cholesterol	Before (2000) and up to 4 yrs after installation (2012)	GPS coordinates for 14 classes of crimes Self-reported blood cholesterol, blood pressure, and stress data via household survey
Jarden et al, 2016	Before–after–control–intervention (BACI) experimental design	Suburban area; Ohio, US	Installation of 91 rain gardens, street-connected bio-retention cells and rain barrels at 2 treatment streets. Rain gardens (< 25 m^2) were installed in front yards and backyards; bio-retention cells (~26 – 44 m^2) were installed between the sidewalk and street	Each treatment street had a matched control street (n=4) of similar size, drainage area and characteristics	+ve: Reduction in storm water flow at the treatment streets with reductions of up to 33% of peak discharge and 40% of total run-off volume	Baseline (Aug-Nov 2012), Phase 1 follow up (Jun-Nov 2013), Phase 2 follow up (Apr- Oct 2014)	Number, duration and precipitation of storm events, peak discharges, and total runoff generated

Reference	Study Design	Country	Study Descriptor Intervention	Control	Outcome	Results Follow-up (months)	Outcome Measures
Green infrastructure for cooling urban/suburban areas (n=1)							
Peng & Jim, 2015	Quasi-experiment, controlled, pre and post design	Suburban area; Hong Kong, China	A 484 m^2 extensive green roof was retrofitted on a 2-story railway station	Nearby original bare roof control plot with an area of 106 m^2	+ve: green roof displayed cooling effects in spring, summer, and fall, with slight warming effects in winter	Baseline (Jun 2008-May 2009); green roof installed in Jul 2009; follow up (Aug 2009-Sep 2011)	Thermal-performance indicators including temperature at 10 cm and 160 cm level, relative humidity at 10 cm and 160 cm level, and surface temperature at the vegetation surface and concrete tile

BACI=Before-after-control-intervention; GPS=Global Positioning System; US=United States; +ve=positive intervention effect; -ve=no intervention effect

Annex 2 – Search strategy

Urban Green Space/Intervention Type

Environmental Design/
Urban Health/
Parks, Recreational/
Forestry/
(urban adj green adj space). ti, ab
green*space. ti, ab
(open adj space). ti, ab
(public adj space). ti, ab
(public adj open adj space). ti, ab
(park not parkin*). ti, ab
(city adj park). ti, ab
(public adj park). ti, ab
(urban adj park). ti, ab
(municipal adj park). ti, ab
(greenway or urban greenway). ti, ab
(urban adj regen*). ti, ab
(trail* or urban adj trail*). ti, ab
(urban adj forestry).ti,ab
(water sensitive urban design). ti, ab
(WSUD). ti, ab
(sustainable urban drainage system*). ti, ab

(bio?retention basin*). ti, ab
(green roof*). ti, ab
(living roof*). ti, ab
(green wall*). ti, ab
(living wall*). ti, ab
(vertical garden*). ti, ab
(street tree*). ti, ab
(green corridor*). ti, ab
(green screen*). ti, ab
(urban green*). ti, ab
(urban conservation). ti, ab
(urban naturalization). ti, ab
(urban rehabilitation). ti, ab
(urban agriculture). ti, ab

Study Design

(intervention stud*).mp
(randomised control* trial).mp
(randomized control* trial).mp
(comparative stud*).mp
(control group).mp
(randomised or randomized or randomly or groups).mp
(quasi*experiment*).mp
(natural experiment*).mp
(pre test or pretest or pre intervention or post intervention or post test or posttest).mp
(intervention or interventional or process or program*).mp
(evaluat* or intervention or interventional or treatment).mp
(case stud*). mp
(retrofit*). mp

Searches were limited to Full Text; English Language; Humans (for medical databases only)

"/", MeSH term; "ti, ab", Title and Abstract; "adj", Adjacent

***The search strategy has been adapted from Hunter et al, 2015**

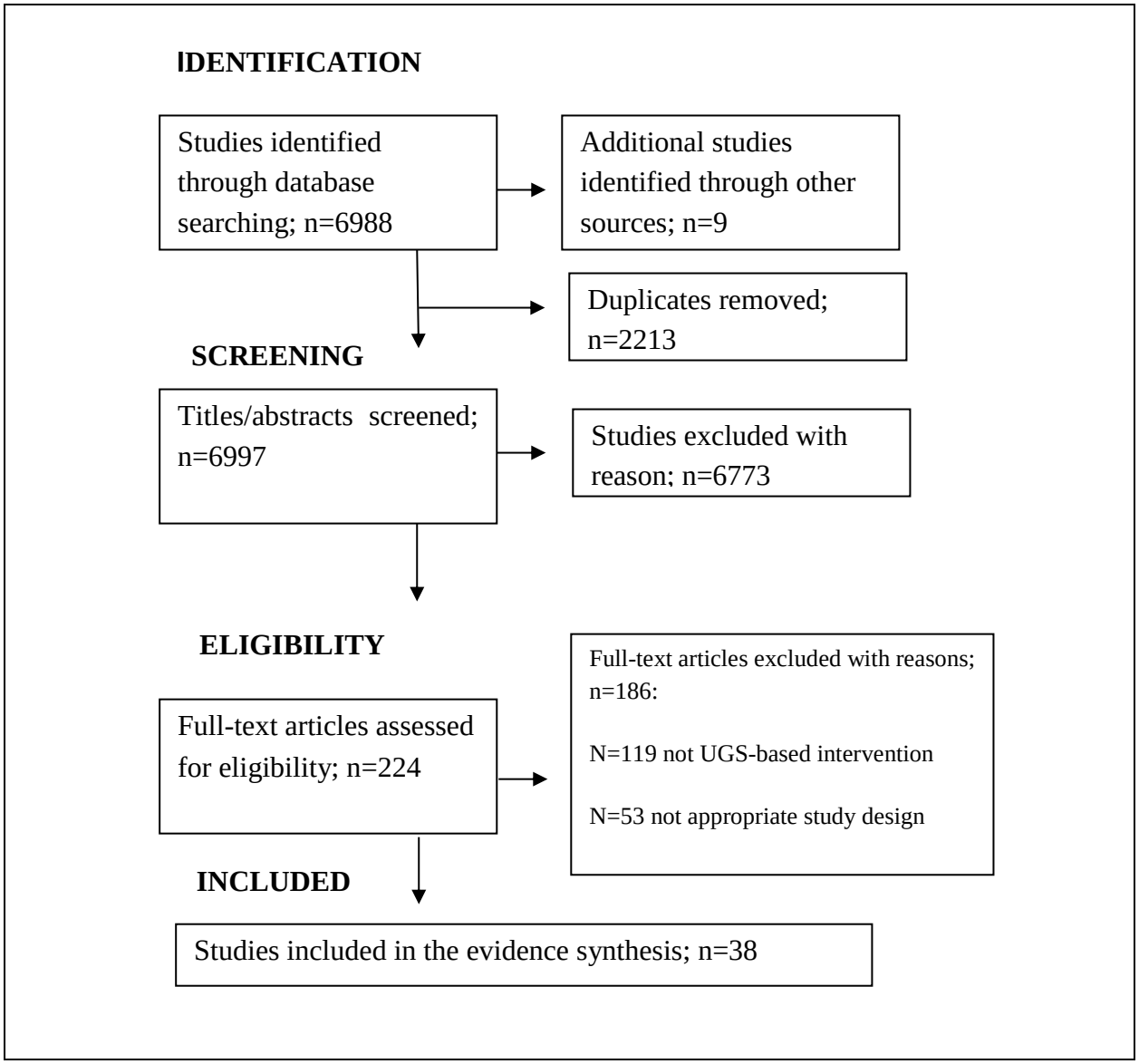
Annex 3 – Definition of PROGRESS-Plus Factors

PROGESS – Plus Factor	Description	Examples
Place of residence	Locations in which individuals reside or perceptions of their location	E.g. urban, suburban, perceptions of safety
Race/ Ethnicity	Self-identified racial or ethnic group or other classifications of culture or language. This includes nationality status (e.g. refugee or migrant)	E.g. racial or ethnic group classifications (white/mixed or multiple ethnicity/ asian/black/other), mother tongue or country of origin
Occupation	Occupational situation, patterns of work or features of the working environment	E.g.unemployed/employed/retired, manual or non-manual work, full-time or part-time employment
Gender	Sex refers to the biological and physiological characteristics that differentiate men and women	E.g. male or female
Religion	An individuals' religious affiliation or system of religious or spiritual beliefs or values	E.g. Self-reported religious denomination, details of belief systems or values held
Education	Self-reported extent and type of schooling, education or other formal training or learning undertaken	E.g. number of years in full-time education, educational attainment or qualifications achieved

Social capital	A multifaceted concept capturing the obligations and benefits conferred upon an individual by their society and social relationships. This can be seen as a measure of interconnectedness between an individual and their social surroundings or group	E.g. perceptions of social norms surrounding trust or reciprocity, social support, social networks, civic participation
Socioeconomic status	An individual's position within a hierarchical social structure. Measures of socioeconomic status aim to capture access to resources or privilege	E.g. poverty level, income (individual or household), asset-based measures such as car ownership or housing tenure
Age	Self-reported age in years	E.g. mean or median age of a study sample or proportions falling in age brackets
Disability	Impairment, activity limitation and restrictions on ability to participate in certain life situations. Disability can be both mental and physical.	E.g. measures of functioning, health status or quality of life (e.g. EuroQol or the SF-36), physical tests of function (e.g. the walk test), or other indicators or disability (e.g. wheelchair bound)
Sexual orientation	Self-reported sex towards which an individual feels attraction or self-defined sexual identity	E.g. hetero- /homo- /bi- /transsexual

This table has been adapted from O'Neill et al (2014) and Attwood et al (2016).

Annex 4 – Selection of Included Studies



Appendix 2:
Good practice and lessons learned.
A review of urban green space intervention case studies

Good practice and lessons learned – a review of urban green space intervention case studies

Annette Rebmann[1], Anne Cleary[2], Matthias Braubach[3]

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3 WHO Regional Office for Europe

Rationale: Research shows that urban green space is important for delivering health, environmental and equity outcomes. However, there is little information on the type and effectiveness of urban green space interventions currently being implemented in Europe. In addition, there is little guidance on how to design and deliver urban green space interventions so that multiple outcomes are realized.

Objectives: To compile and present examples of European case studies on urban green space interventions and to summarize key findings and lessons learned from these local green space intervention practices and experiences.

Methods: A call for case study submissions on urban green space interventions was disseminated through a variety of European professional and city networks. Of the 86 case studies submitted via the online survey, 48 were completed in full with 15 being selected for further investigation via semi-structured telephone interviews.

Results: Urban green space interventions were most often carried out in parks or similar public green spaces, but were also implemented in settings such as schools or health care facilities or in former industrial areas. Most case studies focused on specific urban areas rather than a specific population group, and equity aspects were often considered through the selection of deprived urban areas for the interventions. The most common objectives related to environmental benefits (attractiveness/quality of the local environment as well as biodiversity measures) or promoted active lifestyles (time spent outdoors). Many interventions also reported on delivering positive equity and social cohesion outcomes but only few case studies specifically reported on health outcomes. Monitoring and evaluation was carried out by only two thirds of the case studies, and was often restricted to self-reported and observational data. Little information is available on the health impacts of the urban green space interventions.

The qualitative interviews identified common challenges in the implementation of urban green space interventions (such as funding, maintenance and sustainability, community engagement, reaching out to the most vulnerable groups) but also provided an overview of successful implementation practices.

Conclusions: A large variety of urban green space interventions can be applied to improve the quality of urban settings through delivering diverse environmental, social and health benefits to the local community.

CONTENTS

List of Tables, Figures and Boxes

1 Introduction

1.1 Background

Industrialization in the 19th century led to the migration of people from rural to urban areas stimulating the unprecedented and continued growth of towns and cities as seen today. Approximately, three quarters of Europe's population currently live in urban areas with this number expected to grow over the coming decades (European Environment Agency, 2016)[1].

Increasing urbanization leads to competition for urban space by multiple sectors that require the space for diverse functions, for example, industrial areas, residential quarters, transport and service infrastructure, or recreation. This competition can place pressure on existing urban green spaces leading to their removal or down-sizing. However, given the accumulating evidence on the beneficial effects of urban green spaces for human health, well-being and social cohesion it is important that urban green spaces are used as a key tool for delivering healthy, sustainable and liveable cities.

This report therefore investigates, through case study analysis, the on-ground delivery of urban green space interventions by Member States throughout Europe. The case study review helps to develop an understanding of the types of urban green space action that are delivered on the local scale and the objectives and expected outcomes of such interventions. The case studies on urban green space interventions also help to shed light on the local practices regarding the evaluation of the interventions' impacts, and the integration of health and equity aspects within urban planning processes.

As European cities and towns differ substantially in their size and climatic conditions, as well as their cultural and ethnic backgrounds, the interventions presented and discussed in this report represent unique experiences that reflect the local situation as well as the local decision-making processes. The case studies provide a compilation of European urban green space interventions that help to provide useful information and conclusions on how to implement effective urban green space interventions. However, it is important to note that the information and conclusions provided in this report are subject to the limitations of the study design, including the over-representation of case studies from the United Kingdom.

The experiences provided across all case studies strongly suggest that well-planned urban green space interventions have the potential to provide long-lasting, positive impacts on the urban environment and quality of life and well-being of the local community. This report aims to provide some of the approaches and local experiences that may help deepen our understanding of how to deliver effective and sustainable urban green space interventions that provide optimal benefits for local residents.

[1] http://www.eea.europa.eu/themes/urban

1.2 Objective of the working paper

This working paper presents local practice on urban green spaces and summarizes key findings from a review of European case studies on urban green space interventions. It represents the experience of local authorities and other local actors in providing and modifying urban green space or increasing the use of already existing green spaces, and making them attractive as a resource for urban residents or specific groups, for example schoolchildren or minorities, and discusses the impacts of such green space interventions and the lessons learned at local level. Due to the lack of relevant data, this report does not provide scientific evidence on the effects of urban green space interventions on human health, but it describes the large variety of green space interventions performed in several European towns or cities and gives an overview on the measures performed and their respective objectives and expected outcomes,

1.3 Case study compilation process

The material presented is based on 48 projects submitted to WHO in response to a call for case studies on urban green space interventions. For the case study review, urban green space interventions were defined as urban green space actions (creating new green space, changing or improving existing green space characteristics or functions, or removing green space) in all publicly accessible green spaces – including school yards, private parks and similar settings if they are open to the public. Reflecting the diversity of submissions received, case studies with a focus on promotion and social or behavioural interventions of green space use were also accepted.

A variety of city networks (e.g. WHO Healthy Cities, EuroCities, ICLEI, Nordic City Network), international associations and networks with urban expertise (e.g. International Federation of Landscape Architects, International Society of City and Regional Planners, International Network for Urban Biodiversity and Design, EU UrbAct programme, various EU project networks related to green spaces), and other international and national networks related to health promotion, urban planning, biodiversity and green space were asked to disseminate the call for case studies within their networks.

An online survey questionnaire with mostly pre-coded questions was developed. The survey data collection period occurred from mid-May to mid-July 2016. The questionnaire comprised questions about the characteristics of the green space, the type of intervention and the respective objectives and expected outcomes, the impacts of the intervention, and the lessons learned.

Overall, 86 case studies on urban green space interventions from 21 European countries were submitted. Of these 38 case studies were excluded from the analysis owing to one or more of the following reasons:

- relevant questions were not completed;
- the information provided was not matching the project needs; or
- the information entered was a test run to get access to the full questionnaire.

As a result, 48 case studies from 14 countries were included in the analysis phase. Of these, six case studies were not fully completed, but could still be included in the analysis as they provided sufficient relevant information.

15 case studies were selected for a more detailed follow-up on the intervention and the related practical experiences with project implementation, impacts, lessons learnt and – if feasible – the inclusion of health and equity aspects during the process.

Detailed information on the 48 respective interventions, their objectives and the expected outcomes is provided in Annex 1.

1.4 Structure of the paper

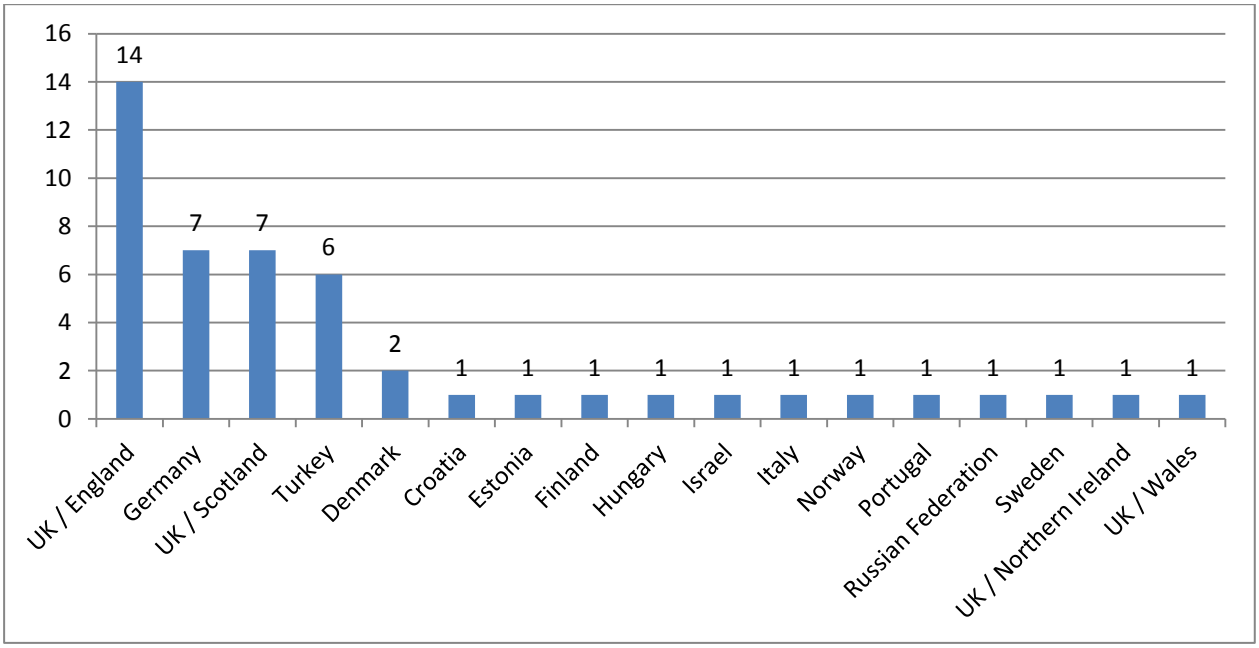
This paper presents the findings of the case study survey in section 2, looking at selected questions. In section 3, common patterns and priorities that have been identified from the case studies are presented and discussed. Section 4 provides a summary of the 15 follow-up interviews on local implementation and lessons learned. Finally, section 5 concludes the case study review and derives key messages for the discussion at the expert meeting.

2 Case study survey findings

2.1 Origin of case studies

From 48 case studies submitted, 23 case studies were performed in the United Kingdom (UK) with emphasis on England (14 case studies) and Scotland (7 case studies). One case study came from Wales and one from Northern Ireland. From continental Europe, seven case studies were submitted by Germany and six from Turkey. Denmark contributed two case studies, Norway, Portugal, Israel, Finland, Hungary, Italy, Sweden, Croatia, Estonia and the Russian Federation submitted one case study each (Fig. 1).

Fig. 1. Origin of case studies by country (n=48)



2.2 Leading authority

Mostly, the case studies were submitted by the administration of the respective town or city, including 21 local authorities and nine public agencies (Fig. 2). Six studies came from nongovernmental or civil society organizations, three from research institutions, and two from private businesses or organizations. Seven case studies were submitted by other organizational structures like non-profit or charity organizations ([16,17,24]), partnerships between public and private organizations (neighbourhood management [42]), local community groups [21], partnerships between the governmental health and environment agencies, like in Possil, United Kingdom [28], or partnerships between a local authority and private organization [15].

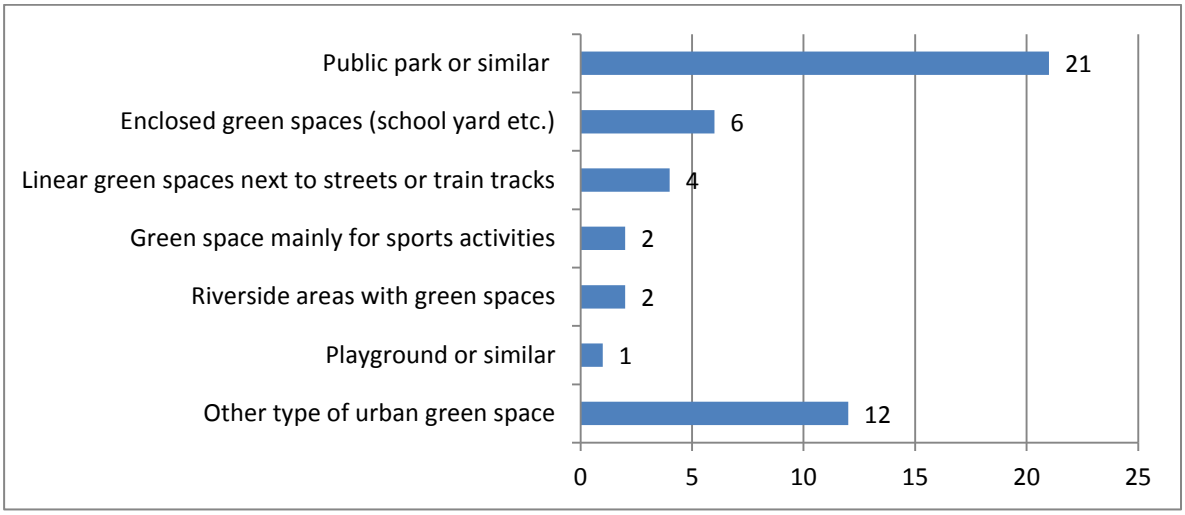
Fig. 2. Leading authorities of the intervention (n=48)

2.3 Type of green space modified

21 interventions related to the creation or improvement of public parks or similar green spaces with mixed function, whereas only one intervention identified itself as targeting playgrounds (Edible Playground, [7]) although various other case studies did include playgrounds as one green space intervention component (Fig. 3). Six interventions addressed measures on enclosed green spaces like inside yards, school grounds or care centres, and four of the interventions were performed on linear green spaces next to streets or train tracks. Two of the interventions were reported to affect green spaces in riverside areas, or green spaces mainly used for sports activities, respectively.

12 interventions reported other types of green space and included interventions such as conversions of degraded areas (e.g. stone quarry), enhancement of nature reserves, woodlands or country parks located in the urban fringe. Also, some interventions combined measures on different green spaces such as a case study from Glasgow, United Kingdom [28], which combined various green space components related to streets, gardening as well as play space and foot and bicycle paths, or a recreation area project in Izmir, Turkey [26] which provided blue and green spaces as well as sport, recreation and cultural areas.

Fig. 3. Type of green space modified (n=48)



2.4 Type of intervention implemented

Most of the interventions represented physical changes to the environment, mostly focussing on establishment or enhancement of public parks and in other instances on rehabilitation of woodlands, brownfields or riverside areas, or the remediation of soil. Many interventions were performed to improve the environmental conditions of the area by, for example, offering new or better quality green spaces with more functional characteristics, possibly including afforestation or signage for orientation and improving accessibility for the residents. Other interventions mainly addressed wildlife conservation or environmental protection related to, for example, flood management or pollution reduction. A few case studies were implemented in relation to local or regional planning concepts or area renewal approaches. Examples of these include case studies on play area planning at a local level, green space trails, landscape transformation or area regeneration and conversion.

Many interventions sought to promote physical activity through the provision of newly created or improved spaces for walking, hiking, cycling or running. Other interventions focused on providing space for sociocultural events. Recreational amenities, sport facilities or playgrounds for children were also established by some interventions.

Some case studies primarily addressed health protection, such as the installation of a green screen along a street for improvement of ambient air quality [37], extensive remediation of contaminated soil [33] or reduction of pesticide use for green space management [41].

Several interventions had a strong social cohesion focus aiming for people to positively engage with the green space and use it as a place for social interaction. Such interventions may also include environmental changes but were often realized without physical intervention components and instead focused on promotion and social intervention approaches to initiate increased and/or altered use of already existing green space. The provision of urban gardening was one example, or the promotion of physical activity among pupils through making school grounds available for children's play outside of school hours [27], or the provision of school gardens [7].

After implementation, many interventions were promoted through marketing initiatives such as hardcopy and online brochures or maps or onsite information systems and signs (see Box 1). The green space was also promoted through organizing community events within the space as well as other organized activities such as guided group walks.

Box 1. Example of onsite information system

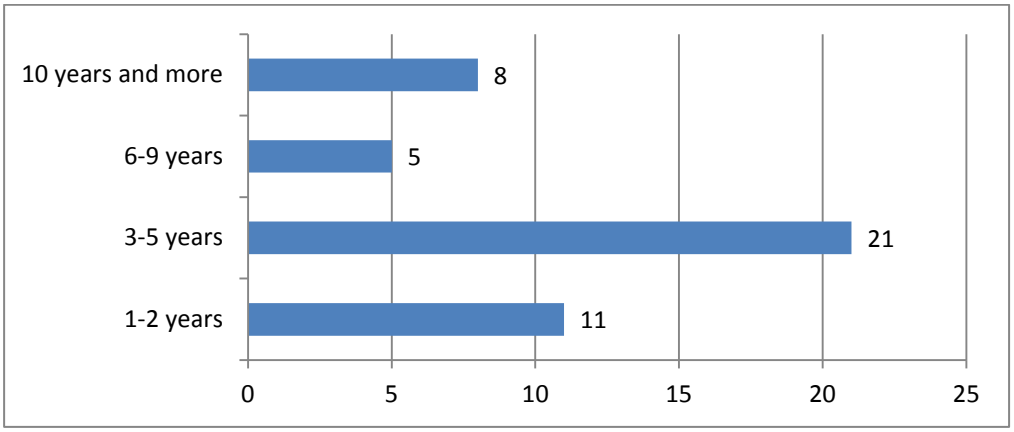
Image: Henriette Degünther

2.5 Cost and duration of interventions

Based on information from 45 case studies, the average duration[2] of the projects was about five to six years but this is strongly affected by some long case studies. Over one fifth of the case studies (n=11) represented short-term interventions with only one to two years of project duration (Fig. 4). 21 case studies took three to five years for implementation, which is the most frequently reported duration. Eight case studies expanded beyond 10 years; these case studies are often characterized by various project phases building on each other. Other long duration projects are resulting from time windows for planning procedures [45] or natural landscape changes such as the growing of woodlands [23].

[2] Data was asked for in the start and end year of intervention implementation but variations may occur in relation to the understanding of what the implementation time represents (e.g in- or excluding planning or evaluation periods).

Fig. 4. Duration of the project in years (n=45)



26 case studies provided a rough costing of the intervention[3], ranging from €10,000 for the establishment of a nature-like park and play area to €30 million for a large green space network due to the purchase of private land and significant infrastructure developments. Nine interventions reported costs below €100,000 while eight case studies reported expenses of more than one million euros.

Overall, interventions with lower cost (up to €50,000) tended to be one-off actions targeted at one limited area, such as the establishment of green screens next to a trafficked street, the improvement or establishment of playgrounds or local gardening and horticultural projects. Establishment and modification of parks and larger green spaces tend to come at a higher cost (from €60,000 to €300,000) but can, depending on the scale of the park and the type of renovation, also require investments of several million euros. In one specific case, major funding was provided by a private donor in Copenhagen, enabling large-scale park refurbishment [36].

Although the fact that 22 case studies did not report on the costs does not mean they were for free, it is noticeable that a large number of the case studies that did not provide cost information have a focus on social measures that aim at motivating people to use green spaces, rather than investing in significant changes of the physical environment.

2.6 Intervention objectives and expected outcomes

For all case studies, the questionnaire asked to indicate the main objective of the intervention, and, if applicable, a secondary objective. For the respective objective, a follow-up question was asked to identify the expected outcome(s) from the intervention

2.6.1 Main and secondary objectives of the intervention

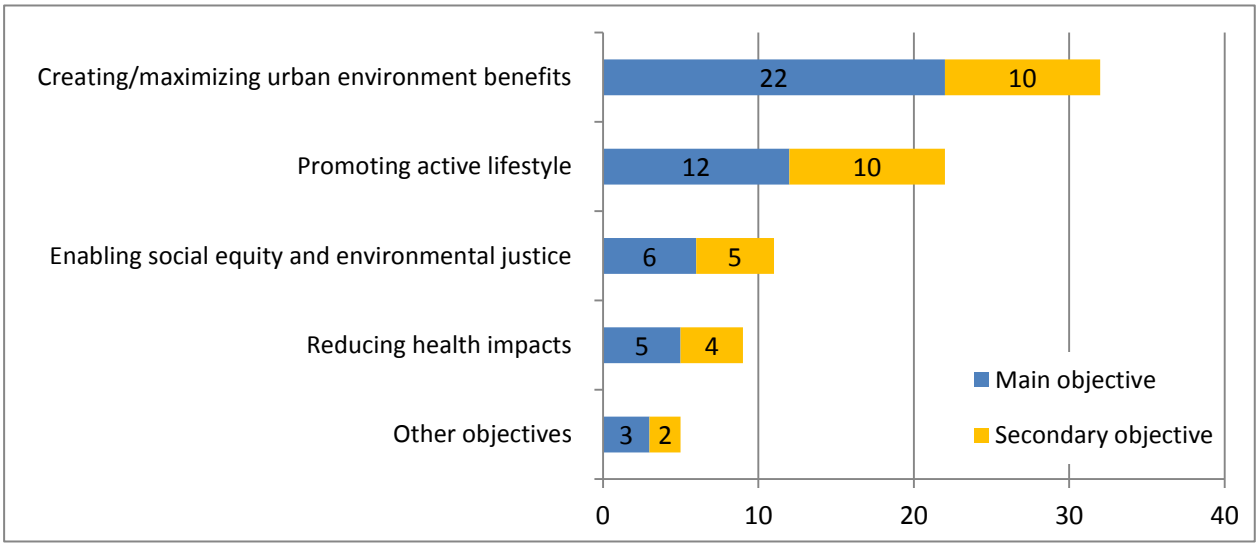
The main objective of the interventions tended to focus on environmental benefits of urban green space, which was reported by 22 and thus almost half of all submitted case studies (Fig. 5). The promotion of active lifestyle was the main objective for 12 case studies, while social equity

[3] The case study submitters were asked to provide the data in Euro but it is impossible to validate the entries made.

aspects (six case studies) and health considerations (five case studies) are less frequently reported as the main driver for urban green space interventions. For three case studies, different main objectives were reported.

31 case studies reported having a secondary objective in addition to the main objective presented above. Of these 31 case studies, 10 interventions focused on urban environment benefits and another 10 on the promotion of active lifestyles. Equity considerations (five case studies) and health and well-being aspects (four case studies) were – similar to the main objectives – reported less frequently as the secondary objective of the intervention (Fig. 5).

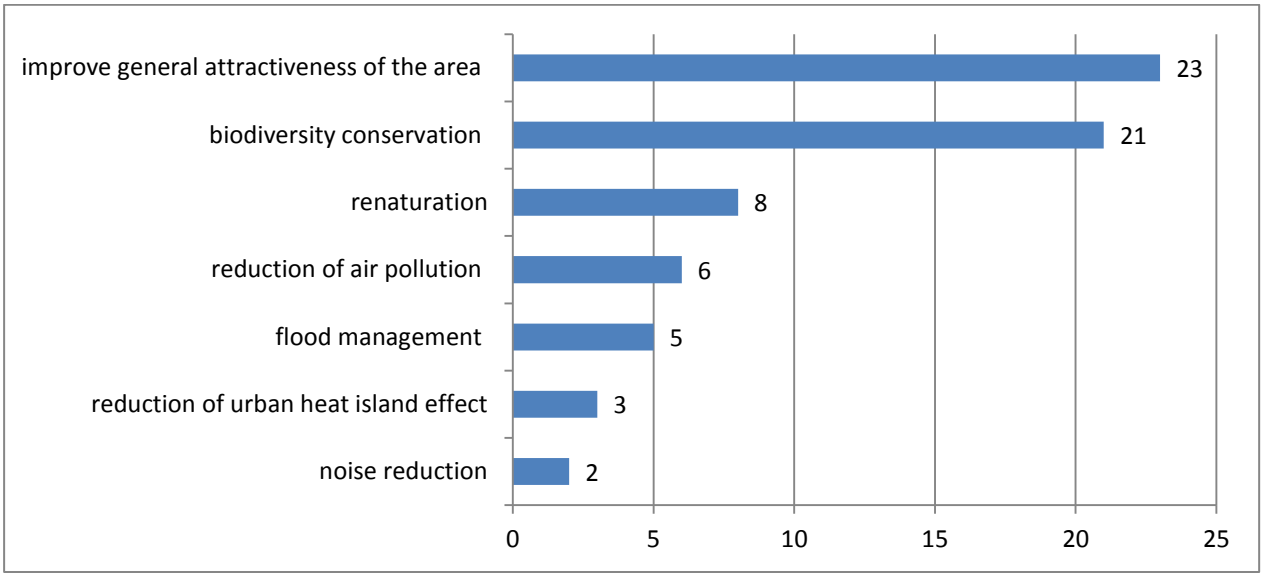
Fig. 5. Main objective (n=48) and secondary objective (n=31) of the interventions



2.6.2 Expected outcomes

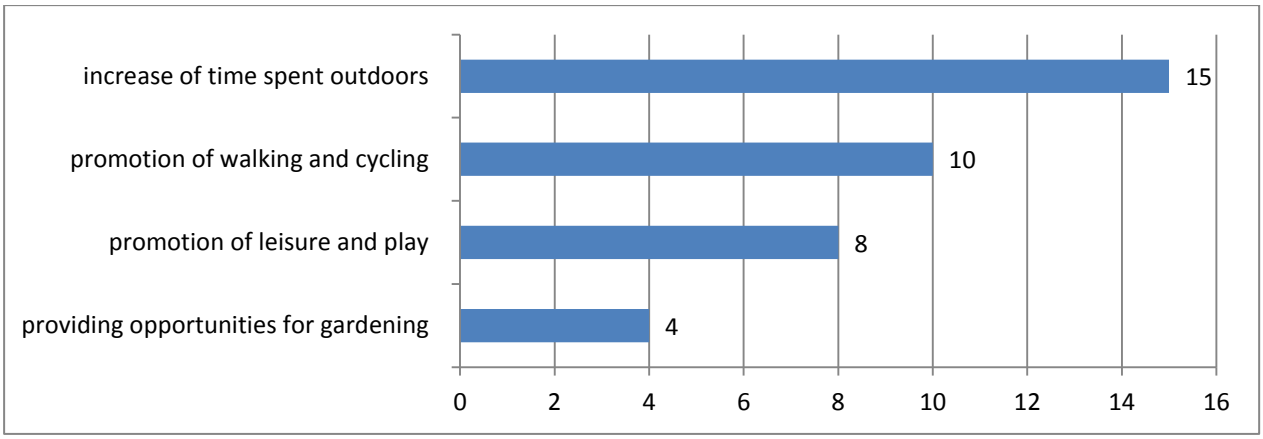
Overall, the generation of **environmental benefits** was the most frequently mentioned objective of urban green space interventions (32 case studies in total, with 11 case studies focusing exclusively on environmental outcomes). The main outcomes expected from these interventions were the improvement of the general attractiveness of the local area (reported by 23 case studies) and biodiversity conservation effects (reported by 21 case studies). Renaturation was reported by eight case studies while reduction of environmental risks such as flood management (five case studies), reduction of air pollution (six case studies), urban heat island effects (three case studies) or noise (two case studies) was addressed less often (Fig. 6).

Fig. 6. Expected environmental outcomes of the interventions (n=32)



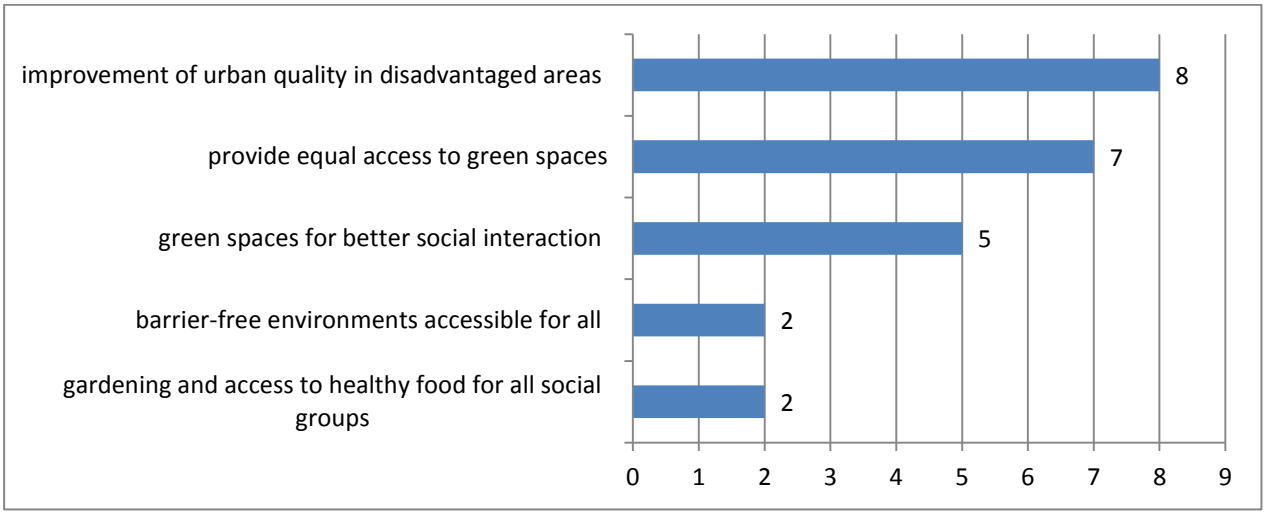
Promotion of active lifestyle was reported by the 22 case studies, with seven focusing on this objective exclusively. Expected outcomes were mostly the increase of time spent outdoors in general (15 case studies), and specifically the promotion of walking and cycling (10 case studies) and leisure and play (eight case studies). Providing opportunities for gardening was reported by four case studies (Fig. 7).

Fig. 7. Expected active lifestyle outcomes of the interventions (n=22)



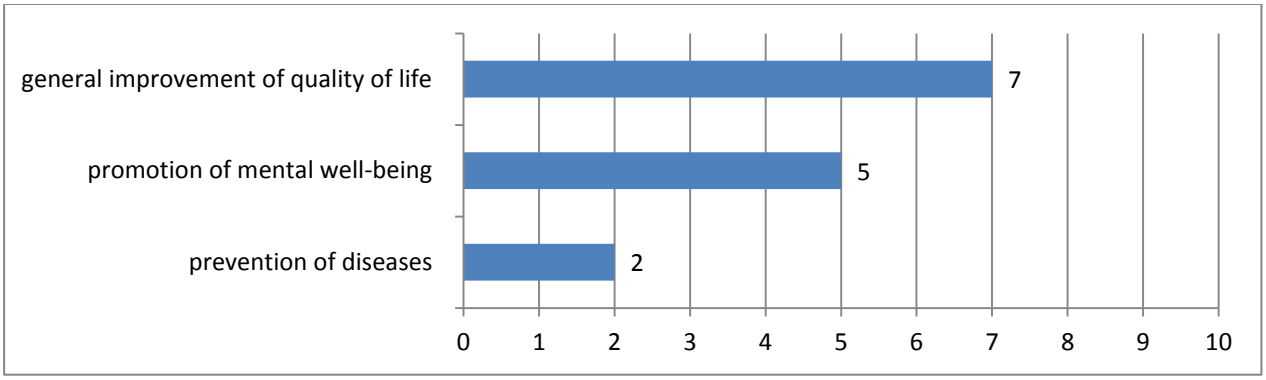
11 case studies identified **equity objectives** as a driver for the green space intervention, but only one case study focused exclusively on equity and cohesion objectives (Open all Hours project in Cardiff [27]). Eight of those case studies reported the improvement of urban quality in disadvantaged areas as an expected outcome, while seven case studies aimed to provide equal access to green spaces. The provision of green spaces for social interaction was highlighted (five case studies) as well as the creation of barrier-free environments accessible for all population groups (two case studies). Equity-related outcomes also related to gardening and access to healthy food for all social groups (two case studies) (Fig. 8).

Fig. 8. Expected equity outcomes of the interventions (n=11)



Only nine case studies reported **health considerations** to be their objective, but none of these case studies focused on health aspects alone. The expected outcomes of these case studies relate to the general improvement of quality of life (seven case studies) and the promotion of mental well-being (five case studies), but also to the prevention of diseases (two case studies) (Fig. 9).

Fig. 9. Expected health outcomes of the interventions (n=9)

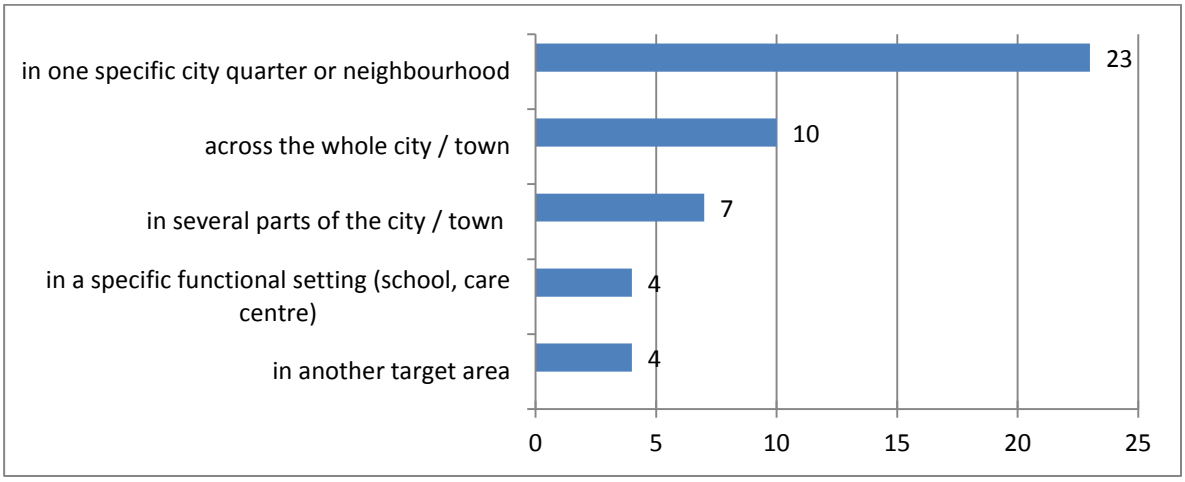


The most frequent combinations of intervention objectives linked urban environment benefits with active lifestyle promotion (11 case studies), and seven case studies brought together urban environment and health benefits. Only three case studies combined urban environment with equity-related objectives, but six case studies combined equity aspects with active lifestyle promotion. Two case studies focused on both equity and health objectives.

2.7 Targeting of the interventions

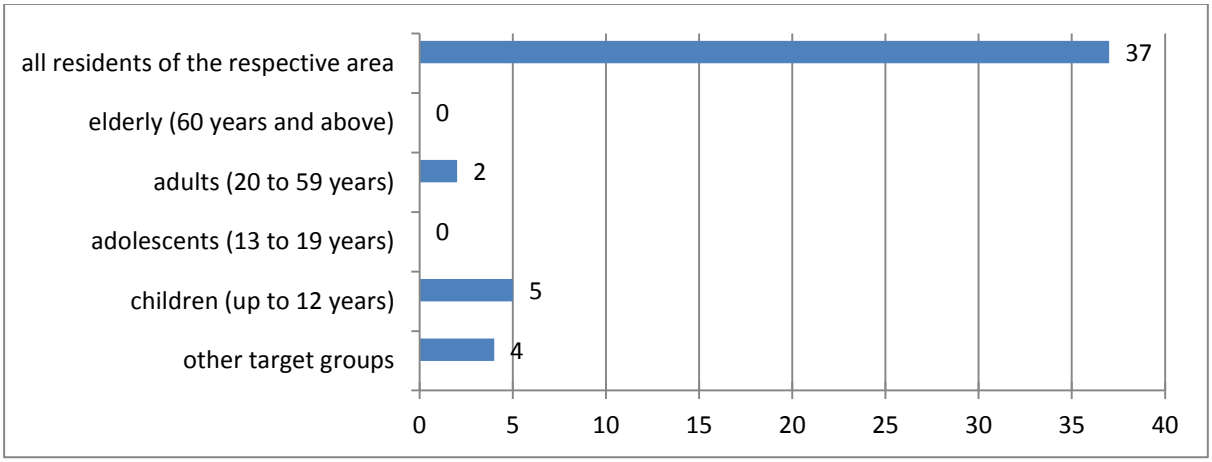
23 interventions were performed within one specific city quarter or neighbourhood, whereas 10 interventions were made on sites across the whole town. Seven case studies were implemented in several parts of the town as multisite interventions. Four of the interventions were implemented in specific functional areas such as schools or care centres, and another four interventions were implemented within other areas such as nature reserves, urban woodlands or public country parks located in the urban fringes (Fig. 10).

Fig. 10. Site of intervention implementation (n=48)



The vast majority of the interventions addressed all residents of the respective area (37 case studies), indicating that urban green space is mostly considered to benefit all population groups (Fig. 11). Five case studies addressed children up to 12 years, mostly related to interventions in school settings. Two of the interventions targeted adults from 20 to 59 years.

Fig. 11. Target group (n=48)



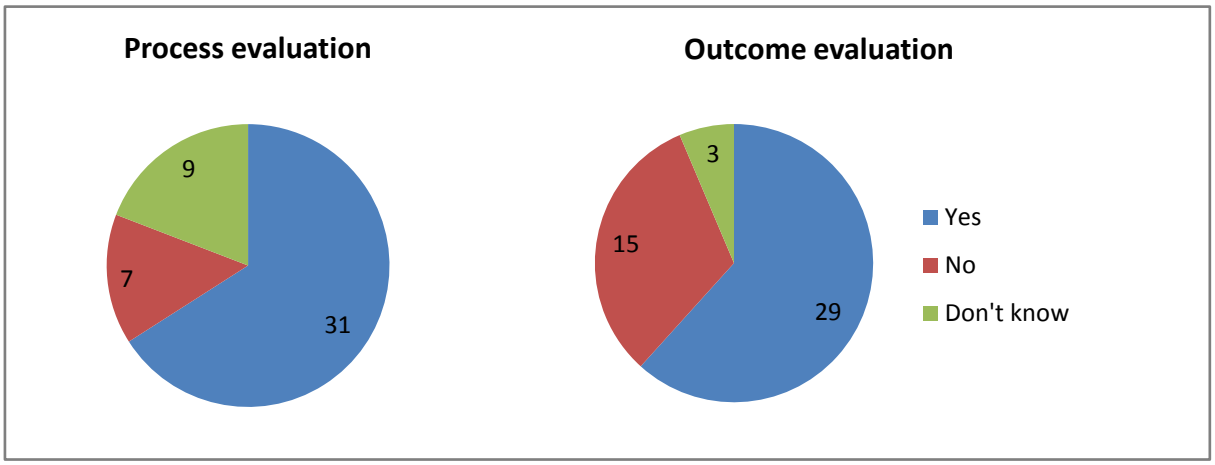
With respect to the four case studies reporting other target groups, these tended to comprise specific underrepresented green space user groups such as black and minority ethnic people, disabled residents, those on low income or youth at risk of social exclusion. One of the interventions with a cohesive approach addressed people with reduced mental health – from psychiatric patients to community residents [6]. None of the projects reported to target adolescents or elderly residents above 60 years.

2.8 Project monitoring and outcome evaluation

47 case studies provided information on their activities to monitor the intervention during implementation (process evaluation) and/or to evaluate the effects of the intervention (outcome evaluation). Of these, 29 reported having completed both process and outcome evaluations. Seven case studies reported not having monitored/evaluated the implementation process, and 15

case studies didn't evaluate the intervention outcomes. Nine of the case study submitters reported on not knowing whether the implementation process had been monitored, and three participants could not give information on the intervention outcome evaluation. (Fig. 12)

Fig. 12. Evaluation of intervention process and intervention outcomes (n = 47)



However, various case studies reporting the availability of data on environmental or health effects were not able to provide structured documentation or reports, suggesting that data may be collected unsystematically or not summarized.

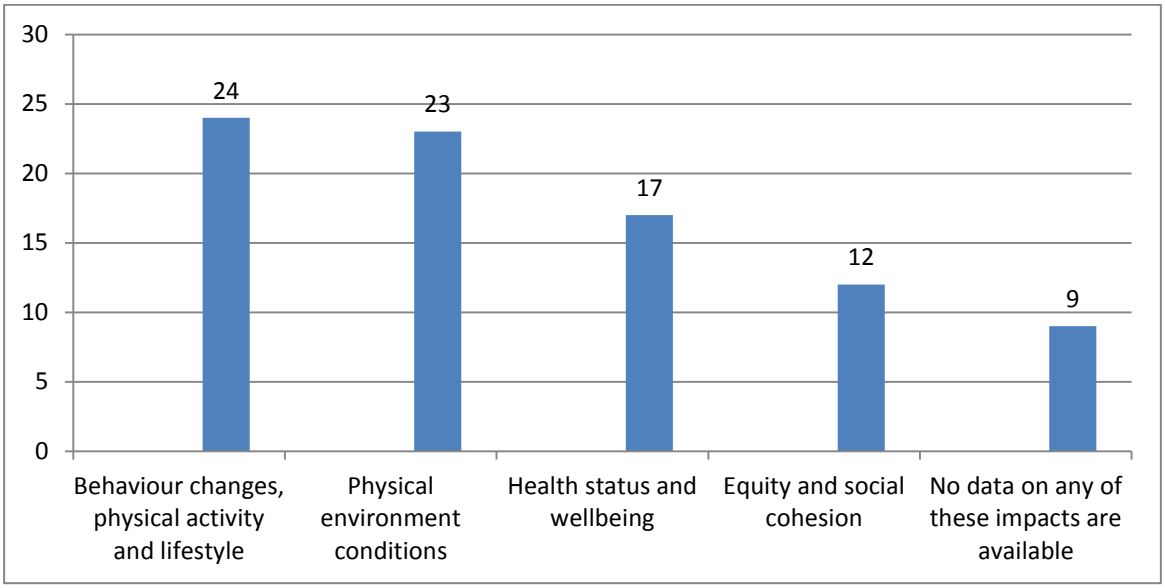
2.9 Data on intervention impacts

Although only 29 case studies confirmed having completed an outcome evaluation, 38 interventions reported that data were available on the impacts of the intervention. On average, each case study reported about two data dimensions to be available and impact information was more often available for behavioural/lifestyle and environmental impacts than for impacts on health and equity (Fig. 13):

- 24 case studies had collected data on behaviour changes and impacts on physical activity and lifestyle;
- 23 case studies reported availability of data on physical environment conditions;
- In 12 interventions, data on equity and social cohesion were collected; and
- 17 case studies reported having data on impacts on health status and well-being.

Nine case studies did not collect any information on the impacts of the intervention.

Fig. 13. Data on the impacts of the intervention (n=474)



Generally, all interventions reported delivering positive impacts through improving environmental surroundings, promoting physical activity, or bringing communities together. However, for the case studies that did evaluate the impacts of the intervention, a variety of outcome measures were used, as described below.

Various interventions measured their impact through data on environmental benefits such as an increase in biodiversity [2,24,45,46], better ambient air quality [8,19,37] or a decline of toxins in soil [33]. Other outcome measures used were increased use of the respective green space by the local community [25,42] and the associated benefits such as reduced stress, increased physical activity and improved cognitive function in the specific case of patients with mental illness [20]. Increased appreciation of nature, self-awareness and improved attitudes towards green space were also referred to as intervention outcomes [24,44], as well as stronger community involvement through green space-based interactions [14,16,42]. In the Finnish case study Moved by Nature [31], weight lost by improved physical activity was measured as key indicator. Moreover, one intervention reported financial savings due to the reduction of chemicals for green space maintenance [41].

Interventions with a focus on equity and cohesion reported rather similar outcome measures but related these to specific target groups or target areas, such as an increased use of green space in deprived areas [22], less social conflicts through better community interaction and activation of socially disadvantaged residents and increased visits by low income groups and black and ethnic minority groups [42].

Overall, data on intervention impacts were mostly reported or observed information, rather than objective data collected through measurements (such as e.g. numbers of amphibia after the

[4] The question on available data on the impacts of the intervention was asked as multiple choice question. Various case studies reported having data on more than one impact dimension.

intervention [2], the decline of toxins in humans [33] or data on physical activity levels and weight reduction [31]). This may be partially affected by the difficulty to objectively measure some of the more complex and/or subjective outcomes related to social cohesion, equity or well-being. Yet, also for environmental or health outcomes, most case studies based the evaluation on qualitative data (such as perception of well-being or increased functionality of the green space), or rather vague quantitative data such as the observed increase of visitors and active use of green spaces [1,9,17,20,23,25,36,42].

2.10 Transfer of case study formats

All participants who answered the question on key experiences and lessons learned (n=45) reported on successful implementation of their intervention and therefore would redo the intervention the same way (27 case studies) or with minor adaptations (18 case studies); no case study contributor stated that the intervention would have to be implemented completely differently. 26 case study contributors also suggested that their intervention could be easily transferred and adapted to other cities, while 19 respondents felt that their intervention could not be easily adapted to other locations.

3 Case study patterns and lessons learned

The 48 case studies on urban green space interventions submitted to WHO were diverse in both location and type of intervention. Moreover, the interventions had a variety of different and often combined objectives and outcomes. This section aims to identify commonalities and patterns observed in all 48 case studies beyond the description of the survey findings presented above, as well as some of the lessons learned that can be derived in general or highlight relevant individual case study experiences.

3.1 Intervention settings and contexts

The case study compilation showed that many case studies were implemented in a certain setting or context, or included certain components in the green space intervention. These intervention contexts related to, for example, brownfield interventions and area regeneration projects, the integration of blue spaces, the use of urban gardening approaches, or the implementation of green space interventions in institutionalized settings such as schools or care centres.

3.1.1 Brownfield interventions and area regeneration

Brownfield interventions often provide great opportunities for urban development and green space planning. The submitted brownfield case studies partially showed an exclusive focus on remediation, and partially represented area regeneration projects which undertook clean-up and remediation activities in industrial or harbour areas combined with the establishment of quality green spaces to shape a new function of the area for the local community.

Examples for brownfield and area generation interventions are the Port Sunlight River Park [17] which addressed the transformation of a landfill site to make the area accessible for recreation within the newly created park, the intervention in Travertin Park [46] which made a former stone quarry accessible to the residents and also addressed the conservation of endangered reptiles, the re-opening of a former factory site along a river to the public, creating a green space resource for all [1], and a soil remediation project [33] which mainly had environmental health objectives but increased the general attractiveness of the area as a co-benefit. Further projects turned old rail tracks into a green trail for walking and cycling [35] or rehabilitated a run-down urban area into a community asset area fostering social exchange [21].

3.1.2 Combination with blue spaces

Nine green space interventions included blue space components, among these were two interventions that also addressed brownfield measures [1,17]. They were realized along riversides or on natural or artificial water bodies in parks and mostly focused on environmental benefits like renaturation, conservation of biodiversity, attractiveness of the area or flood management, and provided spaces for residents to spend more times outdoors within attractive surroundings. Examples for blue space-associated interventions are the creation of a park where natural underground water resources were arranged to be used as blue spaces [5], and the upgrade of urban green spaces by the establishment of an artificial lake for recreation [26]. Other blue space interventions addressed the capacity of green spaces for flood control [12,22,26] or

the creation of green spaces along riverside areas [1,34,47] which were linked with equity objectives, providing access to green spaces for all population groups, especially in deprived areas.

3.1.3 Gardening and "edible" green spaces

A completely different approach for the use of green spaces for human health and social cohesion was pursued by projects that addressed "edible green spaces" or community gardening. Next to offering personal well-being, active recreation and social cohesion benefits through the performance of gardening activities, the projects also aimed to provide knowledge about the cultivation of vegetables and fruits and provided access to healthy food.

Gardening projects that addressed the promotion of intercultural and multigenerational gardening were e.g. performed in the InPeLa project [40] by providing free gardens, or within the Pallas Park project [42]. The Scottish project South Edinburgh Healthy Lifestyles [14] invited residents to gardening workshops while the Edible Playgrounds project [7] represents a comprehensive education approach on environmental awareness and community food-growing on school-owned areas. Edible city Andernach [39] is an example for the integration of urban agriculture in municipal planning, planting vegetables, herbs and fruits in public green spaces. The garden plots can be accessed by the public and all citizens can harvest the agricultural products.

3.1.4 Schools and institutionalized settings

Schools and other institutionalized settings were targeted by various interventions and seem especially interesting for gardening and physical activity promotion projects. Including physical activity in lessons helped sedentary pupils to move more, but required embedding such opportunities into the curriculum [30] or making school grounds accessible outside school hours [27]. One factor for effective implementation of the Edible Playgrounds project [7] was the collaboration with schools to identify where the project would have the greatest impact, which was done by information on the proportion of free school meals as a proxy indicator for schools with many students from lower socioeconomic status background. School projects were most successful when both pupils and teachers were actively involved [7, 38].

Examples of green space interventions in care settings are the Horticulture Therapy Garden [20], providing space for undertaking simple gardening tasks and cultivation of edible plants such as apples and blackberries as an integral part of therapeutic treatment for patients with mental illness, or the Possil Health and Community Care Centre [28] which used green spaces to better connect their centre with the urban surrounding and to provide public recreation areas to the community.

3.2 Implementation approaches

Reviewing the mode of implementation of the interventions, it was apparent that various case studies shared common approaches or process-related experiences. Main patterns emerged in relation to the application of low-budget approaches, the focus on green space interventions as a social rather than an environmental measure, and the establishment of collaboration networks.

3.2.1 Low-budget approaches

In contrast to cost-intensive interventions, some case studies were effective without major financial resources. These case studies tended to focus more on promotion and social or behavioural interventions, using the existing infrastructure – rather than changing the green space – to attract local residents to make active use of it.

Simple and smart initiatives for providing more equal access to green spaces for disadvantaged groups is exemplified with projects such as 'Open all Hours' [27] in Wales, giving all pupils the opportunity to become more physically active by using school grounds outside of school hours for social play and getting together. Another low-budget school-based intervention that made use of existing green space was Woodland Health for Youth [30] in England, where pupils undertook lessons across a range of curriculum subjects within their local woodland with the objective to promote physical activity.

Various case studies arranged events and outdoor courses (sport, recreation, cultural events etc.) to either promote existing green space opportunities, or to reach out to specific target groups [e.g. 1,6,11,14,16,23,31,34,42].

3.2.2 Social cohesion and equity focus

Several interventions focused on social cohesion and equity effects related to equal access to and use of urban green spaces by disadvantaged groups. While the definition of the respective target groups was very different, there was a shared vision that the intervention would provide access to green spaces as a setting for social interaction, cohesion and intercultural exchange.

Examples for projects focusing on social interaction and cohesion are the Green Angels project [16] which engaged unemployed and retired residents in management and care of a local park – providing training in new skills and developing career opportunities as well as stimulating community cohesion through engagement with local green space –or the South Edinburgh Healthy Lifestyles project [14] which aimed to provide spaces for social exchange through neighbourhood-based initiatives to improve and make use of local green areas. Similar impacts – providing green spaces for social and intercultural exchange – were reported by various park-based interventions [1,5,6,8,42].

Equity-driven intervention examples with a social cohesion focus are Woods in and Around Towns [9] which addressed social equity by adding quality features in disadvantaged urban areas, improving recreation facilities and performing community events, the project Beam Parklands [22], which transferred a formerly low quality public space that attracted anti-social behaviour into a multifunctional community asset, or the renewal of Mátyás square in Budapest [25], providing equal access to green spaces for disadvantaged groups.

3.2.3 Collaboration and partnership networks

Multi or intersectoral collaboration – for both planning and implementation – took place in many case studies and was highlighted as a promising approach to enhancing urban development through green space interventions. Case studies stressed the necessity of strong collaboration of all actors involved at all stages of the intervention process, enabling the projects to benefit from the knowledge of various actors but also making them accountable stakeholders [25]. Some case studies specifically highlighted the need for collaboration between health actors and urban planners [31,44] and if the intervention was coordinated by actors outside of the municipal structures, good collaboration with the local authorities was then considered to be paramount. Communication and collaboration with land owners was also referred to as an important element of partnership networking [24,29,45].

Intersectoral opportunities may exist on all spatial administration levels. Many case studies focused on small-scale initiatives and recommended that priorities be set for intersectoral collaboration on the neighbourhood planning level [25,45], while other projects operating at a larger scale pursued intersectoral collaboration for strategic planning frameworks [23].

Consultation with the local residents and target audience was deemed necessary to ensure that the intervention was accepted and used by the local community [11,32,34,42], but also to explain that not all expectations could be met [32]. For example, locally organized nature walks and green gym opportunities can become especially successful when collaboration with health actors enables the engagement of the relevant target groups, as in the Inverness nature walks for well-being [6].

3.3 Challenges and practical experiences

Some case studies reported on barriers that arose within the process or later, mostly related to implementation and evaluation. These experiences, described below, may especially help to inform future case studies.

3.3.1 Barriers and implementation challenges

One key challenge identified was how to ensure the successful targeting and provision of adequate services for hard to reach population groups, either because of the scepticism of the participants [16] or lack of support from landowners [1,48]. Logistical challenges of running intense programmes or outreach activities for specific target groups occurred when site visits increased beyond the capacity of tight budget and staffing situations [11]. Other case studies reported that the timescale of the project was too short [19], and that local authorities may have insufficient experience in managing and maintaining natural and ‘wild-like’ green areas [45]. Also, weather conditions can spoil the success of some outdoor programmes [14] and vandalism can be of concern as well [9].

3.3.2 Evaluation challenges

Evaluation of the interventions was difficult for some case studies and often not carried out. However, when evaluation was done, project schedules and funding may limit it to the project period and restrict the assessment of long-term effects of the intervention [11].

Various case studies [15,20] reported that the implementation of the intervention had provided them with a better understanding of the importance of evaluation, requiring reliable baseline data before the intervention and robust methods to assess the intervention impacts [32]. The project on play area planning [44] indicated the need to integrate such baseline assessments of existing infrastructures as part of the spatial planning process, leading to valid intervention evaluations. The need to regularly report back to the funders on the project status should not only be considered a formal duty but can also help to monitor the project, keep it on track and thereby also help to secure future funding [23].

4 Qualitative follow-up interviews with selected case studies

4.1 Introduction

Of the 48 urban green space intervention case studies submitted via the online survey, 15 of these were selected for further investigation. This selection was based on review of the case study survey data, with studies representing a broad range of intervention types being chosen. A semi-structured interview was carried out via a telephone conversation with the nominated spokesperson for each case study. A list of the 15 interviewed case studies is provided in Annex 2. While each case study is unique, reoccurring themes were identified which provides insight on the common challenges and opportunities involved in the design and implementation of urban green space interventions. The purpose of this section is to summarize the key findings from this more in-depth case study data collection including exploration of the reccurring themes as well as highlighting some unique points of difference that may provide useful insight for other green space researchers and practitioners.

Analysis of the interview data identified four general themes which arose across all aspects of the intervention; design, construction, implementation and evaluation. These four general themes are as follows:

- Vision
- Design (context specific and practical)
- Engagement
- Purpose

This section is hence structured around these four themes, discussing each theme in depth, highlighting specific case studies where relevant. This section concludes by describing the data that were, and more commonly weren't, collected to monitor and evaluate the effectiveness of the intervention. Here we set out the 'wish list' of useful data as perceived by the interviewees.

4.2 Vision

United support of a shared vision helps to build support for the project. Approximately one quarter of respondents highlighted the importance of providing a clear and understandable vision that all stakeholders, including community, can support. This is exemplified in the Stavanger case study [48] where, driven by the 1991 Stavanger Green Plan, the narrative switched from local community complaining about being the municipality in Norway with the lowest amount of green space per capita to the community becoming excited and motivated by the new vision of 'probably the best green structure in the world'. Respondents also spoke of the importance of avoiding an overly detailed and prescriptive vision which can divide and discourage different stakeholder groups from the beginning. This is particularly relevant when dealing with multiple landholders.

In addition to a vision being relatable and understandable it also needs to be flexible to dynamic social and political contexts. This is particularly important given the potentially long

implementation timeframes of certain interventions where community and political support needs to be sustained over several years.

Finally, the vision 'needs a home', meaning it needs it be embedded within a long-term and secure framework whether it be local planning policies or institutional plans. Examples of vision 'homes' that arose during interviews are outlined in Box 2.

Box 2. Examples of how the green space vision has been embedded within relevant frameworks

- In order for a school to be selected for an Edible Playground intervention [7] they must integrate the Edible Playgrounds' objectives within their school's ethos and plans, ensuring that the space will be used and maintained in the long-term.
- As part of the Falkirk Greenspace Initiative [23], Central Scotland Forest Trust worked with the local government authority to develop their Local Development Plan ensuring integration of a green space element.
- The 1965 Stavanger Land Use Masterplan introduced for the first time the concept of a continuous green structure [48]. The construction of the continuous structure started in earnest in the 1980s with the Stokka Lake Trail project proving a great starting success. In 1991 the objectives of the continuous green structure were further defined with the Stavanger Green Plan requiring every inhabitant to have access to the continuous green trail system with 500 m of their home.

Image: Hitherfield Primary Edible Playground – Trees for Cities

4.3 Design

Within the design theme two key subthemes arose; practical design considerations and context specific design.

4.3.1 Practical design considerations

Simple and practical green space interventions can prove highly effective. Alterations that enhance the access and perceived safety and cleanliness of existing green space can significantly increase the positive use of that space. Given limited resources, it is useful to first look at existing green space and consider how could practical alterations help optimise the green space for delivering positive community outcomes. As described by the Woods In and Around Towns

programme [9], these practical alternations could include simple physical changes to the green space such as:

- Enhancing entrances to the green space;
- Path creation and maintenance (e.g. ensuring path does not become overgrown, ensuring adequate drainage, preventing path becoming water-logged) (Fig. 14);
- Making the green space feel safe and welcoming (e.g. including welcome and information signs, designing paths and clearing undergrowth to ensure a clear line of sight); and
- Provision of seating and resting areas.

Fig. 14. Before and after intervention implementation as part of Woods in and Around Towns programme, Scotland

Image: Eva Silveirinha de Oliveira, OPENspace Research Centre

Image: Sara Tilley, OPENspace Research Centre

Note: Left panel shows entrance to greenspace before intervention implementation and right panel shows after intervention implementation as part of Woods in and Around Towns programme, Scotland [9]

When designing a green space intervention it is important to consult with the green space end user to ensure that the space is fit for purpose and will be used. This can help with identifying practical features for the green space tailoring it for the end user (e.g. inclusion of whiteboards within the Edible Playgrounds [7] to enable teachers to carry out lessons within the space). Furthermore, it is important to ensure that the intended end use of the green space is adequately provided for (e.g. an intended end use of gardening may require provision of a water source for irrigation of plants [42]). Finally, the green space should provide a level of coherence for the end user allowing them to understand and navigate the green space. This can be achieved through simple way finders marking the routes [48], or easy to understand icons such as ‘fast forward’ and ‘pause’ symbols upon the trails inviting people to move quickly (e.g. at cycling and running tracks) or to slow down and relax (e.g. benches at pleasant viewpoints) [47].

Increasing green space provision within already dense, built-up urban centres is difficult and requires innovative solutions. Integrating the greenspace within existing infrastructure can prove an effective way to overcome the challenge of limited space. The Bristol Street Green Screens

Trial Project in Birmingham [37] used existing pedestrian guardrails as the structure on which to install green screens proving a cost effective (approx. €25,500 for installation of 141 m green screen) and space efficient solution (Fig. 15).

Fig. 15. Bristol Street, Birmingham in 2014 before and after green screen implementation

Image: Atkins Limited

Image: Atkins Limited

Note: Left panel shows Bristol Street, Birmingham in 2014 before green screen implementation and right panel shows it in 2016 after green screen implementation as part of the Bristol Street Green Screens Trial Project, Birmingham, United Kingdom [37]

Urban green spaces can be vulnerable to vandalism and other anti-social behaviour. This was a challenge frequently encountered by interviewees. The case studies implemented a number of practical design features to help mitigate such anti-social behaviour (Box 3).

Box 3 Crime Prevention

Vandalism and safety concerns around the green spaces were commonly mentioned as challenges encountered by interviewees. Following are some of the practical solutions implemented to overcome these challenges:

- Manage vegetation so that it doesn't block the line of sight on pathways or doesn't block the view of security cameras [9,25].
- Use anti-vandalism measures such as anti-graffiti paint on art installations [47].
- Be persistent with combating vandalism. Fix vandalism (e.g. burnt park bench) as soon as possible. This helps to show local community that the space is cared for and that such negative behaviour is no longer acceptable [9].
- Encourage community pride and ownership in the green space fostering a social norm of care for the green space [18].
- In the more extreme cases certain interventions also employ security guards [25] and close the green space at night [47].

4.3.2 Context specific design

Across nearly all case studies arose the importance of the cultural and social context in which the green space exists. The cultural and social context of the green space's local community needs to be carefully considered when designing green space interventions. The design of the intervention should be, as far as possible, evidence based, with the positioning of space and the features being appropriate for the local context. As such, the design incorporates elements suitable for the local context and does not simply replicate that done elsewhere.

Bespoke solutions for the varying community groups need to be designed in order to engage these groups with the green space. This is illustrated well by a Stepping Stones into Nature project [18] where women migrant-populations were underrepresented users of green space. Engaging with this group began with carrying out willow-weaving art classes in an indoor setting. Through establishing this relationship and over time building trust, together they were able to identify a green space where the women felt safe to visit. The women now regularly use the green space and have even constructed willow tunnels within the green space. Similarly, in the Hüdavendigar City Garden in Bursa, Turkey [8] a women's only swimming pool is available within the green space enabling women to overcome cultural barriers to swimming in mixed facilities. Another nice example of how to embed the green space within the local identity of the area comes again from the Hüdavendigar City Garden [8]. A local tree donation campaign with the slogan of 'I am here also' was held where community members could donate a tree to the green space and have their name assigned to the tree. This provides a sense of ownership and connection between the local community and the green space as well as an interesting feature to visit within the green space.

The environmental context of the green space was also identified as a key design consideration that could present both challenges and opportunities for the green space. For example, with the Port Sunlight Park in England [17] the principles of nature sympathetic design had to be applied so as not to negatively impact the adjacent protected wetlands. The green space design therefore had to ensure that the footpaths were installed at an adequate distance away from the mudflats so as not to disturb the visiting populations of migratory bird species. While this placed a challenging constraint on the design of the green space it also provided the opportunity to educate users on the environmental importance of the site. Similarly, the Beam Parklands [22] had the opportunity to incorporate flood mitigation functionality within the green space but then had to overcome the challenge of engaging and educating the community, who perceived the inundated areas of the green space as a problem.

4.4 Engagement

Across all 15 interviews the theme of engagement arose strongly. The majority of respondents emphasized the importance of applying a dual approach to green space interventions where physical, environmental changes to the green space occur in conjunction with community engagement, participation and activation. It is important that this social element is integrated right throughout the design and implementation of the green space intervention. Indeed, the benefit of engaging community from the onset is invaluable as opposed to applying a 'build it

and they will come' approach which seems to have limited success. The Stavanger Green Structure intervention [48] did not initially result in an increased use of the green space by community. It was only when the '52 Everyday Walks' project was implemented, which provided easy to follow maps coupled with clear way finding trail markers and organized walking groups, that uptake of the green space really occurred among community. In hindsight it would have been useful to have implemented this social engagement component of the intervention alongside the physical changes as it would have communicated at an earlier stage the value of the project to the community and helped to secure their support for the green space project hence saving time continuously justifying the work. This was also evident in the Pallas Park case study [42] where Phase I of the project was mainly focused on physical changes to the built environment and hence the green space was not well-accepted by community who were dissatisfied with the robust design of the new park and lacked sense of ownership. Phase II and III of the project therefore had a much stronger focus on intercultural activities to promote acceptance and use of the green space. The Connswater Community Greenway intervention [34] provides an example of where community engagement was present from the project's beginning. This was owing to a 'bottom-up' approach being applied which involved the employment of a full time community support officer.

The type of engagement used and the type of stakeholders engaged with varied across the different interventions. Stakeholder engagement could take the form of community participation during any or all stages of the intervention. For example, community participation in the design phase of the Hungarian GreenKeys project [25] led to the green space serving the multiple needs of the diverse community because their interests had been identified through this participation, although it was a challenge for the designers to accommodate these differing and sometimes conflicting needs. Another form of community participation is seen with the 'Parque Ribeiro do Matadouro' case study [47] where the Santo Tirso Municipality ran a competition among community to name the park generating interest in and ownership of the green space. In order to sustain community engagement with and support of the intervention it is important to not delay in delivery of on-ground outcomes. Delays in delivery can have a number of negative impacts, such as a) depressing local enthusiasm for the project (sense of despondency and reduced commitment by local community), and b) in terms of evaluation by research centres based on grant funding, with delays requiring funding extensions and extending project delivery times potentially resulting in an attenuation or reduction in original outcomes.

Other forms of stakeholder engagement can be with local landholders. Almost a third (n=4) of respondents had to overcome the challenge of collaborating with multiple landholders in order to implement the greenspace intervention. Various solutions were employed to overcome this challenge including activating the 'compulsory purchase' rights of the local government in order to acquire the land needed as was the case with the Stavanger Green Structure intervention [48]. Other case studies applied a softer approach of appointing designated community engagement officers to build relationships and trust with the local landholders [23]. The Falkirk case study [23] describes how local landholders who were once resistant to the building of footpaths through their land are now, in some cases, actively encouraging this practice. The change in

thinking came about through landholders seeing the benefits of the green space and realizing that by directing footfall close to their farm buildings, they could establish economic opportunities, such as ice-cream parlours or accommodation for long distance hikers/cyclists.

In addition to engaging with the local community and green space end users it is also important to identify and engage with local 'champions'. Over half of the respondents spoke about champions, or key actors, without whom the project would not have been a success. Depending on the intervention and local context these champions can present themselves as a variety of people, from passionate and innovative officers of various stakeholder partners (e.g. local government officers) who are dedicated to delivering positive community outcomes to well-respected, local celebrities endorsing and supporting the project as with the support of the Pärnu Riverside Reopening project [1] by a former Olympian rowing champion of Estonia.

Finally, forming the right partnerships and collaborations around the green space can also be critical to ensuring the intervention's success. As can be seen in table 1, the types of collaborations involved in delivering the green space interventions vary greatly. While some interventions are led by the local government authority others are led by a third party organization such as a non-for-profit organization. Having a third party lead the intervention can have its advantages owing to the third party serving as an independent voice and having certain liberties over, for example, a government organization, as was highlighted as a key advantage with the Falkirk Greenspace Initiative [23]. Conversely, a third party lead can also have disadvantages through creating confusion among the community about who is responsible for the green space, as was highlighted with the Hungarian GreenKeys project [25]. In some cases it is important for the lead organization to identify existing local networks and organizations to partner with. Partnering with such local networks provides an efficient way for the lead organization to engage with the local community and build relationships and trust. This was seen in the Stepping Stones to Nature project where interventions implemented in lower socioeconomic areas allowed greater opportunities for partnering with local networks which were more active in these areas. Initiation of these partnerships depends on the local circumstances and the funding opportunities available at the time. A number of interventions were initiated through external funding grants (e.g. Big Lottery Fund and EU GreenKeys project funding) while others depended on funding from local and state government. Ensuring long-term funding of these green space interventions for their maintenance and upkeep can be a challenge with a number of case studies engaging with local volunteer groups to help fulfil the maintenance needs of the green space intervention [7,11,17,23].

Table 1. Overview of collaborations involved in funding and delivering the green space interventions

No.	Intervention Title	Lead Organization	Key Collaborators	Funding Source	Approx. Cost
1	Pärnu Riverside Reopening project	Pärnu City Government	Landholders and health experts	Pärnu City Government	€1.4 m
7	Edible Playgrounds	Trees for Cities	Hitherfield Primary Schools	School where intervention is implemented, various grants and corporate partnerships	€40,000
8	Hüdavendigar City Garden	Municipality of Bursa	Not stated	Municipality of Bursa	€4.2 m
9	Woods in and Around Towns	Forestry Commission Scotland	University of Edinburgh	Funded by the Forestry Commission Scotland and the National Institute for Health Research Public Health Research Programme	€300,000
11	Active England Woodlands Project (five projects)	Forestry Commission	Sport England	Big Lottery Fund and Sport England	€3.6 m
17	Port Sunlight River Park	The Land Trust	Wirral Metropolitan Borough Council, Forestry Commission and United Kingdom Waste Management	Wirral Metropolitan Borough Council, Biffa Award, United Kingdom Waste Services and the English Woodland Grant Scheme	n/a
18	Stepping Stones to Nature	Plymouth City Council	Natural England and a range of community, voluntary and public sector providers	Funded by Big Lottery as part of Natural England's Access to Nature Programme	€1.3m
22	Beam Parklands	The Land Trust	Environment Agency, London Borough of Barking and Dagenham and London Borough of Havering	Funding from European Regional Development Fund matched by Environment Agency work	n/a
23	Falkirk Greenspace Initiative	Central Scotland Forest Trust (now CSGNT)	Falkirk District Council, Central Regional Council, Forth Valley Enterprise, Forestry Commission Scotland, Scottish Canals, Callendar Estates, Scottish Government, National Health Service, CATCA and Landholders	Various grants and project funding throughout the years	n/a
25	GreenKeys Mátyás Square Project	Rév8 (urban development corporation)	Local Government of Józsefváros	EU GreenKeys project funding	€62,500
34	Connswater	Belfast City	Queen's University Belfast and	Big Lottery Fund, Belfast	€47 m

No.	Intervention Title	Lead Organization	Key Collaborators	Funding Source	Approx. Cost
	Community Greenway	Council	Department for Social Development	City Council and Department for Social Development	
37	Bristol Street Green Screens Trial Project	Atkins	Southside Business Improvement District of Birmingham, Birmingham City Council and Staffordshire University	Southside Business Improvement District of Birmingham and Atkins	€29,000
42	Pallas Park	Quartiers-management Schöneberger Norden	Local authority, local non-profit organizations, housing company	Federal Funds for "Socially cohesive cities" with contributions from municipality	n/a
47	Parque Ribeiro do Matadouro	Santo Tirso Municipality	Not stated	Santo Tirso Municipality	€1.4 m
48	Green structure acquisition and 52 Everyday Walks	City of Stavanger	Landholders and Norwegian Rambler Association	City of Stavanger	€30 m

Note: Some cost figures may include evaluation expenses when the budget figures could not be separated

4.5 Purpose

An interesting theme that was mentioned by almost half of the participants was the need to establish a sense of purpose for the green space. According to the respondents, interaction with and activities undertaken in green spaces should be meaningful for the user in order for them to derive the broader benefits of green space use (i.e. benefits beyond physical health). It is therefore recommended as important to provide green spaces that allow visitors to experience a sense of purpose. Some case studies suggested gardening as a meaningful green space activity through which to achieve this sense of purpose although, as highlighted by the Pallas Park intervention in Berlin [42], activities such as gardening require shared understandings on codes of conduct in order for them to be effective. Sense of purpose could also be achieved through providing platforms for social engagement within the green space (e.g. organized group activities held within the green space). These can range in scale from facilitating smaller group-based access and activities for underrepresented groups, as with the Active England Woodlands Project [11], to larger local government organized community events, as with the Parque Ribeiro do Matadouro case study [47]. Encouragement of social interaction within green space can also be achieved through simple design features such as providing trails and pathways that are wide enough to allow people to walk side by side, as with the Stokka Lake Trail as part of the Stavanger Green Structure intervention [48].

Green spaces that provide locally unique features can provide people with a purpose for visiting that green space. Again these 'destination features' can range in size and sophistication from the interactive art installations in Parque Ribeiro do Matadouro ([47], Fig. 16), to the Kelpies equine sculpture in the Falkirk Greenspace Initiative [23] or to the park bench designed by a well-

known artist as in the Stepping Stones to Nature project [18]. These unique features also help promote a sense of pride and ownership among community for their green space.

Fig. 16. Art installations provide a purpose for people to visit Parque Ribeiro do Matadouro [47]

Image: Victor Esteves, Oh!Land Studio

Building on these concepts of providing green spaces that give people a purpose to visit and providing a sense of purpose while there, two case studies also spoke about the importance of building green space use into the daily routine of people's lives. For example, the Stavanger Green Structure [48] has been designed so that the green space is within 500 m of every home encouraging use of the green space for daily travel and movement within the city. Similarly, the Connswater Community Greenway [34] uses foot and cycle paths to link open and green space in a way that allows for practical, daily use (Fig. 17). Integrating green space use within the everyday routine of people's lives could inherently embed purposeful green space experiences as part of daily life.

Fig. 17. Green space that is designed to allow for its use to be integrated into the daily routine of people's lives

Image: Victoria Park by Fiona Ann Patterson

4.6 Monitoring and evaluating intervention effectiveness

During the interviews participants were asked about data that were collected before, during and after the intervention. Over a quarter (n=4) of the interviewed case studies collaborated with universities or research centres to develop a monitoring and evaluation program for the intervention. Journal articles have been published as a result of these research collaborations (Morris and O'Brien, 2011[5] [11], Ward Thompson et al., 2013[6] [9]), although two of the publications are study protocols (Tully et al., 2013[7] [34], Silveirinha de Oliveira et al., 2013[8] [9]) with results yet to be published. The case studies with the least amount of data collected were the ones where implementation of the intervention commenced during the 80s [48] and early 90s [23]. When speaking to the representatives of these case studies they explained that the methodological techniques for monitoring intervention effectiveness, especially for social and

[5] Morris, J. and O'Brien, E., 2011. Encouraging healthy outdoor activity amongst under-represented groups: An evaluation of the Active England woodland projects. *Urban Forestry & Urban Greening*, *10*(4), pp.323-333.

[6] Ward Thompson, C., Roe, J. and Aspinall, P., 2013. Woodland improvements in deprived urban communities: What impact do they have on people's activities and quality of life?. *Landscape and Urban Planning*, *118*, pp.79-89.

[7] Tully, M.A., Hunter, R.F., McAneney, H., Cupples, M.E., Donnelly, M., Ellis, G., Hutchinson, G., Prior, L., Stevenson, M. and Kee, F., 2013. Physical activity and the rejuvenation of Connswater (PARC study): protocol for a natural experiment investigating the impact of urban regeneration on public health. *BMC Public Health*, *13*(1), p.774.

[8] Silveirinha de Oliveira, E.., Aspinall, P., Briggs, A., Cummins, S., Leyland, A.H., Mitchell, R., Roe, J. and Ward Thompson, C., 2013. How effective is the Forestry Commission Scotland's woodland improvement programme—'Woods In and Around Towns'(WIAT)—at improving psychological well-being in deprived urban communities? A quasi-experimental study. *BMJ open*, *3*(8), p.e003648.

health outcomes, were not readily accessible, sophisticated or mainstream thinking at the time. Most case studies quoted limited funding and resources as reasons for restricted data collection. In addition, monitoring was rarely seen as a priority above on-ground works and hence funding was always allocated to the latter.

Participants were also asked from their perspective 'What data would you find most relevant to document your intervention's impact and how could these data be collected?'. A more nuanced understanding of the use of the green space, beyond just number of visits, was the most commonly desired data among respondents. Quantitative data on health and social outcomes of the green space intervention were also desired. Box 4 outlines a summary of the data desired by the respondents for assessing the effectiveness of the intervention.

Box 4. Intervention Data "Wish List"

During the interviews participants were asked 'What data would you find most relevant to document your intervention's impact and how could these data be collected?'

Use data – Beyond just number of visits but also understanding:

- Use over time including the frequency and duration of visits
- Type of use of green space (i.e. what activities are performed in the green space, by whom and whom with)
- The quality of the time that people spend in green space and how this influences their attitudes and behaviours towards green space both now and later in life
- How people access green space (travel and transport)
- Where people go before and after their green space visit.

Quantitative health impact data:

- Impact of green space on the health and well-being of the local community
- Impact of the green space on local air quality
- Long-term health outcomes.

Social impact data:

- Impact of green space on crime and aggression
- Impact of green space on social cohesion of local community.

Community and stakeholder perceptions:

- Impact of green space on local residential satisfaction
- Perceived value of green space by local businesses and community
- Satisfaction of green space users (preferred elements of the green space, does the green space align with their expectations).

Economic evaluation:

- Cost–effectiveness of the intervention
- Contribution of the green space to the local economy
- Effect of green space on promoting new businesses to establish in the local area.

4.7 Concluding remarks

The 15 semi-structured case study interviews have provided useful qualitative data that has helped build a richer understanding of the challenges and opportunities involved in delivering urban green space interventions. Throughout the interviews participants discussed solutions to overcoming the following common challenges:

- Deterring anti-social behaviour and vandalism within the green space.
- Sustaining community engagement with the green space.
- Sustaining political will and ongoing funding for the green space.
- Ensuring long-term maintenance and upkeep of the green space.

Across the four themes of Vision, Design, Engagement and Purpose arose key lessons learnt on how to overcome challenges, capitalise on opportunities and ensure delivery of effective interventions. These lessons learnt are summarized in Box 5.

Box 5. Overview of key lessons learnt as identified through the interviews

- Develop a clear, simple and relatable green space vision that is flexible to changing social and political contexts and that is embedded within a long-term and secure framework.
- Tailor the green space to the local cultural, social and environmental context.
- Practical interventions focused on delivering safe, accessible, clean and welcoming green spaces can be the most effective and cost-efficient.
- Urban green space interventions need to apply a dual approach where physical changes to the environment are complemented by social and behaviour changes.
    - Community engagement, participation and activation is critical throughout all stages of the green space intervention.
    - Identifying local champions and collaborating with key partner organizations can help facilitate successful green space interventions.
- Build a ‘sense of purpose’ within the green space through facilitating meaningful activities, providing unique points of interest to visit and integrating the green space within daily routines.

5 Key findings and conclusions

Analysis of the survey data from the 48 case studies coupled with analysis of the more in-depth qualitative data from the 15 semi-structured interviews has led to the identification of a number of key findings and practical conclusions for local action on delivering effective urban green space interventions. These key findings and conclusions are not to be considered as exhaustive or absolute but are rather to serve as considerations for informing the discussion at the expert meeting.

In this context, it should also be noted that the key findings and conclusions are derived from a set of case studies that have been submitted to showcase good practice. No case study was submitted that represented an example of an unsuccessful or even detrimental intervention, which may have affected the content and tone of the following wrap-up section. Also, it is worthwhile to note that despite the variety of case studies submitted, interventions were only coming from 14 countries with a heavy bias towards United Kingdom-based examples.

5.1 Key Findings

- A large variety of urban green spaces, such as parks, playgrounds, riversides, green trails or urban gardening, can be applied as a spatial determinant to improve the quality of urban settings delivering diverse environmental, social and health benefits to the local community.
- Urban green space interventions most commonly delivered environmental benefits or promoted active lifestyles. Many interventions also reported on delivering positive equity and social cohesion outcomes. Main benefits described by the interventions related to:
    - Improved attractiveness of the area;
    - Biodiversity, conservation and renaturation effects;
    - More time spent outdoors;
    - Promotion of walking and cycling;
    - Promotion of leisure and play;
    - Creation of settings for social interaction;
    - Improved urban quality in disadvantaged areas;
    - Reduction of environmental risk (flooding, heat, air pollution etc.);
    - Provision of equal access to green spaces; and
    - Opportunities for urban gardening.
- Associated with the environmental, lifestyle or social equity outcomes, various case studies referred to health benefits related to:
    - physical and mental health in general;
    - well-being and quality of life; and
    - prevention of disease.

- Despite the diversity of reported outcomes, most case studies provided anecdotal evidence of benefits or reported on perceived improvements from the intervention. Quantitative measurement and documentation of intervention benefits is rare, especially for health and equity.
- There is a critical need for better integration of monitoring and evaluation components to guide the implementation of the interventions and provide reliable assessments of the project impacts.
- Urban green space interventions can occur in a range of settings. Interventions are not limited to public open spaces, such as parks or playgrounds, but can also be delivered in more institutionalized settings such as schools or health care settings where green spaces can be used as a resource for learning, recreation, patient rehabilitation and therapy.
- Green space interventions are often implemented successfully in disadvantaged or deprived areas, providing settings for social exchange and equal access to green and restorative areas and thereby increasing social and environmental conditions.
- Urban green space interventions reflect the principles of nature-based solutions and ecosystem service approaches where nature is considered as a resource for not only environmental outcomes but also for delivering positive health outcomes and for providing safe, accessible, welcoming and restorative settings for social interaction and recreation.
- Combining urban infrastructure and environment interventions with social and community-based interventions can promote the use of urban green space and thereby maximize its impact. These dual approaches can create places of identity and meaning for local residents.

5.2 Conclusions

5.2.1 Conclusion 1: Collaborate with stakeholders

Establishing the right collaborations and governance structures around the green space intervention can aid its success. To establish effective collaborations the following should be considered:

- Collaborations should be diverse, cross-sectorial and transdisciplinary and incorporate diverse sectors such as health, social, cultural, environmental and planning. Green space interventions benefit from cross-sector collaboration, particularly between the health and planning sectors.
- Collaborations should involve key local actors, or ‘champions’, as well as partnerships with key local organizations. This can help build relationships and trust with local stakeholders which is critical to the delivery of effective green space interventions.

- Collaborating with academic institutes and research centres can aid with delivering an effective monitoring and evaluation program for the intervention.
- Collaborations and partnerships can help to establish the governance arrangements for overseeing practical aspects such as funding models and maintenance regimes.

5.2.2 Conclusion 2: Engage the community early and consistently

A new or improved green space will not necessarily lead to increased use of the green space and delivery of social and health benefits when local needs and community perceptions are not considered. The community needs to be invited to participate in the green space planning process, and to actively engage with and use the green spaces. This can be achieved through considering the following:

- Active involvement of the local community and especially the intended end users of the green space during the planning of green space interventions will help to resolve conflicts of interest among different user groups and deliver fit-for-purpose green spaces. This collaboration should occur as early as possible in the design process and be genuine collaboration where the end user is key to the decision-making process as opposed to merely consulting with the end user.
- Green spaces should be inclusive places that are accessible by all members of the community within short distance. Hence, where possible provide a variety of tailored activities to reach out to and engage with diverse population groups, acknowledging the different needs in relation to age, gender, ethnicity as well as socioeconomic and health status.
- Genuine engagement with diverse community groups and stakeholders takes time and effort and requires patience and persistence. This needs to be allowed for within the intervention design and delivery. As the interventions may lead to increased use of the green spaces and an increased demand for community engagement, adequate resources should be planned for to meet this increased demand.
- Build a ‘sense of purpose’ within the green space through facilitating meaningful activities, providing unique points of interest to visit and integrating the green space within the daily routines of local residents.
- Clear and effective communication is critical for engaging people with the green space. Communicate early on the benefits of the intervention and provide regular updates on the intervention’s progress and outcomes. This again helps to build trust and keeps people informed. Online (e.g. park web site) and onsite (e.g. park information signs) communication tools can be used to achieve this.

5.2.3 Conclusion 3: Think long-term

In the majority of cases, urban green space interventions are dynamic and long-term processes normally set within ever changing social and political contexts. Green space interventions therefore tend to require and benefit from long-term thinking and hence the following should be considered:

- Vision – Develop a clear, simple and relatable green space vision that is flexible to changing social and political contexts and that is embedded within a long-term and secure framework.
- Support – Sustain long-term support for the green space amongst both community and political leaders through ongoing collaboration, engagement and communication.
- Timeframes and funding – Align expenditure with timeframes and avoid cases where money has to be spent by a certain deadline that doesn't necessarily match the delivery timeframes, as can sometimes be the case with grant funding requirements.
- Maintenance – Ensure the long-term maintenance and improvement of the green space through developing sustainable maintenance regimes and funding models.
- Outcomes and Evaluation – To ensure that the intervention delivers long-term health, social and environmental benefits it is important that long-term impacts are evaluated.
- Longevity – Green space interventions should be available for the long-term. Where possible, avoid cases where the green space will be vulnerable to being developed which can disempower the community.

5.2.4 Conclusion 4: Be practical

Urban green space interventions are diverse and complex, hence there are no set or technical rules for delivering urban green space interventions successfully. That said there are some common and practical principles that can be applied to the majority of green space interventions, such as:

- First and foremost the green space needs to feel safe and welcoming. This can be achieved through practical measures such as providing welcome and information signs along with well-marked trails with good lighting and lines of sight or through employing park rangers or engagement officers or even security if necessary.
- Show that the green space is cared for and set this as the standard or social norm for the site. This can be achieved by fixing vandalism issues shortly after they occur, avoiding over-flowing bins, removing litter and illegal dumping as well as information signs (for example if allowing the green space to grow wild for biodiversity benefits then explain this to users as opposed to users thinking that the site is neglected).

- Make the green space accessible through providing clear points of entry and integrating the green space with key connection points (e.g. linking with bike routes, walking trails or as part of access to key destinations). Similarly, make green spaces available on local level and with easy access (e.g. short distances), as this enables the local community to include them in daily life routines and make frequent use of the green spaces.
- Complement local environmental conditions by using greenery that is appropriate to the local climatic conditions and that supports native flora and fauna. Similarly, the design of the green space intervention should also consider hydrology and contribute to flood mitigation where possible.
- Social cohesion projects, area regeneration or redevelopment of former industrial sites etc. provide interesting opportunities to embed green space interventions in larger planning frameworks and help them to achieve the best-possible impact for the local community.

Annex 1 – Overview of case studies and their objectives/outcomes

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
1	Reopened Riverside	Pärnu Estonia	Reopening the riverside of Pärnu, an area formerly used by factories and private sector. Creating open spaces and open riverside where citizens can walk, ride by bicycle, make gymnastics. Light roads are lighted by electricity, there can walk or jog securely.	Enabling social equity and environmental justice - creating barrier-free environments accessible to all - providing more equal access to green spaces to disadvantaged population groups, - creating barrier-free environments accessible to all	Promoting active lifestyle and behaviour - More time spent outdoors in general - promoting walking/cycling
2	Reintrodu-cing triturus cristatus	Stockholm Sweden	A new pond for amphibia was built for successfully reintroducing Triturus cristatus from a nearby area.	Improving urban environment benefits of green space - biodiversity conservation and enhancement, - renaturation activities - general attractiveness of local area/neighbourhood	
3	Alo Moloz Hatti	Gebze Turkey	Green space establishment/improvement in enclosed yard area	Promoting active lifestyle and behaviour - promotion of walking/cycling	
4	Theatre Park	Rijeka Crotia	Restoration of a historic park with complete reconstruction of the plant population and new hiking routes.	Improving urban environment benefits of green space - Biodiversity conversation and enhancement	
5	Incilipinar Park	Denizli Turkey	Rehabilitation of an area as park for recreation by opening and arranging natural underground resources to be used within the park. Ponds, walking paths, picnic areas, concert area, children's play grounds, fitness equipments, tennis courts were added.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood; - biodiversity conservation and enhancement	Promoting active lifestyle and behaviour - More time spent outdoors, – – promote walking/cycling, outdoor sports and children's play

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
6	Nature Walks for Well-being	Inverness United Kingdom (Scotland)	No physical change was implemented other than what would be considered regular management to date. Using greenspaces as a vital resource and places to relax, heal and re-energize and address behavioural changes.	Reducing health impacts - promoting well-being and mental state; - improving quality of life in general, - increased value of greenspace	Improving urban environment benefits of green space – increasing the value of green space as a community resource
7	Edible Playground	London United Kingdom (England)	Edible Playground comprising raised beds planted with vegetables, salads, herbs and fruits, with irrigation and composting system, allowing producing food for use in the school dining hall and kitchen classroom. Reclaimed furniture for outdoor teaching. Capacity-building through teacher training, online hub with free downloadable resources, interactive pupil workshops and assemblies, and a bespoke management plan. Personal, social, health and economic education.	Improving urban environment benefits of green space - outdoor education resource for cross-curricular learning, and to promote healthy sustainable lifestyle, - general attractiveness of local area/neighbourhood, - biodiversity conservation and enhancement	
8	Hüdavendi-gar City Garden	Bursa Turkey	Creation of a large park for opening non-usable area for public usage and provide citizens with green areas, children's playgrounds, picnic areas, a pool and various sports fields, bicycle roads and running tracks. Measures for eliminating flood risks and removing illegal buildings and increasing safe urban areas.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - reduction of air pollution, - reduction of noise	Promoting active lifestyle and behaviour, - promotion of walking/cycling, - promotion of leisure and play
9	Woods in and Around Towns (WIAT)	Central Belt United Kingdom (Scotland)	Staged process guided by a detailed woodland development plan: First, physical changes to the environment were made to bring woodlands into sustainable management, including improvement of recreation facilities, cleanup, and the creation of new footpaths, signage and entrance gateways. Second, the woodlands were promoted through community events. Both publicity and group-based activities were used, like walking initiatives with trained leaders or natural play and woodland based classes for schoolchildren.	Enabling social equity and environmental justice - enabling social equity and environmental justice, - adding quality features in disadvantaged urban areas; - creating barrier-free environments accessible to all	Reducing health impacts - improving quality of life in general; - promoting well-being and mental state

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
10	Lowfield Park U-Mix	Sheffield United Kingdom (England)	Regeneration of a small city park. Previously the 2-hectare site was a low-quality underutilized green space. The project was based on an innovative four-way partnership between Sheffield City Council, FURD (Football Unites Racism Divides), Sheffield Futures (Youth Service) and Lowfield School. The park now provides a new, state of the art youth/community building, a 3G synthetic sports pitch, and adventurous play equipment. It is now a managed space with daily on-site presence. The aim is for the rejuvenated park to act as a catalyst for a growth in community cohesion. At the same time, the park has also been host to an innovation project (ProFit) which has established a FieldLab to install and test new ideas to make the park an innovative urban outdoor fitness and exercise location.	Promoting active lifestyle - promotion of leisure and play - more time spent outdoors in general	
11	Active England Woodland Projects	Various locations United Kingdom (England)	1) infrastructure changes such as improved walking and cycling tracks, 2) organized activities and events, 3) outreach to understand hard to reach groups, 4) facilitated access	Promoting active lifestyle - promotion of walking/cycling, - increase community participation in sport and physical activity	Enabling social equity and environmental justice - Reaching groups underrepresented in terms of doing sport and physical activity, particularly for women and girls, black and minority ethnic groups, people on low income, people with disabilities, people over 45 years of age and younger people under sixteen

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
12	Urban green space intervention	Edirne Turkey	Planning of a natural and ecological healthy urban environment, formation of recreational areas, attractions, natural walking areas, gaming group, picnic areas, hiking trails, living centre for disabled and afforestation on road edges, general development of the ecosystem river/ forest.	Improving urban environment benefits of green space - renaturation activities,' - reduction of air pollution, - mitigation of heat waves	Improving urban environment benefits of green space - flood management (control measures), - biodiversity conservation and enhancement, - general attractiveness of local area/neighbourhood
13	Park project	Istanbul Turkey	Public park intervention for improved environmental benefits	Improving urban environment benefits of green space - reduction of air pollution, - mitigation of heat waves, - flood management (control measures)	Reducing health impacts - improving quality of life in general
14	South Edinburgh Healthy Lifestyles	Edinburgh United Kingdom (Scotland)	A programme of outdoor events to introduce people to physical activity, resulting in 10 programmes, 60 sessions – 215 participants taking part which included; a series of 6 cooking workshops to encourage healthy cooking and eating on a budget with 13 participants taking part; A series of 10 gardening workshops and development of a community garden engaging 48 participants; A series of 10 environmental enhancement workshops with 196 participants taking part which led to an improvement in physical health & well-being, confidence and self-esteem, an increased social interaction with a positive access to local greenspace.	Reducing health impacts - promoting well-being and mental state, - *improving quality of life in general*	Enabling social equity and environmental justice - providing spaces for social interaction and exchange - adding quality features in disadvantaged urban areas - providing more equal access to green spaces to disadvantaged population groups
15	Redcross Way Redesign	London United Kingdom (England)	Conceived as part of the wider Bankside Urban Forest strategy to revitalize the network of streets and spaces south of the River Thames in central London, this project redesigned a community street, delivering more space for on-street urban greening through street tree planting, herbaceous planting, and using adjacent green space to add further green infrastructure to the street environment.	Rebalancing the functions of the street for people and wildlife	Promoting active lifestyle and behaviour - Increase of use of the street by people on foot/bike, reduction in traffic speeds - promotion of gardening

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
16	Green Angels at Liverpool Festival Gardens	Wirral United Kingdom (England)	The Green Angels training project run activities which addressed unemployment through providing new skills and training for unemployed and retired people and imbuing a sense of pride and achievement through tangible improvements to the site; The local environment was improved through habitat creation and oases for wildlife. Local residents were engaged in activities that provided physical and mental health benefits.	Enabling social equity and environmental justice - Stimulating community cohesion through engagement with local green space - Training to improve participants' prospects and lifestyle - bringing communities together	Promoting active lifestyle and behaviour - encouraging active involvement in outdoor pursuits - involving the local community in the management and care of the park
17	Port Sunlight river park	Liverpool United Kingdom (England)	Port Sunlight River Park, a previous landfill site that hemmed off from the community, was transformed and opened to the public in 2014 by national land management charity. It is now space home to an array of wildlife and wildflowers, along with a wetlands area and soaring footpaths.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood - biodiversity conservation and enhancement	
18	Stepping Stones to Nature	Plymouth United Kingdom (England)	Funded by Big Lottery as part of Natural England's Access to Nature Programme, Stepping Stones to Nature (SS2N) started in 2009 as a partnership project to get more people engaging positively with nature in and around Plymouth – with a particular focus on more deprived neighbourhoods. Hosted by Plymouth City Council's Planning Services the project took a partnership approach from the outset including community, voluntary and public sector providers.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - Improving quality of urban green spaces through community involvement	Promoting active lifestyle - Improvement in quality of green space, focus on more natural green spaces, - more time spent outdoors in general
19	Green urban area and life quality	Rome Italy	Green space, human health, informative questionnaire	Promoting active lifestyle - more time spent outdoors in general, - promotion of leisure and play	

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
20	Horticulture Therapy Garden	London United Kingdom (England)	Horticulture Therapy Garden for patients with severe mental illness within a previously unused space with accessible pathways, raised beds and seating to create a place that is safe, functional and accessible. The garden includes selected plants such as grasses for sensory characteristics, and edible plants. The project has created community space where patients and staff can work together with nature, simply doing gardening tasks or. use the garden to run outdoor yoga, meditation and occupational therapy sessions.	Improving urban environment benefits of green space - building a functional resource for outdoor therapy - general attractiveness of local area/neighbourhood, - biodiversity conservation and enhancement	Reducing health impacts - promoting well-being and mental state - improving quality of life in general
21	GOW (Gibson-Otago-Westbank)	Glasgow United Kingdom (Scotland)	The backcourt area was originally badly maintained, overgrown and unsafe. For the redevelopment and to oversee and control the measures, a committee with local residents was founded. Key measures taken were removal of overgrown plants, complete redesign of bin sheds, and creation of several distinct gardens within the area. This was followed up with a monthly clean-up to ensure standards were kept high. The backcourt became a focal point for the community and is now widley used by schools, walking tours etc.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - renaturation activities	
22	Beam Parklands	London United Kingdom (England)	The area located in floodplain of the River Beam, a tributary of the River Thames was improved and generally enhanced with the primary function of flood defence. Alongside the Environment Agency's flood defence improvement works an attractive multifunctional community asset was created and opened up to the public in 2011.	Improving urban environment benefits of green space - biodiversity conservation and enhancement, - general attractiveness of local area/neighbourhood, - flood management measures	

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
23	Falkirk Greenspace Initiative	Glasgow United Kingdom (Scotland)	The Falkirk Greenspace Initiative has been delivered over a 20 year timescale. A mosaic of woodlands and other habitats and a network of paths have delivered transformational landscape change to the urban fringe providing a coherent setting for major recreational and tourism development and community-led projects. Falkirk Council and Central Scotland Forest Trust (now CSGNT), and their partners, have created a resource which has improved the quality of life for local people, significantly increased the attractiveness of the area to visitors and for inward investment, and enhanced the natural and cultural heritage value of the area.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - Creating community woodland and address poorly performing greenbelt and urban fringe areas, - biodiversity conservation and enhancement	Enabling social equity and environmental justice - creating barrier-free environments accessible to all, - mitigating detrimental impact of post industrial landscape, - adding quality features in disadvantaged urban areas
24	Canvey Wick nature reserve	Essex United Kingdom (England)	Canvey Wick, a former a landfill site and proposed oil refinery, was was transformed into a nature reserve which was officially opened to the public in 2014. In the course of this measure, habitats for rare and endangered invertebrates, were enhanced. It is now a successful public amenity, used by the local community for walking, wildlife watching, horse riding and dog walking.	Improving urban environment benefits of green space - biodiversity conservation and enhancement, - general attractiveness of local area/neighbourhood	
25	Mátyás square renewal	Budapest Hungary	The GreenKeys project was realized in the 8th district of Budapest called Józsefváros included the renewal of Mátyás square which is a central public space within one of the most deprived neigh-bourhood of Budapest. The public space rehabilitation was a pillar of the neighbourhood-oriented urban regeneration programme. The main result of pilot urban green space intervention was a redeveloped and well-maintained public park with new community functions: covered space for public events; improved green surface; larger playground; new public furniture made by recycled materials; public buildings (for toilettes as well as for park guards). The surrounding public areas were also renewed in order to complete the green space interventions.	Enabling social equity and environmental justice - providing more equal access to green spaces to disadvantaged population groups, - adding quality features in disadvantaged urban areas, - providing spaces for social interaction and exchange	Promoting active lifestyle and behaviour - more time spent outdoors in general; - changing the using of public space

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
26	Bornova Asik Veysel Recreation Area Project	Izmir Turkey	Designed and implemented to create attraction centres across the city, for city citizens to attend culture-art activities, areas to play sports and rest. It is provided for city citizens to participate in sports activities with the bicycle road and outdoor sports equipments taking place in the area. At the same time a new sports activity centre was gained for the city with a Olympic ice-skating rink. The concerts, theatre etc. cultural activities arranged in the assembled amphitheatre have created an important activity area contributing to city culture. With the artificial lake and wooded areas created in recreation area, city citizens may relax in air-conditioned viewing terraces and resting areas.	Improving urban environment benefits of green space - renaturation activities; - biodiversity conservation and enhancement; - flood management (control measures)	Promoting active lifestyle and behaviour - more time spent outdoors in general - promotion of leisure and play
27	Open All Hours	Cardiff United Kingdom (Wales)	In Wales, school grounds offer neutral space that provides opportunities for outdoor play. Play Wales, the NGO for children's play developed a toolkit for school communities and their partners to make school grounds available for children's play out of teaching hours. Evidence suggests that school grounds across Wales are underutilized and not accessed by children for playing. The use of school grounds for playing out of teaching hours toolkit is designed to help local organizations and school communities to work together to consider making school grounds available to local children out of teaching hours. Play Wales worked with the Education and Early Childhood Studies team at Cardiff Metropolitan University and the School of Social Sciences at Cardiff University to research and pilot the toolkit in three schools. We evaluated the effectiveness of the tools, and identified the impact on children, schools and the wider community. The pilot findings informed a new edition of the toolkit.	Enabling social equity and environmental justice - providing more equal access to green spaces to disadvantaged population groups, - providing spaces for social interaction and exchange, - Children accessing their right to play	

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
28	Possil Health and Community Care Centre	Glasgow United Kingdom (Scotland)	Street trees /public realm to connect care centre entrance to garden /play space/urban gym and community growing space	Promoting active lifestyle - promotion of gardening, more time spent outdoors in general	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - biodiversity conservation and enhancement, - reduction of air pollution
29	Making space in Dalston	London United Kingdom (England)	Making Space in Dalston is a design led example of deliberative planning; the process of constant feedback between thinking and doing, where partners prefer to get their hands dirty in collaboration with local people rather than spending money on reports or subscribing to conventional top-down approach typical of the masterplanning process. By involving local people in decision-making, it allowed local partners to take ownership of the projects, discuss governance and evolve together the mechanisms for future sustainability. Each project responded to particular needs. Some were permanent, some temporary, and others 'meantime' projects or test beds for the experimental use of space awaiting development negotiated through a meanwhile lease.	Improving urban environment benefits of green space - renaturation activities, - general attractiveness of local area/neighbourhood, - learning through doing	
30	Woodland Health for Youth	Plymouth United Kingdom (England)	The Woodland Health for Youth (WHY) project focused on children who undertook lessons across a range of curriculum subjects within their local woodland with the purpose of stimulating their engagement in learning as part of the Natural Connections Demonstration Project. The pedagogy employed encouraged active experiential learning. Children's indoor and outdoor activity throughout the school day was measured by using accelerometers and moderate and vigourous physical activity levels compared in indoor lessons, breaktimes and outdoor learning sessions.	Promoting active lifestyle - more time spent outdoors in general, - equalising physical activity at school	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
31	Moved by Nature	Kuopio Finland	Interventions for increasing the use of natural environments in health promotion and improving the access to and the quality of natural environment and better collaboration between health, well-being, tourism, and nature sectors with a mutual aim "health promotion". Therefore, services to improve health and well-being of population groups at highest health risk, such as new immigrants, overweight men at risk of type 2 diabetes, youth and long-term unemployed at risk of social exclusion were developed outdoor events for encouraging urban citizens to visit e.g. Puijo nature protection and recreation area were promoted. A school model to utilize urban green space to improve social coherence and to prevent school drop-out and social exclusion was developed.	Promoting active lifestyle - Improved well-being through active engagement with natural environment - promotion of walking/cycling	Improving urban environment benefits of green space - Enhancing the use of urban green space in promotion of health and well-being - biodiversity conservation and enhancement
32	Rouken Glen Park	Giffnock United Kingdom (Scotland)	The project was divided in to five key areas. They were; Refurbishment of the Pavilion; New Walkway and Path network; Refurbished Play Area; New Filtration System in the boating pond and The Walled Garden landscape project. A consultant was appointed to set out and oversee the physical project which included the above sites. A Council Officer managed the project on behalf of the Parks Section. Many Parks staff were involved from the outset through to completion of the project, using their experience and knowledge in horticulture, arboriculture, play, construction and their knowledge of the park etc. The park can now be considered as a visitor attraction which caters for and accommodates various attractions and activities without losing its primary function but continues to offer excellent outdoor free green space for all to enjoy.	Improving urban environment benefits of green space - biodiversity conservation and enhancement, - renaturation activities, - general attractiveness of local area/neighbourhood	

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
33	Soil remediation	Chapaevsk Russian Federation	Soil of 10 streets (Zaporozhskaya, Rabochaya, Yaroslavskaya, Krasnoarmeyskaya, Artilleriyskaya, Kuybyshev, Meditsinskaya, Karl Marks, Vokzalnaya, Zheleznodoroghnaya streets) strand one public park around medical hospital was remediated. Remediation included elimination of upper layer of soil; substitution of soil by fat and clear soil; lawn grass and tree planting preceded the change/reconstruction of sidewalks, roadway, and water supply. In total 34.6 hectares of soil were remediated.	Reducing health impacts - Decrease of contamination of environment and people exposure to toxic chemicals, including organochlorines (pesticides, dioxins and PCBs) and metals - reducing/preventing diseases	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, reduction of air pollution, - biodiversity conservation and enhancement
34	Connswater Community Greenway	Belfast United Kingdom (Northern Ireland)	Developments along the CCG include: A 9km linear park for walking and cycling, 16km of foot and cycle paths, 26 new or improved bridges and crossings, Cleaning up of 5 km of rivers, Creation of hubs for education, interpretation points and tourism and heritage trails, Creation of a new civic square for celebrations and events, Providing a wildlife corridor from Belfast Lough to the Castlereagh Hills.	Enabling social equity and environmental justice - providing more equal access to green spaces to disadvantaged population groups - adding quality features in disadvantaged urban areas, - providing spaces for social interaction and exchange	Promoting active lifestyle and behavior - promotion of walking/cycling, - more time spent outdoors in general
35	The Green Path	Copenhagen Denmark	Transforming an old train track into a path for bikes and pedestrians through the central parts of the city, tie Frederiksberg and Copenhagen together. Creating an urban space for the citizens with playgrounds along the path.	Promoting active lifestyle - promotion of walking/cycling, - promotion of leisure and play	
36	Faelledpar-ken	Copenhagen Denmark	The renovation of the park included a wide range of interventions that promote health and physical activity by 3,5 km of walking and running tracks, 3 new playgrounds for children and adults, fitness equipments, a scate park, a football field and a dance scene.	Promoting active lifestyle - more time spent outdoors in general, - promotion of leisure and play	
37	Green Screens Trial Project	Birmingham United Kingdom (England)	Bristol Street Birmingham is a dual carriageway with a wide grassed central reservation along which runs almost continuously a metal highway pedestrian guardrail. This project involved fitting green vegetated screens to 141 metres of existing guardrailing. The idea for the trial project was initiated in 2014 and the green screens were installed in 2015. As well as considerably improving the	Reducing health impacts - reducing/preventing diseases, - promoting well-being and mental state	Improving urban environment benefits of green space - reduction of air pollution

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
			visual appearance of the street, another aspect of this project was to test if air quality benefits could be achieved. Staffordshire University monitored the amount of particulate matter intercepted by the green screens following installation.		
38	Campen Active Spaces	London United Kingdom (England)	Commissioned by the council, Camden Active Spaces is a pilot project to address the borough's childhood obesity rates, which are amongst the worst in London. The design team worked with seven schools to design physically challenging and imaginatively designed play spaces for a range of age groups from infants to secondary school age. The facilities are also intended for use beyond the school hours by the local community. Concurrently, University of London conducted a study to monitor the Body Mass Index of students and to test their activity levels through use of actigraph belts over set periods of time.	Promoting active lifestyle - promotion of leisure and play, - more time spent outdoors in general	Enabling social equity and environmental justice - providing more equal access to green spaces to disadvantaged population groups - reducing cultural barriers especially for girls from ethnic backgrounds to be allowed to actively use the outdoors
39	Edible City Andernach	Germany Andernach	Implementation of measures on sustainable local green space management to equally integrate ecological, economic and social aspects on a common approach on green spaces. Urban agriculture was integrated in the municipal green spaces by planting vegetables, herbs and fruits in public green spaces which can be accessed by the public and where all citizens can harvest the agricultural products. Combined with a 14ha periurban permaculture area and various promotion activities, the city aims at promoting and developing public green spaces in a creative and sustainable way and for the benefit of urban biodiversity.	Improving urban environment benefits of green space - biodiversity conservation and enhancement, - local supply of healthy food, general attractiveness of local area/neighbourhood	Enabling social equity and environmental justice - Access to healthy food for all social status groups, - providing spaces for social interaction and exchange, - adding quality features in disadvantaged urban areas
40	InPeLa (Intercultural perma-culture gardening)	Germany Hamburg	Garden plot (for free) for residents to enable intercultural and multigenerational gardening activities (private garden beds as well as communal garden beds), workshops, meetings and social exchange and to foster participation in further neighbourhood activities	Promoting active lifestyle - promotion of gardening, - more time spent outdoors in general	

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
41	Sustainable Landscaping	Israel Kfar Saba	Under the policy of holistic management of natural resources in the city, and in an overall approach viewing the city as a whole, the key measures made were: cessation of use of chemical pesticides and treatment of weeds, the use of plant species adapted to the conditions of the region, minimizing the ongoing maintenance of public green space, connectivity between natural sites and the use of ground prune for mulching soil.	Improving urban environment benefits of green space biodiversity conservation and enhancement, general attractiveness of local area/neighbourhood	Reducing health impacts improving quality of life in general, reducing/preventing diseases
42	Pallas Park	Germany Berlin	The PallasPark project was initiated by the conversion of a parking lot into a public park in 2000. In a second phase, the park was further developed and its quality improved in 2010 and 2014. This resulted in a public green space with play areas for children, sports amenities (basketball court, table tennis table, chess board) and a pavilion. In addition to the physical changes, various sociocultural events in the park were supported. Intercultural gardens for the residents were established, cultural events hosted, and a network established. PallasPark now is known as a space for community life, culture and residential action, and especially urban gardening. In 2014, a club of local gardeners was established which now has taken over the responsibility of the garden section. The gardening space was further expanded in 2015 with new project partners.	Enabling social equity and environmental justice - adding quality features in disadvantaged urban areas, - providing spaces for social interaction and exchange, - providing more equal access to green spaces to disadvantaged population groups	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - renaturation activities
43	100 years city park Hamburg	Germany Hamburg	Restoration of paddling pool and park paths, development of an orientation system, building a new garden of senses, public relation, international Stadtpark congress, issuing of books	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - biodiversity conservation, - renaturation activities	Improving urban environment benefits of green space Jubilee “Hundert Jahre Stadtpark” => Restoration of the site to protect the green monument for further years
44	Play area planning (“Spielleit-planung”)	Germany Oppenheim	Establishment of an area development plan for the provision of sufficient and suitable play, adventure and public areas. A baseline assessment was made for identifying the potential of play, adventure and community use areas. Planners and social workers discussed existing and future structures. Planning of the	Improving urban environment benefits of green space - protecting diverse play, adventure and community use areas in local development planning, securing	

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
			recreational area with the participation of future users; identification of barriers and risks of spatial structures (traffic areas and streets). For example, various small green spaces have been merged to form a larger natural play area (Traumgarten), a garden plot was redesigned into a public natural playground, a network of school paths was established and signed out for increased safety and a public park was developed into an adventure park with special play elements (such as an old ship and creative sitting areas).	quality access for the population, securing regular maintenance., achieving climate benefits.	
45	Nature playground Paradise	Germany Oppenheim	Establishment of a nature-like park and play area on former agricultural land (2 ha) for self-determined use of nature, wilderness and natural materials as main components. The green area care is like an intensely used garden. Planning based on health criteria, participation in planning and implementation, common actions in the park area, public relation through media, confirmation of municipal liability insurance coverage for the park area, improvement of municipal capacities for green space management of wilderness areas.	Reducing health impacts - improving quality of life in general, - personal development by residents (mainly kids) using the area	Improving urban environment benefits of green space - biodiversity conservation and enhancement, - mitigation of heat waves, - general protection of nature and climate
46	Travertin-park	Germany Stuttgart	Transformation of a former stone quarry into a nature reserve. Quarry and surrounding area made accessible to public while preserving historic heritage and also living environment for protected species (common wall lizard, sand lizard, wild bees).	Promoting active lifestyle - more time spent outdoors in general - creation of recreational area for the inhabitants	Improving urban environment benefits of green space - biodiversity conservation and enhancement - Creation of preserved area for protected species
47	Parque Ribeiro do Matadouro	Portugal Santo Tirso	The park was developed in an area of 1.5 hectares along the Matadouro stream, within the urban fabric of the city of Santo Tirso on agricultural abandoned land and a former municipal plant nursery. This project was an opportunity to transform a “non-place” into a space of increased value for the social, urban and natural environment of the city. Using local culture, ecology and tradition as guidelines, together with sustainable and integrated design	Improving urban environment benefits of green space - renaturation activities, - biodiversity conservation and enhancement, - flood management (control measures)	Promoting active lifestyle and behaviour - more time spent outdoors in general, - promotion of walking/cycling

No	Title	City/ country	Intervention description	Primary objective and expected outcomes	Secondary objective and expected outcomes
			methods, an urban park emerged, reviving the sites natural/urban identity. The park was implemented in a flooded area. Natural vegetation is preserved and enhanced through the incorporation of riparian vegetation along the river, but also oaks and other autochthonous plants. The area has different types of spaces that allow several activities like walking and cycling and incorporates interactive structures to enhance information about the space.		
48	Green structure acquisition and facilitation project "52 everyday walks"	Norway Stavanger	The Land Use Masterplan approved in 1965, introduced a continuous green structure. In the 90ies the objectives were enhanced: "Every inhabitant shall have access to the continuous green trail system within 500m from their home". In 2001 a project was launched to make all the Master Plan's green spaces public accessible. Both economical and legal measures were adopted. Compulsory acquisition was used, and substantial compensations were given: building of stone walls, moving of boathouses, building of piers etc. In 2005 approx. 25% of the inhabitants had access to the green trail system within 500m, today 98%. It was still a challenge to inspire people to use the new green opportunities. 52 Everyday Walks were launched in 2012 with an average length of 8 km. Descriptions and maps made available on the web, and path markings were the main measures.	Improving urban environment benefits of green space - general attractiveness of local area/neighbourhood, - accessibility to nature/green trails and establishment of a closed green infrastructure network	Promoting active lifestyle and behaviour - promotion of leisure and play, - promotion of walking/cycling

Annex 2 – Overview of follow-up interviews

No.	Intervention Title	Intervention Location	Interviewee	Organization
1	Pärnu Riverside Reopening project	Pärnu, Estonia	Katrin Alliku	Pärnu City Government
7	Edible Playgrounds	Multiple locations, England	Kate Sheldon	Trees for Cities
8	Hüdavendigar City Garden	Bursa, Turkey	Nalan Fidan	Bursa Metropolitan Municipality
9	Woods in and Around Towns	Multiple locations, Scotland	Catharine Ward Thompson	University of Edinburgh
11	Active England Woodlands Project	Multiple locations, England	Liz O'Brien	Forest Research
17	Port Sunlight River Park	Wirral, North West England	Alison Whitehead	The Land Trust
18	Stepping Stones to Nature	Plymouth, England	Zoe Sydenham	Plymouth City Council
22	Beam Parklands	London, England	Jonathan Ducker	The Land Trust
23	Falkirk Greenspace Initiative	Falkirk, Scotland	Sue Evans and Stephen Hughes	Central Scotland Forest Trust (now CSGNT)
25	GreenKeys Mátyás Square Project	Budapest, Hungary	György Alföldi	Józsefváros Plc.
34	Connswater Community Greenway	Belfast, Northern Ireland	Mark Tully and Deepti Adlakha	Queen's University Belfast
37	Bristol Street Green Screens Trial Project	Birmingham, England	Chris Rance	Atkins
42	Pallas Park	Berlin, Germany	Alexander Meyer	Quartiers-management Schöneberger Norden
47	Parque Ribeiro do Matadouro	Santo Tirso, Portugal	Andreia Quintas	Universidade Fernando Pessoa
48	Green structure acquisition and facilitation project and 52 Everyday Walks	Stavanger, Norway	Torgeir Esig Soerensen	City of Stavanger

Appendix 3:
The role of impact assessments
(HIA, EIA and SEA) in urban green space interventions for health

The role of impact assessments (HIA, EIA and SEA) in urban green space interventions for health

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Rationale: Health Impact Assessment and Environmental Impact Assessment is an important component of spatial planning and helps to identify and avoid negative impacts in planning stage. Yet, little information is available on the implementation and the impacts of such impact assessments in relation to urban green space planning.

Objectives: To identify and evaluate Health Impact Assessment and Environmental Impact Assessment projects that can be considered good practice examples for the consideration of green space and its linkages with/impacts on human health.

Methods: Web searches were conducted to identify potentially suitable Impact Assessment projects. Furthermore, a WHO database on impact assessment projects was reviewed and impact assessment experts were contacted to provide information on relevant projects. Overall, 26 impact assessment projects were identified and 12 of those projects were selected for detailed review.

Results: It proved difficult to ascertain the influence of the evaluated Impact Assessment projects with regards to health and well-being improvements, owing to the lack of available evidence of subsequent monitoring and evaluation of the consideration and uptake of assessment recommendations. Plans or projects that focused on green space development tended to make explicit connections with health while for other projects – with green space not being a central component – the connections between green space and health was less strong and mostly implicit.

Assessment-related findings did not directly alter the contents of the plan or policy, but recommendations around aspects such as community engagement and partnership working were adopted. Also, the assessment projects raised awareness for and promoted consideration of health and well-being within project decision-making, and the assessment process often provided a basis for establishing working relationships between sectors.

Conclusions: The Impact Assessment projects studied in this review did not make the most of the methodologies that are available for developing evidence and for monitoring them. This may be attributed partly to the fact that the effects of interventions are not usually evident in the short run. However, continuous long term monitoring (e.g. over a decade) would in most cases be difficult to secure.

CONTENTS

List of Tables and Boxes

Abbreviations

CCG	Connswater Community Greenway
EA	environmental assessment
EELDS	Local Development Strategy for the East End
EIA	Environmental Impact Assessment
ENCHIA	Eastern Neighbourhoods Community Health Impact Assessment
EU	European Union
HDMT	Healthy Development Management Tool
HIA	Health Impact Assessment
HIS	Health Impact Statement
IA	impact assessment
LTP	Local Transport Plan
NHS	National Health Service
PHAZ	Plymouth Health Action Zone
PPPP	policies, plans, programmes and projects
SDG	Sustainable Development Goals
SEA	Strategic Environmental Assessment
UGS	urban green space
USA	United States of America
WHO	World Health Organization
WRGP	West Rhyl Green Space Project

1 Introduction

It is now commonly accepted that urban green space can have beneficial impacts on human health, including physical/environmental as well as other, such as social/psychological, dimensions. As a consequence, pursuing improved health and well-being outcomes through urban green space (UGS) interventions (either direct interventions or more indirectly, through e.g. inclusion in other policies, plans, programmes or projects) has attracted increasing attention in recent years. There is now widespread support for proposals that seek to increase the provision and usage of green space within urban settings. These proposals are typically underpinned by the belief that green spaces can help address many of the public health challenges faced by towns and cities – lifestyle risks, such as excessive weight and physical inactivity; urban stress and mental health conditions; climatic risk factors, such as air pollution and urban heat islands; among others (see Appendices 3 and 4). The importance of greenspace for health and well-being has also been championed within several recent international declarations and development goals.

In the Parma Declaration on Environment and Health, 2010, ensuring access to greenspace was incorporated under the aim of providing '*…each child with access […] to green spaces in which to play and undertake physical activity'* (Goal 2, part iv). This is by now further supported in the 2015 Sustainable Development Goals (SDGs), with SDG 11.7 reading to *'…provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities'*. Finally, greenspace is embedded within the World Health Organization's (WHO) Health 2020 policy framework under the priority area of creating *'supportive environments and resilient communities'*.

In this background working paper, we will look at evidence for how the health role of urban green space is considered and supported in planning interventions through two types of impact assessment: health impact assessment (HIA), as well as environmental assessment (EA), including strategic environmental assessment (SEA) of policies, plans and programmes, and environmental impact assessment (EIA) of projects. Whilst HIA is an important public health instrument, to date it has usually remained a non-statutory, voluntary exercise (see e.g. O'Mullane, 2013). In the European Union (EU), SEA and EIA are statutory instruments that need to be formally applied in many plan, programme and project situations. Whilst SEA has been formally required to consider human health for over a decade, based on the SEA Directive 42/2001/EC (Fischer et al, 2010), to date, EIA has been asked to assess impacts on human well-being, based on Directive 85/337/EC. The revised EIA Directive (2014/52/EU), which will need to be transposed by EU Member States by May 2017 is now also explicitly asking for the assessment of impacts on human health (Fischer et al, 2016).

The design, development and planning of UGS interventions invariably requires that a process of decision-making be entered into. It is here then, within this decision-making process, that the nature of the intervention, its target audience, and its intended outcomes are decided upon. Here scope also exists for assessing what the health impacts of the prospective intervention are, with this typically being achieved through the performance of an impact assessment (IA).

Subsequently, first a literature review on the connections of green space and health and the role of IA will be presented. This is followed by a review of 12 HIA, SEA and EIA good practice cases on the consideration of green space interventions and the connections made with health in that context. A discussion of the results is provided and finally, conclusions are drawn and recommendations for improving practice are given. Two appendices are provided; one which presents results from an online survey on green space intervention plans and interviews with those involved in associated IA and one which lists the completed templates from the case studies.

2 Green space and health

Within Europe, an estimated 73% of people live in urban areas (United Nations 2015). From a health point of view, this is significant for many reasons, not least because the urban environment is a major determinant of human health and well-being (van Kamp et al, 2003). Indeed, evidence now exists to support the link between environmental exposure and urban health outcomes. For example, studies have found that people living in lower quality environments typically tend to experience worse health outcomes than those living in higher quality environments (Kjellstrom et al. 2007; Croucher et al. 2007; Australian Institute of Health and Welfare 2011). This is often interdependent with a low socioeconomic status and the link between the urban environment and health outcomes is not straightforward. Rather, the complex composition of the urban environment creates multiple mechanisms and pathways through which health and well-being can be affected, on the one hand through the environment and on the other through specific social determinants of health.

Determinants of health are broad in scope, echoing the holistic view of health set out by the WHO – '*that health is a state of complete physical, mental and social well-being and not merely the absence of disease of infirmity*' (World Health Organization 1946). This understanding of health adopts a socio-ecological framework, one which emphasizes that human behaviour (including health behaviours) is influenced by multiple socio-physical factors (Sallis et al 2008). Given that green spaces form part of the wider urban environment, they have become increasingly hypothesised as being influential in the determination of urban health and well-being (de Vries et al 2003).

There is a growing body of research which is looking at the link between green space and health and well-being. These have led to a number of important findings, for example a lower adjusted mortality rates in neighbourhoods with higher levels of green space provision (Mitchell and Popham 2008, Villeneuve et al 2012). Accessible green space, coupled with involvement in local community activities, has also been linked to longevity among senior citizens in densely populated urban areas (Takano et al 2002). More generally, populations exposed to living environments high in accessible green space have been shown to have lower overall rates of disease (Maas et al 2009, Richardson et al 2013), and disease related mortality (Gascon et al 2016).

Green spaces have been hypothesised as providing multiple 'direct' and also more subtle outcomes that can then positively influence health and well-being. More generally, neighbourhood green space has been linked to greater levels of physical activity and its associated health benefits (Morris 2003, Mytton et al 2012, Natural England 2011, Sanders et al 2015, Toftager et al 2011). Findings from a number of studies looking at obesity levels have also pointed to proximity to green space being linked to higher physical activity levels and lower risks of obesity (Ellaway et al 2005, Natural England 2011, Toftager et al 2011).

While physical health may appear a more readily observable benefit of green space, stronger evidence tends to exist around the links between green spaces and mental aspects (van den Berg and van den Berg 2015, Gascon et al 2015, de Vries 2010). Green spaces have been identified as having the ability to serve as a buffer against the detrimental impacts of lifestyle stresses, with health benefits being mediated through the process of stress reduction (van den Berg et al 2010, Grahn and Stigsdotter 2003, Thompson et al 2012) – this being more pronounced for more deprived communities (Kuo 2001, McEachan et al 2016).

The provision of green space can also provide a regulatory role in mitigating against the potential health damaging effects of numerous climatic factors. In a recent meta-analysis, all types of green space were found to be associated with some form of relief from heat stress, urban heat islands and air pollution reductions (Zupancic et al 2015). Studies employing modelling techniques have also been able to demonstrate that urban trees have the potential to remove significant sums of air pollution, consequently leading to air quality improvements (Nowak et al 2006, Selmi et al 2016). There is also moderate evidence to support the assumption that vegetation can reduce the negative perceptions of noise (Dzhambov and Dimitrova 2014), and green space can play an important role in urban water management and purification (Zhang et al 2015).

Although there is now growing evidence which links green spaces and health, our understanding of the mechanism and pathways through which green spaces influence health outcomes remains partial. This has been found to be particularly the case when examining the role of green spaces as venues for physical activity, especially in relation to establishing causal relationships and disentangling the green space influence from that of individual characteristics and other social factors (Greenspace Scotland 2007, Mytton et al 2012). Other studies have found little evidence to support the hypothesised green space-physical activity synergy (Ambrey 2016, Hillsdon et al 2006).

Green spaces have been identified as having the ability to contribute to key urban agendas, such as health and well-being, social inclusion, sustainability and urban renewal (Swanwick et al 2003). From a decision-making perspective, however, it is important to recognize that green space strategies can potentially have a paradoxical dimension. That is while they can help address issues around such things as environmental justice and health and well-being, they may also expose people to health detrimental factors. This includes green space being a source of exposure to factors such as air pollution particularly when located near to heavy trafficked road (Carlisle and Sharp 2001) and disease vectors and zoonotic infections, of which Lyme disease is

a leading concern across Europe (Medlock and Leach 2015). Furthermore, there is potential for increased allergenic reaction depending on the vegetation used (Dadvand et al 2014, Lovasi et al 2013). Another key area of consideration is that through improving a neighbourhood's environmental quality it is possible that a green space strategy may lead to neighbourhood gentrification. This, in turn, may lead to the displacement of the very residents that the green space strategy was originally intended to benefit (Wolch et al 2014).

Such studies further illustrate the broadness of the issues tied to UGS intervention are. They also strengthen the case for why it is important that prospective green space interventions are subject to an assessment of the potential health impacts (both positive and negative). Whilst there can be different reasons for negative impacts, there are a few that can be avoided through effective planning and management, e.g. adequate lighting, safe playgrounds for children and general maintenance.

3 Establishing the boundaries of the working paper

Part 3 consists of two sections. First, a review of documents linking green space and health and labelled as HIA across several countries is conducted. Based on this, the type of HIA considered for this report is explained. Subsequently, the role of SEA and EIA for urban green space interventions and health is explored.

3.1 HIA

A review of a range of documents from different countries that link green space development and health and that are labelled as HIA was conducted at the outset of the study underlying this working paper. This established that the term HIA is used for a range of applications, representing a number of very different approaches. This is similar to what has been observed for other impact assessment instruments, with particular labels not necessarily matching accepted definitions of instruments (Fischer and Onyango, 2012).

Whilst all approaches can have an impact on health in connection with green space development, the conclusions to be drawn and recommendations to be given for supporting more healthy developments depend on the specific approach taken. Before starting to evaluate HIAs with regards to the impact of urban green space interventions, it is important to establish a typology, allowing to look at practice in a context specific way. Any conclusions and recommendations need to take the specific context and approach of HIA into account. Most definitions of HIA revolve around it being a:

> '*means of assessing the health impacts of policies, plans and projects in diverse economic sectors [e.g. transport, agriculture or housing], using quantitative, qualitative and participatory techniques'* (http://www.who.int/hia/en/).

It is commonly understood as an ex-ante assessment tool, i.e. impacts are anticipated and, if necessary mitigated or enhanced before development is implemented. At times it is also said that

it is mainly the '*unintended effects*' HIA should be focusing on (DH, 2010; Orenstein, 2012). In practice, however, the term is used for a range of assessments that may differ from the definition above, as follows:

1. Assessments of products, e.g. artificial turf (Toronto Public Health, 2015).
2. Promotional ('problem driven') guidelines for how 'healthy development' may be supported and/or health and well-being through the enhanced usage of green spaces be promoted, e.g. with regards to tackling obesity (South Carolina Institute of Medicine and Public Health, 2013), regeneration (Limerick Regeneration Agencies, 2008) or [in]adequate housing (Curry County, 2012), Nature Walks for Well-being; Active England Woodland Park England; South Edinburgh Healthy Lifestyles).
3. Toolkits for establishing health impacts of interventions (San Francisco Department of Public Health, 2007)
4. Ex-post healthy development optimization support studies for planned projects that already have obtained development consent (Gobierno Vasco, 2009)
5. Ex-ante HIAs applied in policy, plan, programme and project making processes, leading towards development consent (or equivalent), at times in the context of SEA and EIA or in parallel to them; with regards to green space, two types of HIA can be distinguished:
   a. HIA for green space initiatives, policies, plans, programmes or projects (Bristol City Council, 2013; Ison, 2007; see also Richardson et al, 2012)
   b. HIAs for other sectors' policies, plans, programmes and projects, e.g. spatial/land use (CQGRD, 2012), transport (Swedish National Institute of Public Health, 2005), energy (Buroni, 2007) or waste (Simpson, 2005). These can be applied from within the underlying policies, plans, programmes and projects (PPPP) process (e.g. by a responsible authority), but also from outside that process (e.g. by an external organization) and may raise important UGS issues.

Table 1 provides a summary of the documents that label themselves as HIA, and provides a typology based on their characteristics.

Table 1. Different types of documents which label themselves as HIA

HIA type	Example	Summary
HIA type 1: Assessment of products	Toronto Public Health, 2015	HIA undertaken to gain a more complete understanding of the health concerns related to the use of artificial turf in Toronto given its increasing use
HIA type 2: Guidelines	South Carolina Institute of Medicine and Public Health, 2013	Establishing recommendations for the development of parks with regards to physical activity, social cohesion/capital, community and family economic stability, food access, individual and community safety, air and water quality
HIA type 3: Toolkits	San Francisco Department of	Rezoning options for the Eastern Neighbourhood in San Francisco required application of EIA. The planning

	Public Health, 2007	department was not prepared to include economic and social aspects in that, and as a consequence the San Francisco Department of Public Health decided to conduct an HIA. The main outcome of this was an online HIA toolkit that can be used to assess planned developments
HIA type 4: Ex-post HIA for developments with planning consent	Gobierno Vasco, 2009	Optimising health benefits of a number of planned projects, including (a) a new access road; (b) vehicle access; (c) the construction of a new park and the redevelopment of a quarter/neighbourhood; (d) the construction of two lifts, connecting two neighbourhoods along a hill; (e) the burying of four medium and high voltage power lines, and (f) a new rainwater collection network
HIA type 5a: Ex-ante HIA, applied to a GS PPPP from outside preparation process	Bristol City Council, 2013	Preparation of a masterplan, and hybrid planning application, for the Kingswear Road, Torpoint Road and Haldon Close Development Area (enhancements to the central public open space and demolition of the existing (empty) buildings near that space; provision of 71 residential units)
HIA type 5b: Ex-ante HIA, applied to a non GS PPPP	?	?

From the list, only the approaches reflected in points 5a and b closely reflect commonly used definitions of HIA, and to a lesser extent (if dropping the ex-ante part) also the approach reflected in point 4.

We do not suggest that all these documents should be classed as HIA. However, the table shows how the term is applied in practice which deviates from its original definition. Furthermore, the table also suggests that using the lens of IA for linking green space and health is challenging as we were not able to identify a good practice category 5b HIA case for green space interventions. Therefore, subsequently, we will also use two examples from approaches 2 and 3. In these cases there were no requirement to consider health in planning, but various benefits were said to arise from the approaches.

There are various research studies and reports on health impacts of green space (e.g. Greenspace Scotland, 2007). Whilst at times, these are also (inappropriately) called HIA their main aim is usually to generate evidence for impacts on health. This can be generic, looking at a range of different health effects that are all served by green space development (Lee and Maheswaran, 2010). It can also be specific, looking at e.g. the connection between green space development and mental health (Beyer et al, 2014; Sturm and Cohen, 2014).

3.2 EIA and SEA

Both, EIA of projects and SEA of policies, plans and programmes have their origins in public health. In many countries and systems they were developed on the basis of physical environmental issues and problems that had negative health implications, including environmental pollution and associated poor water and air quality. EIA and SEA are ex-ante assessment instruments that aim at assessing the potential significant negative, along with any positive environmental effects of policies, plans, programmes and projects (PPPPs) that are under preparation. SEA and EIA are pro-active rather than reactive in that they seek to influence the way PPPPs look like. The consideration of different alternatives to achieve stated aims/objectives is at the heart of environmental assessments (EA).

When EA (initially no distinction was made between SEA and EIA) was initially designed in the 1969 National Environmental Policy Act (NEPA) of the United States of America (USA), environmental issues with relevance for health to be considered in EA were largely thought of in terms of biophysical components. However, over recent years this has changed and many EA advocates now acknowledge the need to also consider social aspect, including e.g. employment, education, poverty, crime rates, affordable housing and others (Fischer, 2014).

SEA is now routinely applied in urban/town plan and programme making processes in over 50 countries globally (including the 28 EU Member States). Within this context, an important rationale for its application is the support of liveable and healthy urban environments. This means putting forward ideas to develop green and blue urban infrastructures and spaces are key components of SEA. This is usually justified with positive implications for issues such as air quality, climatic effects (heat island), noise reduction, biodiversity conservation and enhancement, flood management, physical activity, social cohesion, attractiveness of local area, mental health and others (following e.g. Institute for European Environmental Policy, 2016).

With regards to the health effects of interventions, the question to be addressed in SEA is not just whether there are green spaces that are affected and/or to be developed. Rather, the size and type of green space intervention and the management of green space (including e.g. the use of pesticides) are important. Furthermore, the distance of green spaces from those that are supposed to benefit from them (i.e. local populations) need to be considered (Cvejić et al, 2015). In order to establish benefits from green spaces, applying the concept of ecosystem services may be particularly useful (Bolund and Hunhammar, 1999).

4 Review methodology

The review methodology underlying this paper was devised having one overall objective in mind, namely, '*to identify and evaluate HIAs, EIAs and SEAs that can be considered good practice examples for the consideration of green space and its linkages with/impacts on human health*'.

With regards to HIA, a wide range of examples were initially identified, however, many of them did not match the definition provided earlier in section 3 above. Therefore, these were not included (see Table 1 above).

Three main approaches were used to identify potentially suitable cases:

(1) Conducting web searches (mainly Google and Google Scholar), using the keywords 'Health Impact Assessment', 'Strategic Environmental Assessment', 'Environmental Impact Assessment', 'Green Spaces', 'Green Infrastructure', 'health'. About 20 different cases were identified, of which 6 were selected for inclusion in the study.
(2) Going through an HIA database, previously compiled by the WHO, European Regional Office. This was the basis for 5 cases which were included in the study.
(3) Contacting HIA/SEA/EIA and public health experts from 15 EU Member States. Only one case was identified that way (Vienna).

This being a project of the WHO European Regional Office, the emphasis was on European experiences. However, because the initial WHO search underlying the data base had identified a wide range of HIA examples from the United States of America (USA), the decision was taken to include two of these examples as a point of reference for European practices. The cases selected for further evaluation include:

1. HIA of the bid to the Big Lottery Funding for the Connswater Community Greenway in East Belfast, Northern Ireland, 2007 (project focused rapid appraisal);
2. Kingswear Road, Torpoint Road and Haldon Close Development Area HIA (Health Impact Statement), England, 2013 (master plan focused rapid appraisal);
3. West Rhyl Greenspace Project (WRGP) HIA, Wales, 2014 (project focused participatory rapid appraisal);
4. HIA of the draft East End Local Development Strategy entitled 'Changing Places: Changing Lives', Scotland, 2007 (policy focused participatory rapid appraisal);
5. A HIA concerning the Gardens for People project in Stonehouse Plymouth, England, 2002 (policy focused participatory rapid appraisal);
6. Eastern Neighbourhoods Community HIA (ENCHIA), United States, 2007 (problem driven HIA, analysing an existing situation and resulting in recommendations);
7. HIA of Atlanta Regional Plan 2040, United States, 2012 (problem driven HIA, analysing an existing situation and resulting in recommendations);
8. Landschaftsplan Göttingen and associated SEA for the Local Land Use Plan (Landschaftsplan und SUP des FNP Göttingen), Germany, 2015;

9. Gebiedsontwikkeling Brainport Park Eindhoven – Milieueffectrapport (Area Development Plan Brainport Park EIA), The Netherlands, 2015;
10. Vienna main railway station and associated EIA 'urban development' (Hauptbahnhof Wien, UVPs Städtebau, Bahn Infrastruktur und Strassenbau), Austria, 2008;
11. Glasgow City Plan 2 SEA, Scotland, 2009; and
12. Local Transport Plan Plymouth SEA, England, 2010.

Evaluation was done on the basis of a list of questions on the linkages of IA, green spaces and health that were compiled on the basis of the literature review presented above. Box 1 and Box 2 show the questions/parameters used for HIA and SEA/EIA.

Box 1. Questions for analysing HIAs with regard to whether any connections are made between green spaces and health and what parameters are used in this context

- What type of HIA is/was conducted (rapid/comprehensive)?
- What are the reasons for conducting HIA for green spaces policy/plan/programme/project?
- Who is conducting the Green spaces policy/plan/programme/project /intervention?
- Who is conducting the HIA?
- Which authority and department is in the lead and who else is involved/contributing?
- Baseline:
  - What health data are considered/used?
  - Are only existing data used or are data specifically collected?
  - What environmental/green spaces data are used?
  - Is a connection made between green space/environmental and health data?
- What justification/argument is provided for the green space PPPP/intervention?
- Assessment:
  - Physical aspects considered?
    - climatic function (urban heat island)
    - air pollution
    - noise
    - other…
  - Social aspects considered?
    - Specific target groups
    - Accessibility
    - Social cohesion overall
  - Mental health aspects?
  - Biodiversity?
  - Flood management?
  - Attractiveness of local area?
  - Stress reduction?
  - Physical activity?
  - Employment effects?
  - Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc., crime, accidents)
  - What methods are used (qualitative/quantitative); are impacts quantified? If so, how?
  - What health stakeholders are contributing to the assessment?

- Recommendations:
  - What aspects do the recommendations consider?
    - E.g. size of green space, land cover, sports areas, children's areas, gardens, presence of water, environmental quality/wildness, social quality (benches, lavatories, litter, dog and cat faeces)
  - To what extent is health considered in the recommendations of the green space PPPP/intervention?
  - What evidence underlies the recommendations given?
- To what extent has the HIA influenced decision-making? What exactly has changed as a result of the HIA?
- Ex-post evaluation
  - Is any monitoring/follow-up conducted?
  - Are any monitoring/follow-up reports prepared?
    - What do these focus on?
    - Has any evidence been generated and does this include any evaluation of the health effects of the green space PPPP/intervention?
      - Physical activity
      - Quality of life
      - Mental health
      - Disease reduction
      - Noise reduction
      - Climatic impacts
      - Air quality
      - Mortality
      - Social cohesion (who benefits; positive/negative effects)

Box 2: Questions for analysing SEAs and EIAs with regard to whether any connections are made between green spaces and health and what parameters are used in this context

- Are green spaces included in the assessment? If yes, in what way?
- Is human health explicitly considered in the assessment? If yes, in what way?
- Is a link made between green spaces and health? If yes, how:
  - Air quality
  - Climatic effects (heat island)
  - Noise reduction
  - Biodiversity conservation and enhancement
  - Flood management
  - Physical activity
  - Social cohesion
  - Attractiveness of local area
  - Mental health
  - Other…
- Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc.)

- What other links are explicitly made with health in the SEA/EIA?
  - Size of green space intervention
  - Green space within defined distances
  - Type of green space intervention (e.g. including water)
  - Management of green space (e.g. use of pesticides)
- Are ecosystem services mentioned? If yes:
  - Regulating services (climate regulation)
  - Provisioning services (generation of products)
  - Cultural services (non-material aspects e.g. heritage, social relations, security)
  - Other services

5 Reviewed IAs

In section 5, each of the reviewed IAs is introduced. In this context, the underlying policy, plan, programme or project is portrayed and the purpose of the IA is explained. Furthermore, the extent to which different parameters were considered in each assessment is outlined.

5.1 The Connswater Community Greenway (CCG) HIA

The Connswater Community Greenway (CCG) is an urban park project in East Belfast, United Kingdom of Great Britain and Northern Ireland. Developed by the East Belfast Partnership (EBP), the project is being delivered by Belfast City Council and is due to be completed by the end of 2016. The aim of the project is to deliver a 9 km linear park through East Belfast, which will then serve as a multifunctional space for education and learning, social and community interaction, transportation and connectivity, and other activities. In support of the preparation of the bid to the Big Lottery Fund for the CCG, Belfast Healthy Cities and the EBP commissioned a specialist practitioner to perform a HIA of the project proposal (final report published in 2007).

The purpose of the HIA was twofold – to identify the potential health and well-being impacts of the development, and to suggest ways in which to maximize the development's overall health gain. In addition, the HIA process also sought to introduce the concept of healthy urban planning to Belfast. Focusing on 17 key outputs of the proposal, this project-level HIA employed rapid appraisal techniques to qualitatively identify and assess potential pathways and outcomes to health and well-being. This included a desk-top appraisal (including a summary of relevant published literature), consultation with stakeholders at a participatory workshop, and supplementation of results through extraction of data from evaluation forms completed at an earlier project-related community consultation.

Although the HIA process used a rapid appraisal tool comprising selected health determinants, the assessment considers a range of socioeconomic and, to a much lesser degree, ecological health aspects. The HIA report also contains a range of stakeholder generated suggestions on how to maximize the health gain of the CCG, and an overview of entry points for how local and

regional agencies and organizations may become involved in and make use of the CCG, and assist in delivering positive health and well-being outcomes. While no formal monitoring of the uptake of the HIA recommendations was performed, it has been indicated that the HIA directly informed the CCG bid. This, in turn, closely informed the design and build, and other associated activities of the CCG development – e.g. emphasis on community engagement influenced the establishment of a community liaison officer post, and the HIA informed the development of the Physical Activity and the Rejuvenation of Connswater (PARC) research project.

5.2 Kingswear Road, Torpoint Road and Haldon Close Development Area Health Impact Statement

Work began on the preparation of the 'Proposed Plan for Knowle West' in 2009. Endorsed by Bristol City Council (Bristol, United Kingdom) in October 2012, the plan identified land at three sites as a potential development area for new homes and green space. An external consultancy, appointed by the local council and land owner, led on the preparation of the masterplan, and hybrid planning application, for the proposed development area. This included seeking permission to develop new homes, demolish existing (empty) buildings, and enhancements to the central public open space.

A formal HIA process was not performed in relation to the development proposal, a decision which appears to have been heavily influenced by the absence of a legislative requirement to do so. Following the local draft practice note 'Planning a Healthier Bristol – Assessing the health impacts of development' (consultation version, February 2013), however, a Health Impact Statement (HIS) was produced. This HIS also served as an accompaniment to the proposal's Planning, Design and Access Statement.

The HIS is a rapid, prospective qualitative assessment of how the development proposal might positively impact on the baseline position of several health-related topics – connectivity, people, lifestyle, community, built environment, and local economy. Potential health impacts are assessed not in relation to proposed development outputs, but its leading design principles. In this sense, therefore, the HIS can be conceived of as being a policy-level assessment. By its nature, the HIS provides only a general indication of how and the direction (exclusively positive) to which the project might impact health and well-being outcomes. No provisions for monitoring or evaluation if the proposed scheme will perform in the positive manner as outlined are included in the HIS.

5.3 West Rhyl Green Space Project HIA

The West Rhyl Green Space Project (WRGP) (completed in 2015) is situated in the county of Denbighshire on the north east coast of Wales, United Kingdom. The local county council appointed a team of landscape architects to design and deliver the WRGP as part of an overarching housing-led regeneration scheme – the aim of which being to create a vibrant community, construct new energy efficient homes, create an attractive and relaxing new green

space, and provide new retail opportunities. During the initial stages of the project development, efforts were made to ensure that designers and decision-makers were informed about the importance of green space, and that health and well-being issues were integrated into the design process prior to the submission of the planning application.

To assist this process, a HIA was performed for the purposes of shaping the tender brief, and the future direction, of the green space element of the wider housing scheme. Following the systematic methodology described in the Welsh national HIA guidance 'HIA: A Practical Guide' (2012), a rapid participatory HIA was undertaken in 2014. Two main rapid appraisal techniques were employed: a participatory stakeholder workshop, which served as a platform for community and organizational knowledge gathering, and a desk-top appraisal (inclining using previously collated evidence).

The HIA focused on the assessing the potential impacts the project's principles, rather than proposed project outputs, would have on health and well-being. This qualitative assessment involved highlighting those vulnerable groups within the population that might be disproportionately affected by the project, and then, using a select series of social health determinants, identifying the potential health impacts and unintended consequences of the project.

A series of recommendations and mitigatory measures as to how negative health impacts can be minimised and positive health impact maximized are also presented, with these being based on stakeholder input during the participatory workshop. What is more, these recommendations can be divided into two areas of focus: working practices (e.g. partnerships and local level collaborative working), and physical design and green space usage considerations (e.g. installation of Closed Circuit Television Camera-CCTV)

and inclusion/exclusion of dogs). It has been indicated that while the recommendations around working practices were adopted, those in relation to physical design and green space usage proved more difficult to implement (e.g. resource issues prevented installation and maintenance of CCTV, although 'dummy' cameras are said to have been installed to serve as a deterrent).

5.4 A HIA concerning the Gardens for People project in Stonehouse

The Gardens for People Project (England, United Kingdom) is a Groundwork led initiative that aimed to build capacity for local people to sustain green spaces in their community. The project involved partnership working between Groundwork Plymouth and the City Council's Housing for People Project, with the latter approaching Groundwork to organize a community garden project within the Stonehouse area of Plymouth. A key aim of the project was to provide residents with the skills and expertise necessary to maintain a community garden, a process which involved training, practical tools, and the building of capacity and confidence to undertake the work. The training itself involved horticulture guidance, compost production, and transferable skills such as health and safety, risk assessment, first aid and tool maintenance. In

addition, a longer-term aim of the project was to support a community that incorporates tool sharing and time banking.

Plymouth Health Action Zone (PHAZ) HIA group, a subgroup of PHAZ Environment and Health Programme Board, acted as the steering group for the project. As indicated in the final assessment report, members of PHAZ were interested in using HIA as a tool for promoting public health, reducing inequalities and increasing community participation in decision-making. An independent HIA facilitator was commissioned to undertake a rapid, prospective policy-level community assessment of the concept of the project. Alongside identifying the potential health impacts of the project, the HIA aimed to raise the profile of the health outcomes of gardening projects and local community engagement in the assessment and project decision-making process. The boundaries of the HIA were confined to the community garden accessible only to the social housing residents of the Valletort House flats – making it an early example of a HIA undertaken for a small community garden accessible only to residents of a single block of social housing flats.

Employing an adapted version of an existing participatory HIA framework, the assessment was based on qualitative data gathered through two participatory stakeholder workshops; with findings from these being underpinned by a review of published literature to ascertain the potential health impacts of the community garden. Stakeholders identified a range of potential project health impacts, with these being predominantly linked to social health aspects (e.g. well-being, social cohesion). Moreover, stakeholders also provided an extensive range of suggestions of elements which should be integrated in the final project plans and decision-making processes in order to optimise any positive or ameliorate any negative project health impacts.

5.5 San Francisco Eastern Neighbourhoods Community HIA

Over recent decades, a combination of rapid growth in housing demand, neighbourhood gentrification, and increasing land use conflicts has placed strain on the socioeconomic well-being of San Francisco's eastern neighbourhoods, USA. In 2002, the city's planning department launched a neighbourhood planning process in order to address existing and future land use conflicts. This process resulted in revisions to existing urban development policies, the creation of new neighbourhood plans, and the potential rezoning of current land uses to accommodate new housing and existing light industry. The compiled rezoning options were legally required to be subject to an EIA process, however the local planning department elected not to integrate health considerations into the process – citing practical and conceptual reasons, such as the focus of EIA being explicitly that of direct environmental impacts.

In the absence of a formal mandate to consider health within planning, the San Francisco Department of Health convened and led an 18-month independent, parallel collaborative HIA process – The Eastern Neighbourhoods Community Health Impact Assessment (ENCHIA). The aim of this was to understand and articulate how health gains can be maximized from land use development, and to analyse the likely impacts of the Eastern Neighbourhoods land use plans and zoning controls. Delays in the publication of these plans, however, frustrated this process.

This, in turn, led to the refocusing of efforts towards the creation of a general assessment tool and methodology that could be applied to assess land use development proposals.

The conclusion of the ENCHIA process was the creation of the city's first Healthy Development Management Tool (HDMT). The HDMT brings together all the products of the ENHCHIA process, providing decision-makers with a set of metrics to use in the assessment of urban development PPPPs. To aid with application and dissemination, the HDMT was converted into an online resource and accompanying data depository.

While the original assessment process was frustrated by plan publication delays, the HDMT is said to have been applied to 3 draft neighbourhood plans and the findings of these considered by the City Planning Department (specifically on topics related to housing and transportation). The HDMT has also been identified as forming the basis for establishing working relationships, which then influence work around several health aspects (e.g. air quality, noise, pedestrian/cyclist injuries). Finally, the indicator system and development checklist contained in the HDMT were used as resources by other agencies in the development of their own IA tools.

The most recent iteration of the HDMT can be found here: http://www.sfindicatorproject.org/.

5.6 HIA of the Atlanta Regional Plan 2040

PLAN 2040 is a long-term (29 years) regional comprehensive plan prepared for the Atlanta region, USA, by the Atlanta Regional Commission (ARC) (adopted July 2011). The plan integrates multiple aspects of regional planning, including bringing together land use and transportation policies; in addition to housing, greenspace, water and air quality, and changing demographic and economic scenarios. This regional planning effort also includes a new Regional Transportation Plan, a six-year priority Transportation Improvement Plan, and a comprehensive Regional Development Plan for the region's 10-county core.

Although some examples of comprehensive planning HIAs exist in the United States of America, the PLAN 2040 HIA represents one of the earliest HIAs of a regional comprehensive plan for a major metropolitan area. The HIA was conducted before the plan was adopted and it was indicated that this was a pilot study for how HIAs might be conducted in future at the regional level. While the HIA is in many respects in line with existing definitions of HIA, particular in terms of its methodological approach, its purpose and output are somewhat different. This comprehensive, policy-level HIA is neither explicitly concurrent nor prospective, but both at once. The purpose of the HIA is to develop an understanding of how regional planning may impact health and well-being (including establishing Healthy Planning Concepts), to build capacity for future HIA practice, and to establish an evidence-based framework for assessing complex, comprehensive and long term PPPs. One of its key outputs, therefore, is a methodological approach and orientation around how to perform a HIA.

The HIA report specifically focuses on providing a detailed insight into how health can be addressed in PLAN 2040's transportation performance measures. Through a qualitative process

of evaluating how health is incorporated into the PLAN, looked at through a transportation lens and employing findings from peer-reviewed publications and expert consultation, a series of recommendations on how negative health impacts might be mitigated and health gains maximized. In general terms, the HIA attempts to demonstrate that sustainability, economic output, and human health are mutually supportive and attainable goals of regional planning. In terms of monitoring and evaluation, the report highlights that the HIA team may make repeated presentations to decision-makers and various stakeholders on how the recommendations of the HIA might be adopted. A multicomponent evaluation programme for the HIA is presented, incorporating a process of inviting experts, HIA practitioners, academics, and students to analyse the process and expected short-term output of the HIA.

5.7 Landschaftsplan Göttingen and associated SEA for the Local Land Use Plan

Göttingen, Germany, is a University town of about 130 000 inhabitants in the South Eastern part of the German Land of Lower Saxony. In 2010, the town decided to prepare a statutory and area-wide landscape/environmental development plan, along with a revised land use plan. Both plans are closely associated in the German planning system. Work on an associated SEA for both plans started in 2011. Whilst the land use plan establishes the spatial framework for future economic development and population growth, the landscape/environmental development plan considers how development can happen in an environmentally sustainable manner. This includes the development of green and blue corridors and spaces.

The SEA includes an extensive environmental baseline description, based on seven criteria. These include soil, water, climate/air, biodiversity and biotopes, landscape, human beings and cultural and material assets. The section on human beings mainly focuses on the living environment (residential areas and the wider environment). Nearly the entire section is dealing with green corridors and spaces, focusing on recreational aspects and the potential for supporting outdoor activities and exercise. Objectives for each of these criteria are established next.

With regards to concrete action, a range of activities are to be pursued. These include renaturation of areas that have experienced a decrease in value of the natural environment in order to increase their recreational value. Furthermore, ways in which development of nature, landscape and recreation can be integrated are explored. Development of green corridors and spaces to achieve more walking and cycling along with traffic calming is actively supported. Finally, green spaces are developed to enhance the possibilities for outdoor exercise.

The SEA assessed different options of about 130 development sites within the town. In this context, positive and negative impacts of different options on the seven criteria introduced above are assessed. Furthermore, a number of development measures are introduced for various sites and biotopes. Whilst the assessment extensively uses matrices to show impacts, land-use and landscape plans present a number of highly detailed maps.

Generally speaking, the SEA was used in a more reactive way to check whether what was proposed by the spatial planners was able to meet environmental objectives. However, it was not used pro-actively to develop ideas and/or options for development (Ohlow, 2016).

5.8 Area Development Plan Brainport Park EIA

This is an EIA for the development of a major area in the North Western part of the city of Eindhoven, Netherlands, which is located in the South East of the Netherlands with a population of about 220 000 spread over an area of about 1 400 ha. The proposed development includes a range of knowledge intensive industries and supporting high-tech facilities. In this context, the plan talks about a campus idea, consisting of developments that complement each other. Furthermore, a green framework of parks (including a major existing park), green spaces and a green corridor is at the heart of the development. Planning consent is to be achieved through a process consisting of three master plans; one comprehensive spatial plan, one accessibility plan and one for phase one of the development of the Brainport Park. A main aim is the development of a high spatial quality of the area through an attractive and green environment. A green corridor cutting through the area from the North West to the South East into the city centre is a key aspect of the development. A life-cycle approach starting with all stage from research and development on the one hand and sales and services on the other is used in this context.

The EIA assesses three infrastructure and urban development alternatives. This is pursued in terms of 12 main assessment themes, including:

- air quality
- archaeology, cultural history and landscape
- human health
- nature
- noise
- safety
- soil
- spatial quality
- sustainability
- traffic, and
- water.

The profile of the development area is to be supported with regards to being a leader in health and well-being opportunities. Furthermore, high quality living areas are to be developed that should take advantage of a green and healthy environment.

All EIAs in the Netherlands are closely monitored and supported by the Netherlands Commission for Environmental Assessment. This is why the Commission's published factsheet on the development of green spaces and health is worth mentioning here (2016). This is based on experiences made by the Commission over many years on looking at health effects in EIA for

major developments. This factsheet provides four recommendations on the amount of green space and distance to living areas, the type of green to be used (trees, shrubs, meadows etc.), accessibility of green areas with different means of transport and social safety as well visibility, openness and accessibility. Chapter 9 of the EIA exclusively addresses health. Whilst the main focus here is on noise and air quality, recreational and sports opportunities are also considered.

5.9 Vienna main railway station and associated EIA 'urban development'

This EIA was prepared in 2007/2008 and focused on the development of a new main railway station in Vienna (capital of Austria with about 1.8 million inhabitants) along with a range of other associated developments and other enhancement measures along about 6 km of railway tracks. Developments include a new urban quarter on 59 ha for 5 000 new apartments and a total of 10 000 new residents, as well as around 550 000 m^2 of office space for 25 000 workers. The development also includes a new urban high quality park of 8 ha along with new schools and a nursery. A green corridor was planned that cuts through the entire length of the project. The new development will replace an existing freight railway terminal, which will move to the edge of the city, making space for what is seen to be more suitable inner city developments. The new park is said to be established for the benefits of all Vienna residents, and in particular for the new residents and office workers that should use it for recreational purposes and outdoor exercise.

The EIA itself is tiered with the SEA for the City Development Plan 2005, in which various development alternatives were considered. An accompanying landscape plan will be used to design green spaces. The green corridor is planned along the over 6 km of new development, and includes planting trees along existing roads. Section 3.1 of the EIA report focuses on human beings and there is a dedicated part on human health. The main focus in this context is on noise, air quality and vibrations.

Whilst the size and the types of green spaces are established and discussed, an explicit link with health was not attempted, even though there is a very obvious implicit one. Ecosystems are mentioned, but only with regards protection measures of ecosystems. Ecosystem services are also considered more implicitly.

5.10 Glasgow City Plan 2 SEA

Glasgow City Plan 1, Glasgow, Scotland, United Kingdom, was developed without an SEA. City Plan 2 moves the development agenda forward and was prepared with an SEA. The period covered by this plan is from 2009–2014 and is due to be reviewed every five years. The requirement to integrate SEA into the plan preparation process was introduced prior to the start of the work for City Plan 2. This was also the Council's first experience preparing an SEA. The Plan's development strategy is based on a 'vision' for the city. This vision is supported by three guiding principles, namely: a) promoting social renewal and equality of opportunity; b) delivering sustainable development; and c) improving the health of the city and its residents.

Table 2. SEA objectives for Glasgow City Plan 2

SEA objectives of City Plan 2 Glasgow	
1.	Protect landform, natural processes and systems
2.	Protect and increase the use of soils in a sustainable way
3.	Protect and enhance the water environment, including river systems
4.	Protect, enhance and, where necessary, restore (specified) species and habitats
5.	Protect, enhance and, where necessary, restore landscape character, local distinctiveness and scenic value
6.	Protect, enhance and create green spaces importance for recreation and biodiversity
7.	Regenerate, derelict, contaminated or otherwise degraded environments
8.	Respect and enhance the quality of urban form, settlement pattern and identity
9.	Protect, enhance and, where necessary, restore building character and townscape
10.	Protect, enhance and, where appropriate, restore the historic environment
11.	Improve design quality in new development
12.	Reduce energy consumption
13.	Facilitate renewable energy
14.	Reduce the need to travel and journey length
15.	Encourage a greater proportion of journeys to be taken by walking, cycling and use of public transport
16.	Reduce waste
17.	Protect the environment from pollution
18.	Promote environmental capacity and the precautionary principle
19.	Reduce the impacts of climate change
20.	Create the conditions to improve human health

Source: Glasgow City Council, 2016

The Environmental (i.e. SEA) Report sets out 20 key environmental objectives (see

Table 2). Additional environmental objectives for transport, travel, climate change and human health were added to the City Plan's SEA and their inclusion was later supported by the consultation authorities. The Environmental Report identified some unknown effects particularly in relation to pollution, climate change and health and highlighted that more research was needed in these areas. The report further suggested that mitigation measures, such as landscaping and replacement of green space will be required through master planning. Out of the 20 objectives of the SEA, objectives 6 and 20 are dedicated for green space and health. Furthermore, objectives 1 and 15 deal with protection of '*landform, natural processes and systems*' and encourage '*greater proportion of journeys to be taken by walking, cycling and use of public transport*'. These too emphasize on issues related to green space and health.

The interconnection between green space and health is explicitly made in objective 20 which states

> *'The root causes of poor health are numerous and interlinked. They include those relating to smoking, drinking and dietary health but poor health can also be attributed to other conditions determined by air and water quality, accessibility to local recreation facilities, greenspace, cultural and sporting facilities and health services, etc.*' (Glasgow City Plan 2)

In attempting to achieve a Healthy City status, the Council, along with other agencies including the National Health Service (NHS), is implementing a number of programmes and investigating the links between human health, the built and natural environments and physical development. Furthermore, this connection is exemplified in the indicators developed for monitoring health. This includes for e.g. amount of green space in Glasgow; number of accessible parks and recreational/cultural facilities in the City and path and cycling network in Glasgow. This plan is required to be monitored and the latest monitoring report dated 2011 is available at https://www.glasgow.gov.uk/CHttpHandler.ashx?id=13034&p=0

5.11 HIA of the draft Glasgow East End Local Development Strategy entitled 'Changing Places: Changing Lives'

Glasgow City Plan 2 sets outs the strategic vision, principles and policy framework for land-use development in the City of Glasgow (Scotland, United Kingdom), and covers the period 2009-2014. One of the guiding principles of the Plan is to improve the health of the city's residents, with the piloting of the HIA process being specified as one approach to achieving this. Within the Plan the Clyde Gateway, which encompasses a substantial area of land to the east of the city centre, is identified as being a key potential feature of the city's future development. This includes the regeneration of the East End, which includes Parkhead, Dalmarnock and Bridgeton. The Local Development Strategy for the East End (EELDS) – *Changing Places: Changing Lives* – was approved by the Council in 2008, and aims to create a vibrant, new city district through a process of reinvention and reconnection. The strategic objectives of the EELDS include increasing housing and employment opportunities, modernizing infrastructure to support sustainable development, and to *'develop and maintain a quality Green Network offering safe, stimulating, and healthy environments'*.

In 2007, a pilot HIA was undertaken of a draft (November 2006) version of the EELDS. This HIA was commissioned by the Glasgow Centre for Population Health, and was performed by a specialist practitioner in HIA. A prospective policy-level assessment the HIA employed the rapid-appraisal technique of a participatory stakeholder workshop (which included a half-day site visit), with this being supported by a desk-top study (literature review). Qualitative in nature, the assessment entailed stakeholder groups being asked to consider the potential impacts of the EELDS on the health and well-being of the existing community. To facilitate this, stakeholders were provided with a prioritized list of health determinants (based on the EELDS) and baseline community health status with which to make identify potential positive and negative health impacts.

A broad range of physical, social and economic health aspects are considered in the assessment, although ecological factors appear to have been omitted. In relation to each of the nine elements of the development strategy that were appraised, a series of recommendations (or suggestions) are provided. These relate to both the specific wording of the strategy (e.g. strategic objectives or design principles) and ways to maximize the project's overall health gain, with these being support (where possible) by evidence from literature. While none of the stakeholder groups

worked on the strategy objective covering green space, green space emerges as an important determinant within the appraisal and stakeholder suggestions. In addition, the HIA promotes the incorporation of health promotion and protection into the consultation of the SEA of Glasgow City Plan 2 (that SEA doesn't make reference to the HIA, though) and integrated water plan.

5.12 Plymouth Transport Plan SEA

SEA has been undertaken in relation to Plymouth's third Local Transport Plan (LTP), Plymouth, United Kingdom, that covers the period from 2011 to 2026. The LTP has been produced and was adopted by the City Council in April 2011.

The SEA objectives have been categorised under the following broad topics: air quality, biodiversity, climatic factors, heritage assets, townscape and landscape, noise, water, human health (a stand-alone HIA has been undertaken in parallel with the SEA, however, only for a very minor part of what the SEA was covering). Area specific issues have been investigated under two headings; a) eastern Corridor and b) northern Corridor. The work is complemented with a number of other studies, including noise impact assessment, sustainable neighbourhood assessment, child safety audit, HIA, equality impact assessment, barriers to walking study and a green infrastructure delivery plan. Amongst 13 key issues identified by the sustainable neighbourhood assessment, 'community facilities' was one. This included sport, leisure, play equipment, youth facilities, green space, shopping, and religious facilities. This particular key area connected green space with health implicitly. 'Life expectancy and health' was also one of the key areas identified.

The Plymouth Green Infrastructure Delivery Plan pulls together strategically important projects that will deliver the aspiration for a coordinated and sustainable green infrastructure network. The connection between green space and health has been implicit in such initiatives. Amongst 11 objectives that have been used to assess the LTP, two deserve special mention. These are:

- to protect, promote and improve human health and well-being through healthy lifestyles; and
- to prevent habitat and species loss and fragmentation and to promote a healthy natural environment.

The SEA is supported by various studies and throughout the report health and green space seems to be implicitly connected. However, there may be more clues connecting health with green space within the other studies (HIA, Green Infrastructure Delivery Plan) than there is visible within the SEA alone. The monitoring strategy is supposed to be implemented from the commencement of the adopted LTP 2011-26 (Plymouth City Council, 2016).

6 HIA experiences: review findings

An evaluation of 7 HIA studies was undertaken in order to develop a better understanding of the experiences and practices of impact assessment in UGS interventions. Of these 7 studies, 5 were selected from the United Kingdom and 2 from North America. The over representation of United Kingdom examples, especially when considering the European scope of the project, is indicative of one of the challenges faced by the study team. That is, while efforts were made to identify cases from across Europe, few examples of the application of HIA in green space projects were found outside the United Kingdom. This in itself could be reflective of the fact that the United Kingdom has been a major proponent of HIA for a number of decades. Moreover, the application of HIA in the context of green space interventions remains a developing field. In terms of the actual evaluated HIAs, these fell into two categories: 1) project or policy focused rapid appraisals (United Kingdom examples, i.e. HIA 1-5), and 2) problem driven appraisals (USA examples, i.e. HIA 6-7).

The first category of case studies was that of project or policy focused rapid appraisals. These HIAs were collectively prospective in nature, with their purpose being to inform relevant project/policy actors of the potential health impacts of the project, and present recommendations on how to maximize the overall project/policy health gain. In addition, they tended to have a second purpose, namely serving as a mechanism for introducing 'healthy planning concepts' to local spatial policy and planning processes (HIA 1), raising the profile of green space projects (HIA 3,4), and facilitating community engagement in the project or policy development process (HIA 1,3,4).

While undertaken for a variety of projects, the HIAs employed similar rapid appraisal techniques –participatory stakeholder HIA workshops, underpinned by desk-top studies (i.e., a review of published evidence). In all but one of the cases, where only a desk-top study was conducted (HIA 2), potential health impacts were identified through the performance of an HIA workshop; with participating stakeholders being asked to consider and highlight any potential positive or negative health impacts. A key objective of these HIAs was thus to identify, rather than actually appraise, any potential health impacts. A broad range of health aspects were considered in the HIAs, especially socioeconomic aspects and, to a much lesser extent, biophysical aspects.

The second category of case studies was that of problem driven appraisals. While these assessments somewhat differ from existing definitions of HIA, they provide an interesting point of reference for European practices. The starting point for these HIAs had not been the identification of potential policy-related health impacts. Rather, it was the development of a broader understanding and articulation of how land-use development can promote (and protect) health and well-being. In doing so, they aim to fill a perceived existing 'gap' in knowledge and practice around the consideration of health and well-being in land-use planning – e.g. in one case the HIA process was started due to the absence of consideration of health and well-being within the statutory EA (HIA 6). Moreover, they aim to demonstrate and build capacity for the consideration and use of HIA within land-use planning processes. This is evidenced by the outcome of these HIA processes: a methodological approach (or 'toolkit'), complete with metrics

for use in the assessment of urban development policies, plans, programmes and projects, which can be used to support the consideration and integration of health and well-being into land-use planning processes.

It is difficult to ascertain the influence of the evaluated HIAs with regards to health and well-being improvements, owing to the lack of available evidence of subsequent monitoring and evaluation of the consideration and uptake of HIA recommendations. For each of the cases, contact was sought with those who had either led or were connected with the HIA process – those contacted were asked to answer a series of targeted questions around the role of HIA in the project. Respondents indicated that the project and policy focused rapid appraisals had been influential, although this influence was of a more indirect nature (HIA 1, 3). For example, the HIA findings did not directly alter the contents of the plan or policy, but recommendations around aspects such as community engagement and partnership working were adopted (HIA 1, 3). The HIA also raised awareness for and promoted consideration of health and well-being within project decision-making. In one instance, the HIA process and findings also provided the basis for the development of a research project aimed at evaluating the health gain of the green space intervention (HIA 1).

In the case of the problem driven HIAs, it was indicated that the devised HIA methodological approach had subsequently been applied in the appraisal of a number of neighbourhood plans. It was also noted that the HIA process had been used as a basis for establishing working relationships, the aim of which being to promote and protect health and well-being through land-use planning. Moreover, a developed indicator system and development checklist (both elements of the HIA toolkit) had been used as resources by other agencies in the development of their own tools designed to assess neighbourhood conditions and development impacts (HIA 6). For both categories of HIA, those contacted indicated that no formal monitoring or evaluation of the uptake or consideration of the HIA findings and/or recommendations had been performed.

7 Discussion

Table 3 below shows coverage of a number of criteria for both, HIAs as and SEAs/EIAs. In this context, six main categories are used: biophysical aspects, social/economic aspects, type of assessment, methodological approach, impact on decision and whether or not monitoring was/is done. Interpretation of IA review results start with looking at similarities and differences between HIAs on the one hand, and SEAs/EIAs on the other.

Overall, if considered as two assessment ‘groups’, EIAs/SEAs tend to consider biophysical aspects to a larger extent than HIAs. The one aspect which is considered similarly in HIAs is flooding/water. This is inverse to the situation of social and economic aspects which tend to be considered more completely in HIAs, with the exception of neighbourhood environment (attractiveness), which was also considered in all reviewed EIAs/SEAs. None of the EIAs/SEAs, though, considered crime/anti-social behaviour/violence, whilst this was considered in five of the seven HIAs.

Whilst all EIAs and SEAs considered negative next to positive impacts of the underlying plan/project, the assessment of positive impacts of an initiative was of particular importance in the considered HIAs, with two cases not focusing on impacts at all, but rather on making suggestions for what healthy development may look like (HIA6, HIA7). Therefore, there is a tendency to treat the legally required EIAs/SEAs as impact focused instruments, whilst the largely non-statutory HIAs are often used more is the sense of guidelines, supporting heathy development.

Whilst all assessments used qualitative information and assessment techniques, none of the HIAs were applying quantitative methods. On the other hand, quantitative techniques (models and overlay mapping) were used in three out of five EIAs/SEAs.

Making judgements on the impacts of the various assessments on the project/plan decisions taken was particularly difficult with regards to the HIAs, as these were often prepared outside plan/project making processes (opposite to all EIAs/SEAs that were prepared within a plan/project making exercise) and only two of the HIAs were confirmed to have had a more minor impact. Whilst the two considered EIAs had a moderate impact on the project for which they were prepared, all three SEAs were said to have had a minor impact. Health focused monitoring, finally, was entirely absent in EIA/SEA, whilst two of the HIAs were associated with what was termed 'informal' monitoring.

Overall, our review has established that green spaces and associated impacts on human health are considered in HIA, EIA and SEA in different ways and formats. In this context, based on reviewing seven HIAs and five SEAS/EIAs, two main approaches are emerging: (1) one where HIA is used to raise awareness for the role of green infrastructure or promote specific green infrastructure initiatives based on a perceived existing problem (problem driven assessment), and (2) one where EIA and SEA as well as at times HIA are used to assess spatial or other sectoral (e.g. transport, energy, waste) plans and projects, and in this context consider the need for developing green spaces, and making reference to possible health implications (impact driven assessment).

The (1) first approach usually provides a rich source for exploring different ways on the assumed functioning of different types of green (and often blue) spaces and their potential health implications. Associated documents are often written as quasi guidance documents to make policy-makers, planners, developers and other stakeholders aware of the role of green spaces. In this context, an important aim is the consideration of green spaces in future planning and associated decisions.

The (2) second approach is usually associated with a less prominent position of green spaces and health, mainly due to other (and possibly competing) interests and development ideas driving the plan or project underlying the assessment. Whilst at glance it may, to some, appear that the second approach is less worthy of study as it is more limiting, in particular as green spaces and health often only contribute a small part to the assessment, when it comes to the implementation of green spaces on the ground, it is here where concrete action is usually happening.

The (1) problem based approach aims at potential future projects, whereas the (2) impact driven approach aims at influencing concrete developments by assessing their impacts, ultimately aiming at shaping a specific development in a healthier and/or more environmentally sustainable way. Here, the assessment instrument (i.e. HIA, EIA or SEA) needs to be pro-active, looking at different options to meet development goals and objectives and helping to identify the most suitable (i.e. most healthy and environmentally sustainable) option. In this context, what has been identified as a major barrier towards achieving this is a reactive approach to assessment, i.e. rather than being used pro-actively, HIA, EIA and SEA are applied reactively, only testing whether (and to what extent) certain objectives are met, and in this context frequently applying a matrix based 'tick-box' approach. However, in the professional literature, this reactive approach has been identified as one of the key reasons for IA not to be able to develop its full potential (Fischer, 2008). It is in the way of using assessment as a design tool which helps shapes ideas and outcomes. One of the main reasons for being reactive is that it is used to 'prove' that a project's decision-making process had incorporated required considerations.

Also, currently, in most countries, HIA is an instrument which is not formally/legally required, as opposed to EIA and SEA. This means it is usually used voluntarily. This is one of the reasons for it being often used as rapid appraisal techniques – participatory stakeholder HIA workshops, underpinned by desk-top studies (i.e., a review of published evidence). In all but one of the cases, where only a desk-top study was conducted, potential health impacts were identified through the performance of an HIA workshop. In this context, many HIAs appear to be approaching plan, programme and project making exercises from the *outside*, making suggestions to those working on them to consider certain aspects in the future, rather than working with them on improving things *within* a particular planning or programming situation. However, real impact is achieved when working in collaboration in a specific plan, programme or project situation.

Table 3: Coverage of HIAs and SEAs/EIAs

	HIA 1 – Connswater Community Greenway	HIA 2 – Kings-wear Road, Torpoint Road and Haldon Close	HIA 3 – West Rhyl Greenspace Project	HIA 4 – Stonehouse Gardens for People Project	HIA 5– East End Local Develop-ment Strategy	HIA 6 – Eastern Neighbour-hoods Community	HIA 7 – Atlanta Regional Plan 2040	EIA 1 – Gebiedsont-wikkeling Brainport	EIA 2 – Vienna	SEA 1 – Landschafts-plan Göttingen	SEA 2 – Plymouth Local Trans-port Plan (2011-26)	SEA 3 – Glasgow City Plan 2
Biophysical aspects:												
• climate function							X		X	X	X	X
• air quality				X	X		X	X	X	X	X	X
• noise	X			X	X		X	X	X		X	
• water/flooding	X	X	X		X		X	X		X	X	X
• flora & fauna/ biodiversity	X	X	X				X	X	X	X	X	X
Social/economic aspects:												
• social cohesion/ exclusion/support	X	X	X	X	X	X	X		X		X	
• Physical activity	X	X	X	X	X	X	X	X	X	X	X	X
• Mental well-being (e.g. stress, self-esteem, confidence)	X	X	X	X	X					X		X
• Neighbourhood environ-ment: attractiveness	X	X	X		X	X	X	X	X	X	X	X
• crime/anti-social behaviour/violence	X		X	X	X		X					
• Improved environmental and healthy access to services/amenities	X	X	X		X	X	X	X			X	
Assessment of impacts:												
• Negative	X		X	X	X			X	X	X	X	X
• Positive	X	X	X	X	X			X	X	X	X	X
Methodological approach:												
• Qualitative	X	X	X	X	X	X	X	X	X	X	X	X
• Quantitative								X	X	X		
Impact on any decisions:												
Major												
Moderate								X	X			
Minor	X		X							X	X	X
Health monitoring?												
• Formal												
• Informal	X						X					

= 0%; = 1% to ≤ 35%; = 36% to ≤ 65%; = 66% to 99%; = 100% *by category, i.e. HIA and SEA/EIA*

8 Conclusions and recommendations

This working paper has explored evidence for how the health role of UGS is considered and supported in planning interventions through IA, focusing on HIA, SEA and EIA. To start with, it was found that with regards to HIA, there a number of different approaches that are calling themselves HIA, that are however not in line with accepted definitions (see typology from Table 1). In the interest of clarity there is a need to label approaches consistently.

It was challenging to locate representative samples of specific types of IAs, reflecting exemplar cases for combining health with UGS. For example, no ex-ante HIA, applied to a non-green space PPPP but that explicitly covered green space measures (type 5b in the typology introduced in Table 1) could be identified. A reason may be that in this type of HIA, the inter-relationship of health and appears to be usually implicit only. However, more in-depth research would be necessary to confirm this.

Another key finding is that only those plans or projects that have green space development as the main starting point make an explicit connection with health. When green space interventions is not the starting point, the connection made of health and green space is less strong and frequently implicit only. In both cases, though, currently little effort is made to establish evidence for the causal relationships of green space interventions and health. As was suggested by one of the interviewees, this is connected with '*health [being] a product of a wide range of environment, social and economic factors, and it would be difficult to attribute any change in health conditions to any one particular factor*' (Planning Officer 3, 2016).

Continuing from the previous point, it is also concluded that the IAs studied here do not make the most of the methodologies that are available for developing evidence and for monitoring them (see Morrison-Saunders and Arts, 2004; WHO Regional Office for Europe, 2016). This may be attributed partly to the fact that the effects of interventions are not usually evident in the short run. However, continuous long term monitoring (e.g. over a decade) would in most cases be difficult to secure.

Generally speaking, it was established that most IAs played a minor role only in influencing underlying plan and project processes, adding moderate value to the issues regarding green space and health. The interviews conducted as part of this study further reveal that there is a lack of ownership of the IAs conducted, for e.g. they were usually prepared by third party consultants. Due to time constraints, the consultants would refrain from presenting a refined version of the reports. For planners, IA was only one part of many and therefore, they felt less inclined to make a lot of effort to focus on it. Furthermore, when contacting people who were involved in the preparation of the IAs, it was found that institutional turnover was high and many people that had worked on IA had subsequently left their positions. This made it difficult to gain a better insight into the IA. Based on these experiences, we recommend that dedicated individuals are allocated to work with the IA processes. This should also help in strengthening organizational learning related to IAs (Gazzola et al, 2011).

Two main approaches of IA with regards to GS interventions and associated health impacts have been identified:

(1) A problem driven approach, where human health is to be promoted through UGS and where the UGS intervention itself is the main subject of a plan or project. In this context, HIA is often applied, adopting the role of guidance, enhancing communication and awareness amongst stakeholders. Furthermore, at times HIAs also takes the role of a (health) promotional tool, with a tendency towards qualitative analysis and a focus on positive outcomes.
(2) An impact driven approach, which focuses on (often negative) impacts of a (usually non-UGS intervention specific) plan or project (which considers UGS, though) and where mostly EIA/SEA are applied. Both, UGS and health will usually be only one of many aspects considered. Here, it is often difficult to isolate impacts on health and health monitoring will be tricky.

One of our main recommendations emerging from the use of these two approaches is that on the one hand, the use of HIA should be extended to assessing impacts of proposed plans and projects (both UGS and non-UGS focused), while EIAs/SEAs should aim at giving more space to a problem approach, being less reactive and more pro-active, explicitly establishing the causal effects of green space interventions on health. Amongst the examined IA cases in this working paper, a few had SEAs/EIAs prepared along with HIAs. Unfortunately, though, they are frequently not applied together. In those studies considered here HIA and SEA/EIA were usually not integrated, meaning that added value was not fully realized. Connections between problem driven and impact driven IA processes should be improved.

In conclusion we recommend that proactive IA approach should be applied, combining problem and impact driven elements in an integrated HIA/EA. As this is what the SEA Directive (142/2001/EC) of the EU is already asking for and what the new EIA Directive (2014/52/EU) is also demanding, efforts of pilot studies should focus on this ‘combined approach’.

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Annex 1: Experiences with impact assessment: interview findings of 15 cases

Urban areas provide diverse settings in which to plan and implement UGS interventions. As a result, the characteristics and nature of UGS interventions can vary immensely. To develop a better understanding of the types of interventions that exist, a review of European green space projects was undertaken in the first half of 2016. Case studies were collected on the basis of an online survey questionnaire, with submissions being encouraged from several European urban networks (e.g. Healthy Cities). The purpose of the case study research was threefold: to gain an overview of the types of green space projects that exist, the data available to support their impacts on health and well-being, and to identify transferable lessons which might be of use for others in planning and implementing green space projects (see Appendix 2).

In total, 48 of survey submissions fulfilled the case study selection criteria. Of these, 26 green space projects had been subject to some form of IA. After further examination, it was found that some did not fall into the HIA, EIA/SEA categories. In other instances, they did not fit the common understanding of IA set out earlier in this paper. Having discounted these cases, a total of 17 potential cases remained.

As part of the case study review, semi-structured interviews were conducted with representatives from 15 of the cases. These interviews explored several project-related areas, including the project genesis, design and development, implementation, and subsequent monitoring and evaluation procedures (including data to support health-related project impacts). One area of questioning centred on the understanding and use of impact assessment, with 7 of the interviews involving such a discussion (owing to their indication of a completed IA in the original survey questionnaire).

With regards to the interviews, it became apparent that interviewees found questions around IA the most challenging to answer. Indeed, the interview process yielded limited data with regards to the use of IA in green space projects, especially when compared to other areas of questioning. That said, the interviews did allow for some interesting insights into the experiences and practices of IA.

To begin, the overall position of IA – specifically EIA and SEA – within green space projects was seen as being that of a statutory obligation. That is, interviewees explained that an EIA or SEA had been performed because of the nature of the green space project (including site constraints, e.g. nature or landscape designations) and the current spatial policy framework resulted in a statutory requirement to do so. In addition, IA reports (and their findings) were also indicated as contributing to the respective project's evidence base, submitted as part of the land-use planning application process. The purpose of those IAs differed from that traditionally associated with IA. That is, the rational thinking about and appraisal of project/policy proposals (including different scenarios) and the production of recommendations designed to maximize positive and minimise negative project/policy outcomes. Instead, these statutory IAs appear to have been used as an instrument to ensure (or "prove") that a project's decision-making process

had incorporated required considerations. Furthermore, one interviewee explained that it was unfortunate that the consideration of social determinants of health remained second to those of biophysical determinants within EAs.

In terms of the use of non-statutory HIA, interviewees pointed to its role as being that of a communication tool. That is, the HIA process and findings were used as a medium for communicating to project stakeholders the health benefits of green space development. This was found not only to be for political or funding purposes, to which the HIA facilitated project 'buy-in', but also community members. Through participatory processes HIA was viewed as being an instrument for community engagement, capable of building relationships with and obtaining and articulating community views, needs and wants. It was, however, noted that the actual influence of HIA in terms of improving the health gain from the final project was more difficult to establish. In one instance it was expressed that given that the improvement of human health and well-being was already a central aim of the project, the function of the HIA was superfluous in this regard – original plans to perform a second follow-up HIA being dropped owing to the perception that it would not deliver any additional benefits. Again, however, in this example HIA was used for the purposes of facilitating institutional project buy-in.

A final point to raise relates to the general understanding of IA. In two instances, the submitted online survey identified that an IA had been performed. Upon further examination, however, it transpired that no formal IA had been undertaken. Instead, supplied responses (and documentation) tended relate to *ex ante* scoping studies or *ex post* evaluation studies.

Annex 2: Completed templates of case studies

Information

Title: Health Impact Assessment of the bid to the Big Lottery Funding for the **Connswater Community Greenway in East Belfast** **Country:** Northern Ireland (United Kingdom) Year: 2007
Section 1 Context
- What is the green space intervention/PPPP about?
The Connswater Community Greenway (CCG) is an urban park project in East Belfast, United Kingdom. When completed the CCG will deliver a 9km multifunctional linear park through East Belfast, incorporating multiple features – pedestrian and cycle paths; heritage trails; improved parkland; linkages to community facilities (schools, leisure and health centres, etc.); river remediation and regulation, and more. Through physical changes it is envisaged that social outcomes can be realized, such as improved health and well-being outcomes, urban environmental quality and social capital.
- Who is conducting the green space intervention/PPPP?
Projected developed by East Belfast Partnership, and being delivered by Belfast City Council.
- What justification is given for the green space intervention/PPPP?
(No specific statement in HIA)
Section 2 Health Impact Assessment (HIA) Details
- What type/level of HIA was conducted?
A rapid, project level prospective HIA
- Who is conducting the HIA and what authority/department are in the lead?
Specialist practitioner in HIA on behalf and with support of Belfast Healthy Cities.
- What rationale is given for conducting the HIA?
To support the preparation of the bid for the Big Lottery Fund for the CCG. The aim of the HIA is to identify the potential impacts of and suggest ways to increase the overall health and well-being gains of the introduction and ongoing management of the CCG.
- Who is the HIA intended to inform?
Proponents of the scheme and decision-makers.
- What health stakeholders contributed to the HIA?
Assessment performed by Specialist Practitioner in HIA affiliated to the Public Health Resource Unit, Oxford. HIA management team include members from the Belfast Health and Social Care Trust, with funding from Belfast Healthy Cities and Belfast Health and Social Care Trust.
Section 3 Baseline Reporting
- Does the HIA provide a public health profile, and does this allow for the establishment of health and well-being requirements?
A summary community profile is presented, compiled from information extracted from earlier CCG Needs Analysis (2006). General, but not specific health, and well-being requirements can only be established: employment, long-term illness, health problems or disability issues, living environment issues, education needs, and health inequalities.
- What health data are considered/used?
a) Northern Ireland Multiple Deprivation Measure (2005) – health domain. b) Census 2001 data (East Belfast) –% people with long-term limiting illness, health problem or disability;% people providing unpaid care to family, friends, neighbours or others c) Household survey by East Belfast Community Development Association – households receiving incapacity benefits; households taking medication for stress, nervous illness or depression; deprived household drug and alcohol problems
- Was data collection undertaken or was only existing data used?
Secondary sources only.
- What environmental (including green space) data are used?
None – identifies that three out of four Inner East Belfast wards have limited access to green and open space, but no data provided.

- Is a link made between environmental (including green space) and health data
No.
Section 4 Assessment
- Physical aspects considered?
a) Improvements to natural and built environment (generic) b) Noise (reduction) c) Flooding (reduced flood risk) d) Aesthetics
- Social aspects considered?
a) Physical activity (walking, cycling, play) b) Active travel c) Social cohesion (reduction of outward migration, social interaction/reduced isolation) d) Crime and safety (potential for anti-social behaviour, criminal, social or psychological aggression, drug abuse and conduct offences) e) Family cohesion (maintenance and improvement of structure) f) Well-being (sense of place, pride, civic ownership, esteem, stress reduction and relaxation) g) Health and social care (improved access to health care facilities) h) Health (morbidity and mortality reduction from multiple factors, e.g. overweight and obesity; access to healthy nutritious food (linked also to allotments)) i) Social capital (providing a physical basis for) j) Leisure and recreation (improved opportunities) k) Education (educational opportunities, attainment, quality, health education e.g. smoking)
- Economic aspects considered?
a) Tourism (increased visitor numbers) b) Employment opportunities (quality of employment) c) Business opportunities (potential increase in business start-ups) d) Reduction in transport and fuel poverty
- Ecological aspects considered?
a) Improved biodiversity (generic)
- Other aspects considered?
a) Improved area image and reputation
- Were both beneficial and adverse health effects considered?
Yes – but only in relation to crime and safety (fear of antisocial behaviour, potential crime and drug abuse, physical and psychological impacts on victims of crime)
Section 5 Methods and techniques
- Is an established approach and/or methodology used?
Ison, E. (2002) Rapid appraisal tool for participatory stakeholder workshops. Eleventh iteration.
- What methods/techniques were employed?
Rapid appraisal techniques – a) desk-top appraisal; b) a participatory stakeholder workshop; and c) extraction of relevant information from completed evaluation forms collected from East Belfast Partnership consultation events.
- Was quantitative evidence gathered and analysed? If so, how?
No
- Was qualitative evidence gathered and analysed? If so, how?
Qualitative study. Potential health and well-being impacts identified using a rapid appraisal tool (see above) comprising selected determinants of health. Potential impacts are then identified according to how they were determined: only during desk-top appraisal; during desk-top appraisal and participatory stakeholder workshop; participatory workshop; or extracted from evaluation forms from community consultation events.
- Does the assessment specify a temporal scope?
Combines short and long term potential outcomes, but does not specify timespans.

Section 6 Reporting, influence and evaluation
- What aspects are considered in the recommendations?
a) Community engagement and ownership – secure widespread community support through community consultation; b) Multilevel engagement of policy-makers and service providers – ensure that opportunities provided by project are maximized, including increasing awareness and understanding of health and well-being benefits; c) Encourage uptake and use of the green space – including providing features that facilitate usage (cycle and pedestrian paths, street infrastructure, such as seating and lighting) d) Innovative and high-quality specification design; e) Management – need for short and long term management strategy; f) Health promotion and health improvement – use the project as a mechanism to address, and potentially reduce, some health inequalities. g) Education opportunities – maximize education and skills development opportunities of project, including for health and well-being; h) Policy support – consistent policy that supports project; i) Monitoring – need for establishment of baseline of various indicators before implementation of the project.
- To what extent is health considered in the HIA recommendations?
The recommendations (or suggestions) sit within a section dedicated to suggesting ways of increasing the potential health gain of the project. In that sense, each of the recommendations has at least a link to health and well-being. More specifically, there is a specific recommendation on using the project as a mechanism to address (and perhaps reduce) health inequalities and maximizing education opportunities.
- What evidence underlies the recommendations?
Where specified, recommendations are supported by information from the review of published literature, the established Summary Community Profile
- What is the overall conclusion of the report on the likely impact of the green space intervention/PPPP on health?
The CCG has the potential to improve overall health outcomes, but to reduce health inequalities it is important that targets initiatives at the various vulnerable groups are developed.
- To what extent has the HIA influenced the decision-making process?
Anecdotal evidence suggests that HIA influenced the bid, which then closely informed the design and build as well as associated activities – e.g. emphasis on community engagement, including establishment of community liaison officer, encouraging physical activity, and informing development of a £5million research project (Physical Activity and the Rejuvenation of Connswater (PARC) by the Centre of Excellence in Public Health at Queen's University Belfast.
- Is any provision for monitoring/follow-up in the HIA report?
No formal monitoring provisions made.
- Have any monitoring/follow-up reports been prepared? If so, what is the focus of these?
No formal monitoring of update of HIA recommendations performed. However, good working relations between project partners has allowed informal follow-up and to identify influence as outline above.
- Has any evidence been generated and does this include any evaluation of the health effects of the green space intervention/follow-up?
PARC study – specifically around physical activity, number of baseline analyses (e.g. cost–benefit analysis). To date, no follow-up data has been collected. However, further analysis and evaluation due.
Section 7 Remarks
• Reference is made to healthy urban planning principles. • This project level HIA looks only at project outputs and does not consider alternative scenarios, including status-quo. • Mapping exercise (table 5.1) identifies entry points for local and regional agencies and organizations for both involvement and usage of the CCG and how they can help deliver potential health gain. • HIA is defined in terms of the Gothenburg Consensus paper 1999, the HIA being understood to support decision-makers with information; • Led by an understanding of health based on a combined socioeconomic and biomedical model of health.

Information

Title: Kingswear Road, Torpoint Road and Haldon Close Development Area Health Impact Statement Country: England Year: 2013

Section 1 Context
- What is the development about?
Preparation of a master plan and hybrid planning application for the Kingswear Road, Torpoint Road and Haldon Close Development Area – including enhancements to the central pubic open space, demolition of existing (empty) buildings near that space, 71 new residential units, and outline planning permission for further residential development at a near site.
- Who is conducting the green space intervention/PPPP?
Bristol City Council and Knightstone Housing Association (land owner).
- What justification is given for the green space intervention/PPPP?
Local planning policy (Core Strategy, June 2011) identifies South Bristol as a focus area for development and comprehensive regeneration, including provision of new housing. This regeneration project, in turn, will bring much needed improvement to public open space, as well as housing (particularly social housing).
Section 2 Health Impact Assessment (HIA) Details
- What type/level of HIA was conducted?
Health Impact Statement. Ex-ante. Policy
- Who is conducting the HIA and what authority/department are in the lead?
Stride Treglown Limited – appointed by city council and landowner to lead a consultant team in preparation of a masterplan, and hybrid planning application, for the area.
- What rationale is given for conducting the HIA?
Unclear as to what the overall intended purpose is. However, noted as having regard to draft practice note 'Planning a Healthier Bristol – Assessing the health impacts of development' (consultation February 2013).
- Who is the HIA intended to inform?
Decision-makers, local authority (including planning authority), landowner (housing association) (however, this is inferred).
- What health stakeholders contributed to the HIA?
Unclear
Section 3 Baseline Reporting
- Does the HIA provide a public health profile, and does this allow for the establishment of health and well-being requirements?
Yes. General health and well-being requirements can be established, such as increasing physical activity among adults, improving educational attainment, and area specific data for development – deprivation, life expectancy, high levels of cancers and health disease mortality.
- What health data are considered/used?
a) Public Health Observatory 'Health Profile 2012: Bristol' b) 2011 Census Profile – self-assessed proportion of population health status (e.g. very good or very bad health). c) Life expectancy, mortality from cancer and heart disease, smoking prevalence, level of obesity, deprivation (these described qualitatively)
- Was data collection undertaken or was only existing data used?
Existing (secondary) data only.
- What environmental (including green space) data are used?
Unclear – none specified.
- Is a link made between environmental and health data?
No.
Section 4 Assessment
- Physical aspects considered?
a) Connectivity (access to services, local road network, footpath connections) b) Access to greenspace c) Water management (surface water drainage)
- Social aspects considered?
a) Community cohesion (creation of balanced community through mixed housing provision and tenure types, community asset and space for community activities) b) Physical activity (improve/create new footpaths and cycle paths, dog agility area) c) Nature play (no formal but rather natural and informal play opportunities)

d) Nutrition and diet (provision of food growing opportunities, follow an edible landscape approach – both open spaces and private gardens provide opportunity) e) Well-being (sense of pride)
- Economic aspects considered?
a) Employment (no new employment opportunities, however connected to wider area)
- Ecological aspects considered?
a) Biodiversity (opportunity to improve)
- Other aspects considered?
a) Enhanced area desirability and attractiveness
- Were both beneficial and adverse health effects considered?
No, assessment focus is on how the proposal might improve the baseline situation.
Section 5 Methods and techniques
- Is an established methodology specified?
Health impact assessment prepared with due regard to the draft practice note 'Planning a Healthier Bristol – Assessing the health impacts of development', which was published for consultation in February 2013.
- What methods/techniques were employed?
Rapid appraisal techniques – a) desk-top appraisal.
- Was quantitative evidence gathered and analysed? If so, how?
No.
- Was qualitative evidence gathered and analysed? If so, how?
Qualitative assessment. Existing baseline position in respect to several health-related topic areas (connectivity, people, lifestyle, community, local economy, and built environment, then an assessment looking at the proposal's design principles and impact on this baseline position.
- Does the assessment specify a temporal scope?
No.
Section 6 Reporting, influence and evaluation
- What aspects are considered in the recommendations?
-
- To what extent is health considered in the HIA recommendations?
-
- What evidence underlies the recommendations?
-
- What is the overall conclusion of the report on the likely impact of the green space intervention/PPPP on health?
The statement is said to demonstrate that the proposed scheme will provide a healthy living environment, promote health lifestyles, and provide good access to health facilities and services. Impact of proposed development on health and well-being of new occupants, local residents and other users of the site is, therefore, said to be positive.
- To what extent has the HIA influenced the decision-making process?
- Is any provision for monitoring/follow-up in the HIA report?
- Have any monitoring/follow-up reports been prepared? If so, what is the focus of these?
- Has any evidence been generated and does this include any evaluation of the health effects of the green space intervention/follow-up?
Section 7 Remarks
• Supporting text to proposed land allocation state that development proposals should be supported by a HIA; however, latest 'Planning Application Local Requirements List' (August 2013) states that there is no requirement for a HIA to be submitted with a planning application. • Draft practice note provides concise summary of relevant policy context at national and local level, and does not repeat it – so does not consider specific policy context to the development

- Noted that significant amount of consultation undertaken with the local community and key stakeholders to influence subject of the planning application, which considered all aspects of the project including health.
- Green space viewed as providing a central public open space as an important community resource offering opportunities for physical activity, interaction and learning.

Information

Title: **West Rhyl Greenspace Project** (WRGP) **Country:** Wales (United Kingdom) **Year:** 2014
Section 1 Context
- What is the development about?
The West Rhyl Greenspace Project (WRGP) is part of an overarching housing led regeneration scheme, the aim of which being to create a vibrant community through the construction of energy efficient homes, new green space, and providing new retail opportunities.
- Who is conducting the green space intervention/PPPP?
Urban Vision's (joint venture between Salford City Council, Capita and Galliford Try) team of Landscape Architects were appointed by Denbighshire County Council to design and delivery the WRGP.
- What justification is given for the green space intervention/PPPP?
(none directly specified) However, the project is said to come at a time when there is renewed focus on the public health benefits of green space – with reference given to position statement by The Landscape Institute.
Section 2 Health Impact Assessment (HIA) Details
- What type/level of HIA was conducted?
A rapid, prospective plan-level HIA.
- Who is conducting the HIA and what authority/department are in the lead?
Public Health Wales led the HIA – Principal HIA Development Officer and Public Health Practitioner. Support by Denbighshire County Council.
- What rationale is given for conducting the HIA?
To inform designers and decision-makers (Tender Brief) about green space, to ensure health issues integrated into the design process (e.g. needs of local community, impacts on them, and level community participation), and to guide direction of the project prior to submission of planning application.
- Who is the HIA intended to inform?
Designers and decision-makers.
- What health stakeholders contributed to the HIA?
Public Health Wales
Section 3 Baseline Reporting
- Does the HIA provide a public health profile, and does this allow for the establishment of health and well-being requirements?
No (however, noted that other statistical and academic evidence already gathered)
- What health data are considered/used?
No
- Was data collection undertaken or was only existing data used?
N/A
- What environmental (including green space) data are used?
None
- Is a link made between environmental and health data
No – however, link made in evidence review.
Section 4 Assessment
- Physical aspects considered?
a) Environmental improvements (housing, generic) b) Infrastructure (green infrastructure – greening of other streets, green corridors)

c) Flooding (flood management – prevention, lesson discharge/run off, does not contribute to coastal flood management)
- Social aspects considered?
a) Physical activity (cycling, running, dog walking) b) Community cohesion (community events, possible increase in community tensions) c) Cultural integration (cultural mixing, incorporation of local/resident culture into design) d) Well-being (boost aspirations, sense of place) e) Crime and safety (road and traffic safety, safe walking routes to school, perhaps encourage anti-social behaviour, alcohol and substance abuse) f) Civic function (local pride) g) Urban inequalities (affordable housing scheme (AHS), social clauses in construction contract) h) Skills and learning (college, horticultural groups, gardens) i) Usage limitations (potential dog exclusion/by-laws) j) Population demographics (may lead to inward migration and change in population profile, needs to be place for existing and new residents not just the latter) k) Equity issues (need for CCT to enhance use and reassure all users, including vulnerable groups)
- Economic aspects considered?
a) Maintenance and construction (encourage community involvement) b) Local community displacement (increase in houses prices, gentrification) c) Loss of local area funding (economic uplift may improve LSOA rating and lead to loss of funding)
- Ecological aspects considered?
a) Supports biodiversity
- Other aspects considered?
a) Enhancement of area desirability b) Waste management (aesthetic consideration for property waste disposal, e.g. bins) c) Access to local facilities and services (beach, town centre, GP, dentist) d) Potential establishment of community shop (access to fresh food, extension of food bank) e) Inclusive design (from outset) f) Sustainable travel (charging points) g) Support healthy urban planning and housing regeneration aims and principles h) Displacement of existing parking availability (potential impact in other areas)
- Were both beneficial and adverse health effects considered?
Yes – for each 'section' of the checklist covered, positive and negative/unintended impacts considered.
Section 5 Methods and techniques
- Is an established methodology specified?
Followed systematic methodology as described in the Welsh HIA guidance 'HIA: A Practical Guide (2012)'.
- What methods/techniques were employed?
Rapid appraisal techniques – a) rapid participatory HIA workshop; b) information extracted from previously collated evidence/stakeholder group workshop.
- Was quantitative evidence gathered and analysed? If so, how?
No
- Was qualitative evidence gathered and analysed? If so, how?
Qualitative assessment. Welsh HIA guidance used at participatory workshop to 1) identify local client/vulnerable groups; 2) using social determinants checklist identify any positive or negative and unintended impacts of plan.
- Does the assessment specify a temporal scope?
No.
Section 6 Reporting, influence and evaluation
- What aspects are considered in the recommendations?
Each section of the assessment (e.g. living environment or access and quality of services) is accompanied by recommendations/improvements: a) Space legibility (ensure signage, maps safe routes to schools) b) Waste management (litter/dog bins) c) Safe by design (aim to become self-policing), requiring initial investment (e.g. CCTV)

d) Need for intersectoral partnerships e) Reduce anti-social behaviour through community outreach programmes (e.g. alcohol consumption) f) By-laws (e.g. dogs to be on leads); community engagement, including naming competition, opening event and local management committee g) Link to Community Land Trust h) Need to consider impact of project on surrounding areas (adopt spatial perspective), e.g. displacement of parking & need to incorporate additional greening i) Equitable access, including disability proofing (disabled parking bays, dropped kerbs) j) Ensure inclusivity in plan; also idea of clarification, compromise and consultation on specific elements of project (e.g. CCTV).
- To what extent is health considered in the HIA recommendations?
Primarily in relation to safety (e.g. prevention of anti-social behaviour, waste, pedestrian routes (safe routes to school, CCTV).
- What evidence underlies the recommendations?
- What is the overall conclusion of the report on the likely impact of the green space intervention/PPPP on health?
That the WRGP provides an opportunity to showcase the benefits of open green space on health and well-being.
- To what extent has the HIA influenced the decision-making process?
- Is any provision for monitoring/follow-up in the HIA report?
- Have any monitoring/follow-up reports been prepared? If so, what is the focus of these?
- Has any evidence been generated and does this include any evaluation of the health effects of the green space intervention/follow-up?
Section 7 Remarks
• HIA understood as a process which 'supports organizations to assess the potential consequences of their decisions on people's health and well-being' • Evidence base presented in form of a concise review of published literature. • Qualitative in nature with no quantification of results it is an exercise in community and organizational knowledge gathering to identify any health impacts.

Information

Title: **Eastern Neighbourhoods Community** Health Impact Assessment (ENCHIA) **Country:** San Francisco, United States of America Year: 2007
- What is the development about
In January 2002, the San Francisco Planning Department launched the Eastern Neighbourhoods Community Planning Process in order to address growing land use conflicts (particularly those around housing demand). The outputs of this process included major revisions to existing land use plans and development policies, including creating new community plans and rezoning of current land uses to accommodate new housing and existing light industrial uses.
- HIA Details
No formal mandate to conduct HIA. While EIA performed on the rezoning options, the local planning department elected (quoting constraints around feasibility and practicality) not to integrate health considerations into the environmental assessment. Thus, the local public health department convened and led an independent, parallel process to identify the likely health and social impacts of the rezoning on local communities – the 'Eastern Neighbourhood Community Health Impact Assessment' (ENCHIA). A comprehensive collaborative HIA.
- Who is conducting the HIA and what authority/department are in the lead?
San Francisco Department of Public Health
- Rationale for HIA
To understand and articulate how land use development could promote and protect health, including identifying and

analysing likely impacts of land use plans and zoning controls on community concerns.
- What health stakeholders contributed to the HIA?
A multistakeholder Community Council of 25 organizations: a) American Lung Association b) Center for Human Development c) SF Department of Public Health Also involved: a) Neighbourhood Parks Council b) Urban Habitat c) SF Departments: Planning, Parking and Traffic, Recreation and Parks Development, Redevelopment Agency, Policy, etc.
- HIA process
The ENCHIA process occurred over 18 months, was guided by HIA principles, and involved 7 stages – moving from an initial scoping and planning of the HIA through to the development of a 'Healthy Development Measurement Tool'. The ENCHIA process was established explicitly to understand and articulate how land use development could promote and protect health, including identifying and analysing the likely impacts of land use plans and zoning controls on community concerns. While originally designed to comprehensively evaluate and inform the rezoning, neighbourhood area plans, and environmental impact review processes, delays in publications of the neighbourhood plans served to frustrate this process.
- HIA output
The HIA process was adapted and refocused to place efforts on the creation of a general assessment tool to apply to land use development – the Healthy Development Measurement Tool. This took the form of an online resource and data repository to facilitate applications – http://www.sfhealthequity.org/elements/land-use/20-elements/land-use/67-sci
- Healthy Development Measurement Tool
Brings together all work and products of the ENCHIA process which provides decisions makers with a set of metrics to use in the assessment of urban development projects, plans and policies: a) *Healthy City Vision* – seven elements: environmental stewardship; sustainable and safe transportation; public safety; public infrastructure/access to good and services; adequate and healthy housing; healthy economy; community participation. b) 27 Community Health Objectives – if achieved would result in greater and more equitable health assets c) Measurable Indicators – for each objective to help measure progress towards goals and evaluate benefits of PPPPs d) Baseline data – for each indicator e) Development targets – specific planning/development criteria to advance Community Health Objectives f) Health-based rationales – why each target would improve health g) Policy and design strategy – recommendations that explain how objectives, indicators and targets can be achieved through policy or project design specifications.
- Development
Revisions have been made to the HDMT. Firstly, it has changed name from the 'Sustainable Communities Index (SCI)' and now the 'San Francisco Indicator Project'. Secondly, it is an online framework and data repository that examines how San Francisco neighbourhoods perform across eight dimensions for a healthy, equitable community – environment, transportation, community cohesion, public realm, education, housing, economy, and health systems.
- "success"
- Remarks
• Socioeconomic model of health/broad definition • Goal of HIA said to be to bring to light information on how public policy decisions might affect health, as well as socio-physical resources required for good health. • Follows a 7 stage process, similar to that prescribed in literature and guidance (p.28) • Showcases how HIA principles can be applied in the facilitation of collaborative working, creation of a new tool/process, etc.

Information

Title: Health Impact Assessment of **Atlanta Regional Plan 2040** **Country:** United States Year: 2012
- What is the development about
PLAN 2040 is a long-term (29 year) regional comprehensive plan prepared for the Atlanta region by the Atlanta Regional Commission (ARC) – adopted July 2011. It is one of the first regional plans in the U.S. to integrate land use and transportation policies, and includes multiple elements of regional planning: transportation and land use, housing, greenspace, water and air quality, and changing demographic and economic scenarios. This unified regional planning effort includes a new Regional Transportation Plan (29 years), a 6-year priority Transportation Improvement Plan, and a comprehensive Regional Development Plan for the region's 10-county core.
- HIA Details
A comprehensive HIA, including an original literature review, data analysis, and stakeholder participation. Noted as being a concurrent HIA, but also possessing a prospective dimension (in that is provides recommendations for future regional planning efforts).
- Who is conducting the HIA and what authority/department are in the lead?
Centre for Quality and Regional Development (CQGRD), Georgia Institute of Technology.
- Rationale for HIA
Several efforts are made to define the purpose, goals and objectives of the HIA. The purpose of the HIA is said to be to develop an understanding of the impact land use, transportation and related regional policies have on health and well-being outcomes and the distribution of this within the metro Atlanta population; to integrate the HIA process into larger planning processes and to ensure explicit consideration of human health impact in regional transportation and land use planning – demonstrating that sustainability, economic benefit and health are mutually supported and attainable goals for regional planning; build regional capacity for HIA practice through collaboration and community research partners; and to establish an evidence-based framework for assessing large, complex, and long-terms plan encompassing multiple jurisdictions and unknown future variables.
- What health stakeholders contributed to the HIA?
Unclear.
- Health profile provided and data used
A comprehensive health profile allowing identification of key health and well-being issues and requirements is provided. This uses qualitative and quantitative data, extracted form secondary sources and includes statistics displayed in text, in tables and visually presented using GIS.
- HIA process
County-level comprehensive plan HIAs provided the methodological context for the assessment, with supporting evidence being provided where possible to demonstrate that recommended changes will not have a negative effect on standard planning objectives. The HIA report provides a detailed view into how health can be addressed in the plan's transportation performance measures, including a report on the analytical methodology and process improvement strategies for healthy comprehensive regional planning. Process: a) initial scoping to identify priorities and concerns, and current health research revised in order to generate information about health determinants; b) based on a literature review, identify potential health indicators to use in assessment; c) review of plan to provide overview and synopsis; d) selection of health indicators based on these analyses to assess health trends on a regional scale; e) based on peer-reviewed publications and expert consultation, evaluation of the extent to which health was incorporate into PLAN 2040 planning process; f) presentation of evidence-based recommendations to mitigate negative health impacts and health disparities and to maximize health gains.
- Identified health and well-being areas
a) Safety and Security (death and disability caused by traffic accidents and violent crime, impact of perceived risk on healthful behaviours) b) Active Living (physical activity) c) Civic Life, Social Connections (social connection, emotional well-being, ability to cope with environment) d) Access, Equity and Economy (equitable access to jobs, housing, goods and services, interrelationship between economic status and health, regional economic impact of health and economic disparities) e) Ecology and Environmental Quality (air, noise, water and soil pollution, urban climate and global climate change, environmental justice)
- HIA conclusion

In adopted form, Plan 2030 contains some healthful element, some elements that missed opportunities to promote better health outcomes, and some elements that might negatively impact health. In general terms, it established healthy development and zoning guidelines for key regional centres, but is missing some essential details, while the list of programmed and long-term transportation projects may exacerbate current unhealthy conditions.

- HIA recommendations

1. **Design and development** – diversity mode share, increase connectivity, increase density/compact development, reduce/mitigate land-use transportation conflicts.
2. **Planning methods** – include wide range of health indicators in transportation measures/data analysis, standardise project ranking, collaboration with health interest organizations, establish health priorities, reduce disparities, use HIA
3. **Programs and implementation** – ensure that program goals are fully represented in plans and projects, include health metrics.

Throughout the report recommendations are distinguished by role, ranging from 'for ARC boards and communities' through to 'city and county planning, zoning and public works departments', 'developers', 'public health officials', and anyone 'who wishes to conduct their own HIA' – including providing links to a range of resources to assist this process. In the case of PLAN 2040 HIA, CQRD presented recommendations that apply not only the plan itself but also extensive recommendation that apply to the planning process as conducted by the ARC and the policies and the external agencies that govern the process – these recommendations standing beyond the life the of project, and into the ensure future of regional planning.

- HIA influence

Noted that HIA process will not conclude until the PPPP it addressed is completed. During this time, the HIA team may make several presentations to decision-makers and various stakeholder groups, advise decision-makers on effectively implementing the HIA recommendations and evaluate the implementation and resulting health outcomes.
The HIA team plans to provide technical assistance to support healthy regional planning, including adoption of HIA recommendations. Additionally, team plans to evaluate the effectiveness of the HIA based on awareness and implementation of recommendations and conduct additional trainings in future.

- HIA evaluation and monitoring

Effectiveness of HIA not evaluated during the HIA process, rather a several stage evaluation process is proposed – invitation of product and process evaluation reviews, academic (staff and student) analysis of the HIA process, and academic (staff and student) analysis of near-term impact of the HIA. Monitoring activities will be conducted through regular communication with ARC and review of state and federal actions.

Section 7 Remarks

- Although some examples of comprehensive planning HIAs exist in the US, the PLAN 2040 assessment is one of the earlier HIAs of a regional comprehensive plan for a major metropolitan area.
- The ARC is moving to incorporate assessments of the impacts of regional plans on health within communities.
- Study designed to support ARC's on-going initiatives, such as developing assessment methodologies and acting as a pilot for how HIAs can be conducted at the regional level.
- HIA methodology based on the socioeconomic model of health. Follows the traditional six critical HIA steps.
- Notes that HIA has only recently began to be utilized in the US, with few assessments having been conducted for a regional comprehensive plan – typically, focus on localised projects or plans.

Information

Title: Health impact assessment (HIA) of the draft East End Local Development entitled '**Changing Places: Changing Lives**'
Country: Scotland (United Kingdom)
Year: 2007

Section 1 Context

- What is the development about?

The vision of Glasgow City Council is to create a vibrant, new city district, through a regeneration process based on reinvention and reconnection. Noted that the regeneration in the East End will be a model of sustainable development, and will address the issues of population health, environmental quality and meet people's needs.

- Who is conducting the green space intervention/PPPP?

Glasgow City Council
- What justification is given for the green space intervention/PPPP?
None
Section 2 Health Impact Assessment (HIA) Details
- What type/level of HIA was conducted?
A rapid, policy level prospective HIA.
- Who is conducting the HIA and what authority/department are in the lead?
Specialist practitioner in HIA, and commissioned by The Glasgow Centre for Population Health.
- What rationale is given for conducting the HIA?
4 mains drivers: 1) city council commitment to integrate health into the strategic planning process; 2) EELDS sets out regeneration strategy for the Clyde Gateway (national regeneration priority); 3) poor local population health; and 4) need to meet objectives under Phase IV of the WHOs Healthy Cities Programme, of which Glasgow is a member.
- Who is the HIA intended to inform?
Glasgow City Council
- What health stakeholders contributed to the HIA?
Unsure – Glasgow Centre for Population Health commissioned report.
Section 3 Baseline Reporting
- Does the HIA provide a public health profile, and does this allow for the establishment of health and well-being requirements?
None provided in report.
- What health data are considered/used?
Specified that a summary of self-reported health status for the community living in the East End was provided as a baseline against which to judge potential health impacts.
- Was data collection undertaken or was only existing data used?
Unsure
- What environmental (including green space) data are used?
None
- Is a link made between environmental and health data?
No
Section 4 Assessment
- Physical aspects considered?
a) Green and blue space b) Pollution (air, noise, odour) c) Flooding (reduction, introduction of SUDs) d) Land contamination
- Social aspects considered?
a) Housing (private housing may lead to isolation/gated communities) b) Social capital (diversity of community, break down territorialism, social contact and interaction, social support and cohesion, potential disenfranchisement and resentment of new residents) c) Well-being (confidence, self-esteem, positive expectations and aspirations, fear of change, nuisance from sewage works) d) Crime and safety (improved safety, risk of road traffic accidents, open water risks) e) Physical activity (pedestrian and cycle path network, opportunities to play through new play areas, removal of existing sports pitches) f) Community severance (transport infrastructure/networks) g) Education (spaces for education and new community schools, shorter term negative effects through reduce provision and longer distances to travel) h) Recreation, sports and leisure (increased access to facilities, removal of sports pitches) i) Access to health and social services (poor/decreased access) j) Local services (lack of childcare) k) Population displacement (travellers)

l) Inequalities (increase in private housing may exacerbate inequalities gap)
- Economic aspects considered?
a) Accessibility and connectivity (opportunities for employment, housing, services, facilities, and base amenities) b) Local economy (business investment, retail opportunities, greater connectivity may encourage 'leakage' c) Productivity (improvement) d) Employment (opportunities) f) Increased land value
- Ecological aspects considered?
- Other aspects considered?
a) Area image and identify b) Community disruption and other impacts from construction (loss of access to existing facilities) c) Aesthetic quality of area
- Were both beneficial and adverse health effects considered?
Yes
Section 5 Methods and techniques
- Is an established methodology specified?
No
- What methods/techniques were employed?
Rapid appraisal techniques – a) participatory stakeholder workshop (including site visit) and b) desk-top study (literature review).
- Was quantitative evidence gathered and analysed? If so, how?
No
- Was qualitative evidence gathered and analysed? If so, how?
Potential health impacts identified through a process involving firstly provided stakeholders with a prioritized list of health determinants (based on EELDS), and a health status baseline (self-reported health status) with which to judge potential impacts on health of existing communities.
- Does the assessment specify a temporal scope?
No
Section 6 Reporting, influence and evaluation
- What aspects are considered in the recommendations?
Multiple recommendations (or suggestions) are put forward in the HIA report, and include: a) Accessibility and connectivity b) Community/stakeholder engagement in planning process c) Obtain and employ good practice in healthy urban planning d) Mitigate against construction impacts e) Health and social care services (improve provision and access to) f) Sustainable development g) Mixed development h) Mixed housing tenure i) Crime and safety (safe-by-design development) j) Reduce fuel poverty k) Amenities, facilities and services (accessible, good-quality –education, retailing) m) Leisure and recreation opportunities n) Integrated transport network (traffic management, sustainable transport, active travel – cycling and walking) o) Cultural conservation p) Environmental improvement (e.g. integration of informal and formal green, blue and open spaces) q) Incorporation of health promotion/protection into the consultation of the SEA/integrated water plan
- To what extent is health considered in the HIA recommendations?
All recommendations (or suggestions) are noted as being intended to address and enhance impacts on health and well-being.
- What evidence underlies the recommendations?
Where possible suggestions supported by evidence from literature.

- What is the overall conclusion of the report on the likely impact of the green space intervention/PPPP on health?
None given.
- To what extent has the HIA influenced the decision-making process?
- Is any provision for monitoring/follow-up in the HIA report?
- Have any monitoring/follow-up reports been prepared? If so, what is the focus of these?
- Has any evidence been generated and does this include any evaluation of the health effects of the green space intervention/follow-up?
Section 7 Remarks

Information

Title: A Health Impact Assessment concerning the Gardens for People project in Stonehouse **Country:** England (United Kingdom) **Year:** 2002
Section 1 Context
- What is the development about?
A Groundwork led initiative that aims to build capacity for local people to sustain green spaces in their community – including training, practical tools and the capacity and confidence to undertake the work.
- Who is conducting the green space intervention/PPPP?
Groundwork Plymouth in partnership with Plymouth City Council's Housing for People Project.
- What justification is given for the green space intervention/PPPP?
Section 2 Health Impact Assessment (HIA) Details
- What type/level of HIA was conducted?
Rapid, prospective, policy-level (pilot) community HIA
- Who is conducting the HIA and what authority/department are in the lead?
Independent HIA facilitator
- What rationale is given for conducting the HIA?
Aims of the HIA included: a) Identifying the potential influences of the project on the health of the local population affected by the proposal b) Raise awareness and create reflection around broad health issues c) Recognize link between health and participating in local environmental action d) Raise the profile of health outcomes of gardening projects e) Acknowledge the impact of the project on health inequalities f) Recommendations about how to increase positive and reduce negative health impacts of the project. A key objective of the HIA is to gain the contribution of stakeholders on the potential health impacts of the project proposal.
- Who is the HIA intended to inform?
The Plymouth Health Action Zone (PHAZ) HIA subgroup and decision-makers and those responsible for the project.
- What health stakeholders contributed to the HIA?
a) Local GP b) Local health visitor and assistant c) Social services representatives
Section 3 Baseline Reporting
- Does the HIA provide a public health profile, and does this allow for the establishment of health and well-being requirements?

Yes, although only allows general health and well-being requirements to be determined.
- What health data are considered/used?
a) Census data b) Index of Multiple Deprivation c) Neighbourhood Renewal Fund Survey d) Plymouth Health and Well-being Survey
- Was data collection undertaken or was only existing data used?
Secondary (existing data) only.
- What environmental (including green space) data are used?
No green space data used.
- Is a link made between environmental and health data?
No
Section 4 Assessment
- Physical aspects considered?
a) Pollution (air (e.g. pollen, traffic), noise (e.g. traffic, clubs and bars, children) b) Waste management (animal faeces, lack of waste management strategy/facilities e.g. bins) c) Soil contamination
- Social aspects considered?
a) Accidents and injuries (injuries from gardening, drowning, poisonous plants) b) Well-being (relaxation, sense of achievement, sense stimulation, sense of ownership, stress reduction, potential user group conflicts (e.g. old vs younger people) and associated issues) c) Crime and safety (possible vandalism, fear of crime, substance use, anti-social behaviour) d) Social cohesion (networking, interaction, community participation user group conflicts (e.g. old vs younger people) e) Physical activity f) Diet (fresh nutritious food) g) Disease (e.g. cancers from sun exposure) h) Health inequalities (lack of access due to mobility issues, not suitable for elderly people)
- Economic aspects considered?
a) Employment opportunities (employment opportunities, sale of produce) b) Education and training
- Ecological aspects considered?
- Other aspects considered?
a) Maintenance
- Were both beneficial and adverse health effects considered?
Yes.
Section 5 Methods and techniques
- Is an established methodology specified?
Ison, E. (2001) 'Rapid appraisal tool for HIA in the context of participatory stakeholder workshops' 10th Iteration
- What methods/techniques were employed?
Rapid appraisal techniques – a)stakeholder participatory workshops (2x) and b) desk-top study (literature review)
- Was quantitative evidence gathered and analysed? If so, how?
- Was qualitative evidence gathered and analysed? If so, how?
Qualitative study, with evidence gathered through two stakeholder workshops – one workshop for community residents directly affected by the proposal and local experts, and another for additional stakeholders (e.g. decision-makers, service provides, voluntary organizations, local/external experts, project proponents).
- Does the assessment specify a temporal scope?
No.
Section 6 Reporting, influence and evaluation

- What aspects are considered in the recommendations?
45 suggestions which fall into 2 main categories – 1) Increasing project sustainability (viability) and the corresponding positive health impacts and 2) Ensuring that the landscape design reinforces positive health impacts and reduces negative health impacts. Optimise positive health impacts – a) stakeholder engagement; b) training, maintenance and storage of tools/hazardous materials; c) health promotion using local health visitors; and d) use garden as a wider health promotion tool (diet, physical activity, accident prevention) Ameliorate negative health impacts – a) landscape plans: safety features e.g. garden screen, activity zoning to prevent user conflicts, and low maintenance garden.
- To what extent is health considered in the HIA recommendations?
The recommendations primarily centre on health issues.
- What evidence underlies the recommendations?
Study underpinned by review of evidence contained in published literature.
- What is the overall conclusion of the report on the likely impact of the green space intervention/PPPP on health?
No overall conclusion provided.
- To what extent has the HIA influenced the decision-making process?
- Is any provision for monitoring/follow-up in the HIA report?
- Have any monitoring/follow-up reports been prepared? If so, what is the focus of these?
- Has any evidence been generated and does this include any evaluation of the health effects of the green space intervention/follow-up?
Section 7 Remarks
- Assessment adopts a social model of health - Defines health in terms of a) Gothenburg Consensus Paper and b) NHS Health Development Agency - If resources are available, indicated that follow-up evaluation of HIA impact on the planning of the garden in regard to health improvement and addressing inequalities will be conducted. - HIA practitioner spent 145 hours working on assessment, the majority of which spent on transcribing workshop information, researching, writing, and editing the report.

Information

Title: **Landschaftsplan Göttingen** and associated SEA for the Local Land Use Plan (Landschaftsplan und SUP des FNP Göttingen) **Country:** Germany Year: 2015
- What is the development about
The landscape plan and SEA, prepared for the local land use plan Göttingen, a town of about 120,000 inhabitants in Lower Saxony.
- Are green spaces included in assessment? If yes, in what way?
All main green spaces in the town are listed and mapped and allocated to different categories; plans are introduced for their further development; in this context, the development green corridors cutting through the town play an important role, as well as the development of green and blue infrastructure (including green roofs) for climate change adaptation purposes. Here, areas of 'climate comfort' spaces are depicted (areas with high bioclimatic significance). Also, a hiking trail around the town is to be developed for recreational and health purposes.
- Is human health explicitly considered in assessment? if yes, in what way?
Climate adaptation (cooling down effect of green spaces); and exercise (walking/hiking); there is also an associated transport development plan, aiming to develop walking and cycling networks (health is explicitly mentioned in this context)
- Is a link made between green spaces and health? If yes, how (bold and underlined: yes): ○ **Air quality**

- **Climatic effects (heat island)**
- Noise reduction
- **Biodiversity conservation and enhancement**
- **Flood management**
- **Physical activity**
- Social cohesion
- **Attractiveness of local area**
- **Mental health**
- Other…

All green areas above a certain size are evaluated. How existing noise is impacting on the value of those areas is established; However, noise reduction through green space *per se* is not considered. Well-being through landscape (and 'aesthetical pleasure') are considered (i.e. mental well-being); possibilities to flood river valleys away from human settlements are considered. The potential to filter air of green spaces is taken into account.

- Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc.)

No negative impacts are considered

- What other links are explicitly made with health in the SEA/EIA (bold and underlined: yes)?
  - **Size of green space intervention**
  - **Green space within defined distances**
  - **Type of green space intervention (e.g. including water)**
  - **Management of green space (e.g. use of pesticides)**

How to manage green spaces is considered; minimum width of green corridors for climatic purposes is considered (50 meters; ideally over 300 meters)

- Are ecosystem services mentioned, and if yes(bold and underlined: yes):
  - **Regulating services (climate regulation)**
  - **Provisioning services (generation of products)**
  - **Non-material, cultural services (heritage, social relations, security)**
  - Other services

Ecosystems are mentioned frequently, but ecosystem services as such are not explicitly referred to. However, they are reflected implicitly, for example with regards to climate regulation and cultural services (landscapes); e.g. old lime trees along the city wall. The importance of green spaces from a cultural point of view is also mentioned at numerous points. O_2 production and CO_2 consumption by/from green vegetation is mentioned, as well as food production (fruit).

Information

Title: Gebiedsontwikkeling Brainport Park Eindhoven – Milieueffectrapport (**Area Development Plan Brainport Park EIA**)
Country: The Netherlands
Year: 2015

- What is the development about

A plan for the development area Brainport Park located to the North-West of the city of Eindhoven. The area comprises some 1,400 ha and is about the development of knowledge intensive industries. There are other developments, including e.g. an international school, as well as the development of forest and park areas.

- Are green spaces included in assessment? If yes, in what way?

A green framework is underlying the design. In this context, a major green corridor is cutting through the development area Brainport Park from the city centre to rural areas in the North West. In addition, forest and parks are to be developed further.

- Is human health explicitly considered in assessment? if yes, in what way?

Human health is explicitly addressed in a chapter, covering noise and NO_2, as well as recreational opportunities provided by the development. Furthermore, health is considered in chapters on noise, air quality, 'external' safety (risks), as well as more implicitly also in chapters on soil, water, nature and sustainability.

- Is a link made between green spaces and health? If yes, how (bold and underlined: yes):
  - **Air quality**
  - Climatic effects (heat island) – *sustainability is expressed by renewable energy and, in this context, climate change;*
  - **Noise reduction**

○ **<u>Biodiversity conservation and enhancement</u>** ○ **<u>Flood management</u>** – *importance of vegetation and 'green development' for absorbing surface water is stressed*. ○ **<u>Physical activity</u>** ○ Social cohesion ○ **<u>Attractiveness of local area</u>** ○ Mental health ○ Other…
See above
- Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc.)
No potential negative effects are mentioned.
- What other links are explicitly made with health in the SEA/EIA? ○ Size of green space intervention ○ Green space within defined distances ○ Type of green space intervention (e.g. including water) ○ Management of green space (e.g. use of pesticides)
Different sizes of green space for three main alternatives are established; Types of green space is established (Park, Green corridor, forest); management is not mentioned, even though the assumption has to be that it is the local authority which will be responsible.
- Are ecosystem services mentioned, and if yes: ○ Regulating services (climate regulation) ○ Provisioning services (generation of products) ○ Non-material, cultural services (heritage, social relations, security) ○ Other services
'well-functioning' ecosystems are said to contribute to sustainability. However, ecosystem services as such are not mentioned.

Information

Title: <u>Vienna main railway station and associated EIA 'urban development'</u> (over 6 km long), taking 'EIA for urban development' guidelines into account; (Hauptbahnhof Wien, UVPs Städtebau, Bahn Infrastruktur und Strassenbau) **Country:** Austria Year: 2008
- What is the development about
Development of a new main railway station in Vienna along with a range of other associated measures along 6 km of railway tracks; additional measures include a new urban quarter (59 ha) for 5 000 new apartments (10 000 new residents) and 550 000 m^2 of office space (25 000 workers); a new park of 8 ha and new schools and a nursery, along with a green corridor along the length of the project. The new development will replace a freight railway terminal, which will move to the edge of the city.
- Are green spaces included in assessment? If yes, in what way?
A new park is included in the plans for the benefits of all Vienna residents, and in particular for the new residents and office workers; the EIA is tiered with the SEA for the City Development Plan 2005, in which various development alternatives were considered. An accompanying landscape plan will be used to design green spaces. An uninterrupted green corridor is planned along the tracks of the newly design quarter (over 6 km). This includes planting trees along roads.
- Is human health explicitly considered in assessment? if yes, in what way?
There is a section on environmental medicine. Noise along with harmful emissions and potential electromagnetic impacts receive particular attention; so do vibrations. A section on green space planning is also included. Both, construction and completed project phases are considered. Light and water are considered, as is recreation and the important role of green spaces in this context. Human health is also mentioned with regards to cycling and walking; new green spaces are explicitly referred to in the context of positive micro-climatic effects in comparison to existing land use. Noise reducing windows are included. The EIA also suggests a range of mitigation measures.
- Is a link made between green spaces and health? If yes, how (bold and underlined: yes): ○ **<u>Air quality</u>** ○ **<u>Climatic effects (heat island)</u>**

o **Noise reduction** o **Biodiversity conservation and enhancement** *(ecology)* o Flood management o **Physical activity** o **Social cohesion** *(social sustainability)* o **Attractiveness of local area** o Mental health o Other…
- Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc.)
No negative impacts are considered
- What other links are explicitly made with health in the SEA/EIA (bold and underlined: yes)? o Size of green space intervention o Green space within defined distances o Type of green space intervention (e.g. including water) o Management of green space (e.g. use of pesticides)
Whilst the size and the types of green spaces are established and discussed, an explicit link with health is not attempted (even though it is there implicitly)
- Are ecosystem services mentioned, and if yes(bold and underlined: yes): o Regulating services (climate regulation) o Provisioning services (generation of products) o Non-material, cultural services (heritage, social relations, security) o Other services
Ecosystems are mentioned, but only really with regards protection measures of ecosystems. Ecosystem services are not referred to explicitly, even though they are considered implicitly.

Information

Title: **Glasgow City Plan 2** Country: United Kingdom (Scotland) Year: 2009
- What is the development about
Glasgow City Plan 1 was developed pre-SEA as such the new city plan 2 moves the development agenda of City Plan 1 forward by focusing planning activity on regeneration within those parts of Glasgow most in need of comprehensive renewal and enhancement (the Key Regeneration Areas). Ultimately, the Plan seeks to improve Glasgow's social, economic and environmental conditions and enhance the quality of life of its residents.
- Are green spaces included in assessment? If yes, in what way?
SEA objectives 6 and 20 are dedicated to Green space and Health. Objective 6 states it aims to 'Protect, enhance and create green spaces important for recreation and biodiversity'. It promotes improvements to the green network and associated flora and fauna. These include new or proposed local nature reserves. Use of green space is also explicitly stated for Sustainable Urban Drainage systems, flood risk management and promoting quality access to community.
- Is human health explicitly considered in assessment? if yes, in what way?
Objective 20 states it aims to 'Create the conditions to improve human health'. Cycling and walking, pollution levels, accessibility to green space for good health are all considered within the assessment.
- Is a link made between green spaces and health? If yes, how (bold and underlined: yes): o **Air quality** o **Climatic effects (heat island)** o Noise reduction o **Biodiversity conservation and enhancement** o **Flood management** o **Physical activity** o Social cohesion o **Attractiveness of local area** o **Mental health**

○ Other…
The indicators developed for health include green space related data. For e.g. Amount of green space in Glasgow; Number of accessible parks and recreational/cultural facilities in the City; path and cycling Network in Glasgow – number of stations, establishment of new railway lines/ stations and path and cycling networks.
- Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc.)
No negative impacts are considered
- What other links are explicitly made with health in the SEA/EIA (bold and underlined: yes)? ○ **Size of green space intervention** ○ **Green space within defined distances** ○ Type of green space intervention (e.g. including water) ○ Management of green space (e.g. use of pesticides)
Explicit links are made with health and green space. For e.g. 'The Council will also promote, where appropriate, the development of further allotment gardens, particularly where such use is identified and supported by local communities'. Furthermore, Under the provisions of Scottish Planning Policy (SPP) 11: Physical Activity and Sport and Planning Advice Note (PAN) 65: Planning and Open Space, the Council is carrying out an audit of the City's green space.
- Are ecosystem services mentioned, and if yes(bold and underlined: yes): ○ Regulating services (climate regulation) ○ Provisioning services (generation of products) ○ Non-material, cultural services (heritage, social relations, security) ○ Other services
Ecosystem services as such are not explicitly referred to. However, they are reflected implicitly, for example with regards to extend the multifunctional benefits of the green network to increase the City's attractiveness, help combat flooding ETC.

Information

Title: **Local Transport Plan (Plymouth)** Country: United Kingdom (England) Year: 2011-2026
- What is the development about
The Local Transport Plan of Plymouth expired on 11 April 2011, so a new transport plan has been developed and produced – Plymouth's third Local Transport Plan (LTP3). This LTP has a time frame that replicates the city's growth agenda as detailed in the Local Development Framework and so will cover the period from 2011 to 2026.
- Are green spaces included in assessment? If yes, in what way?
SEA does not have a separate objective dedicated for green space, but it is included within a 'sustainable neighbourhood assessment' that was carried out for Plymouth's 43 neighbourhoods. Green space was considered as one of the key community facility. Apart from this, the Plymouth Green Infrastructure Delivery Plan pulls together the strategically important projects that will deliver the aspiration for a coordinated and sustainable green infrastructure network. Green space is also included within the SEA's object where it aims to 'value, protect and, where appropriate, enhance Plymouth's historic environment'.
- Is human health explicitly considered in assessment? if yes, in what way?
Health is touched upon on various occasions. First it is one of the stated objectives of SEA. Specific studies that are used for the SEA includes Park and Ride scheme, Child Road Safety and Barriers to walking study. Along with SEA a standalone HIA is also carried out for the Plymouth LTP as well as Equality Impact Assessment is conducted where the aim of the LTP is stated to 'improve access to community amenities (including health services, further and higher education and opportunities to take part in sport) by increasing the availability of attractive walking, cycling and bus routes.'
- Is a link made between green spaces and health? If yes, how (bold and underlined: yes): ○ **Air quality** ○ **Climatic effects (heat island)** ○ **Noise reduction** ○ **Biodiversity conservation and enhancement** ○ **Flood management** ○ **Physical activity** ○ **Social cohesion** ○ **Attractiveness of local area**

o Mental health o Other…
There is explicit connection made with regards to access to quality green space and green space. It makes the connection in its objective which states it aims 'To prevent habitat and species loss and fragmentation and to promote a healthy natural environment.'
- Are potential negative impacts considered? (e.g. insects, use of herbicides and pesticides, effects on children through fouling etc.)
Child safety is considered in great detail in light of recent data.
- What other links are explicitly made with health in the SEA/EIA (bold and underlined: yes)? o **Size of green space intervention** o **Green space within defined distances** o Type of green space intervention (e.g. including water) o Management of green space (e.g. use of pesticides)
Should be noted again that a standalone HIA is done for this plan. Also Equality impact assessment has been done.
- Are ecosystem services mentioned, and if yes(bold and underlined: yes): o Regulating services (climate regulation) o Provisioning services (generation of products) o Non-material, cultural services (heritage, social relations, security) o Other services
Ecosystem services as such are not explicitly referred to. However, they are reflected implicitly in the SEA. For e.g. in referring to areas of natural beauty that are of international importance and maintaining ecological corridors within the city.

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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Interventions on green space in urban settings can help address public health issues related to obesity, cardiovascular effects, mental health and well-being. However, knowledge on their effectiveness in relation to health, well-being and equity is incomplete. To explore the effectiveness of urban green space interventions to enhance healthy urban environments, the WHO Regional Office for Europe reviewed research findings, local case studies and Environmental Impact Assessment/Health Impact Assessment experiences, and assessed their impacts on environment, health, well-being and equity. This report provides the three working papers prepared for a meeting, and presents the discussion and conclusions on what intervention components have been found to be effective in maximizing the environmental, health and equity benefits derived from urban green spaces.

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