Chapter 8: Assessing city-wide and local health and well-being benefits

Lewis R. Elliott, Mathew P. White, Cristina Vert, Wilma Zijlema and Peeter Vassiljev

Introduction

As noted in Chapter 4, the BlueHealth project (Grellier et al., 2017) developed a range of surveying tools for investigating relationships between residential access to, or recreational contact with, blue spaces and a variety of human health outcomes. Different tools were designed to be applicable at supranational, national and community levels. This chapter outlines two of these tools: the BlueHealth International Survey (BIS) and the BlueHealth Community-Level Survey (BCLS). The former was conceived as an online survey to collect representative national samples of adult participants but could also easily be applicable at a city level. The latter is a concise version of the former, designed to be applicable for surveying communities surrounding a particular site which may be the target of a physical intervention or redesign.

Briefly, this chapter 1) describes the development, sampling, administration and content of the BIS; 2) uses examples from its findings to demonstrate its potential use for planners at a city level; 3) describes the parallel development of the BCLS; and 4) uses findings from a community-level intervention in Plymouth (United Kingdom) to illustrate its potential for planners who are interested in evaluating the impact of a physical intervention on the health and well-being of the local community.

The BlueHealth international survey

The BlueHealth International Survey was conceived as a way of addressing the lack of coordinated and harmonised data across countries on people's recreational visits to natural environments, in particular blue spaces, and their effects on people's physical and psychological health.

Setting

The BIS was administered in 18 countries worldwide. Fourteen of these countries were European Union member states (at the time): the United Kingdom, Ireland, France, Spain, Portugal, Germany, Netherlands, Czech Republic, Italy, Sweden, Finland, Estonia, Greece and Bulgaria. As past research has typically focused on the health benefits of coastal environments as opposed to other blue space environments (Gascon et al., 2017), these countries were chosen for their diversity of blue space geographies. The four other countries where the survey was administered were Hong Kong, Canada, Australia (primarily Queensland) and the United States (state of California only). These were selected based on existing research collaborations and availability of funds to collect data (also the case for Ireland, Finland and Portugal).

National-level sampling was made possible by the online mode of administration used (see subsequently), but equally planners could use regional- or city-level sampling if they wish to contextualise a particular site's surrounding

demography in terms of the wider city or region in which it is situated. Observing similar patterns at different spatial scales (national, regional, city-level) may help illuminate how representative a particular community is of the city, region or country and thus help planners decide where inequalities (e.g. age groups, or disability groups, which may access blue spaces less often) may exist that they then could target with the physical intervention they are planning.

Development, translation and management

The methods associated with the BIS underwent thorough institutional, stakeholder and public consultations to ensure it could address questions that were under-researched in the academic literature and were of interest to national and supranational health and environment policymakers and members of the public, as well as being widely intelligible. The English version of the survey was translated into the primary official language of each territory, with the additions of Russian as well as Estonian in Estonia and French and English in Canada. Official translations of standardised, validated questions and item sets often already existed. For example, many questions were taken or adapted from the European Social Survey, which already undertakes thorough forward- and backward-translation of its items. Otherwise, items were forward-translated. Backward translation would have been ideal, but 1) it would have been costly, and 2) it cannot always overcome problems of conceptual equivalence (i.e. the correct semantic translation of the content). Future iterations of the BIS could address this issue.

It is therefore recommended that if planners intend to adopt an online surveying approach to investigate blue space–health relationships at certain spatial scales, they should consider questions which: 1) are of interest to local stakeholders, 2) are rooted in the public interest and 3) ideally have existing valid translations into the local language. The importance of, and time devoted to, stakeholders and public engagement prior to the development of a novel surveying tool should not be underestimated. Individuals should be mindful that consultation on the BIS took place in 2016 and may require revision if using these items in the future or for other national contexts.

Administration

The survey was administered online by a large market research company based in the United Kingdom that has access to panels of online research participants around the world. This allowed the collection of nationally representative samples according to sex, age and region of residence in most cases: that is, we aimed for the number of participants recruited of each sex, age group and geographical region to match actual proportions of people in the populations of each country. Panel participants from reputable online sources are regularly screened for evidence of systematic response biases which could indicate inattentiveness or automatic completion, increasing the probability of valid responses. They also typically attract diverse demographic samples.

An online surveying methodology using a pre-established panel is recommended if planners wish to target demographically representative samples of adult participants or if they wish to sample residents of a particular region with relative ease. That said, online panels rarely have enough participants to ensure representativeness at finer geographical scales than a region. Nonetheless, online surveying of this kind is a relatively quick and cheap way to gather a large number of responses. It should be noted that online samples do have other limitations in that they only target people with internet access (which could mean that certain demographic groups are under-represented). Furthermore, online panel participants also are usually financially rewarded for participation in surveys, which could lead to socially desirable responding (e.g. responding a certain way because they believe the answer to be a desirable one rather than a truthful one). Planners should also be aware that despite the regular screening of systematic response biases, such biases may still exist in the returned data, and they should be mindful to flag such cases before analysing any data collected. They should also be aware of data loss or ambiguity if “don’t know” options are permitted for certain items or if bespoke interactive features (e.g. mapping features) are integrated. As such, if financial resources allow, planners could consider alternative modes of surveying such as face-to-face or telephone interview surveying.

Sampling, design, and recruitment

The BIS used stratified sampling to achieve quasi-representative samples (typically by sex, age group and NUTS1 region of residence in European countries).¹ As the characteristics of visits to blue spaces are susceptible to seasonal variation (Elliott et al., 2018, 2019), we chose to sample across four seasonal, four-week waves of data collection over the course of a year to ensure that we did not bias our analyses by only focusing on one particular season. As such, consideration should be given to particular seasons (e.g. summer/winter holidays) to ensure that responses collected that relate to these periods do not unduly affect findings (if it is the planner's wish to focus on more seasonally representative data). The BIS aimed to collect 250 responses per country/territory per wave from different individuals (i.e. a repeat cross-sectional design), as 1000 responses could be considered an appropriately statistically powerful enough sample to stratify by sex, age and region, based on similar previous pan-European surveying efforts (Gelcich et al., 2014).

Regardless of whether online sampling is chosen, stratified sampling methods are recommended if planners wish to gather representative samples of a particular area. Depending on the behaviour or health outcome of interest, planners should also consider temporally representative sampling if use of a location, or the behaviour or health outcome of interest, is likely to be affected by seasonal variation. A detailed discussion of sample size calculations and power analysis is beyond the remit of this chapter, but these statistical methods refer to the appropriate sample size for answering a particular research question. If planners wish to stratify their sample by more demographic characteristics to achieve a more representative sample of an area (e.g. by sex, age, region, work status, ethnicity, etc.), then they should recruit more participants in order to make valid inferences about the population based on these characteristics.

Content

A detailed description of the BIS and its question content is available online (Elliott & White, 2020). After reading information about what the survey would entail and giving informed consent to participate, participants first proceeded to answer questions concerning their subjective well-being. It is conventional to question subjective well-being at the beginning of a survey so it is not contaminated by responses to other questions (OECD, 2013). These items comprised four questions on life satisfaction, worthwhileness and happiness and anxiety yesterday, as well as a personal well-being index exploring satisfaction with other aspects of one's life. These are commonplace items in international surveys (International Well-being Group, 2013; OECD, 2013).

Participants proceeded to answer questions on their frequency of natural environment visits, a behaviour associated with subjective well-being previously (White et al., 2017). They then answered items on intrinsic motivations for visiting natural environments (Weinstein et al., 2009), nature connectedness (Schultz, 2002), views of blue space from their residence (Dempsey et al., 2018; Nutsford et al., 2016), perceived walking and driving distances from blue spaces, commuting via blue spaces (Zijlema et al., 2018), perceptions of blue space quality (Garrett et al., 2018) and childhood experiences of blue spaces (Calogiuri, 2016). The citations here refer to studies linking these attitudes, behaviours and perceptions to health outcomes.

They were then asked to recall their most recent recreational visit to a blue space and various characteristics associated with this such as the date and time of visit; type of environment visited; time spent at the blue space; perceived water quality; recreational activities undertaken; time spent doing activities; who (if anyone) accompanied them on the visit; psychological outcomes of the visits (e.g. satisfaction happiness; connection with people; connection with nature); perceptions of amenities and qualities of the space; perceived restorative potential; and any accidents, injuries or illnesses associated with the visit. They were also asked detailed questions concerning the journey they took to access the blue space, including geolocation of the blue space on a map. Ultimately, these items were asked in order to identify the characteristics of visits which best predict beneficial health outcomes (White et al., 2013), and items related to travel were to determine valuation using a travel-cost method (Day & Smith, 2016; Sen et al., 2014).

Participants were then asked a series of questions on their general health, including the WHO5 well-being index (Mitchell et al., 2015; Topp et al., 2015), perceived general health (Wheeler et al., 2012), presence of a disability (Boyd et al., 2018), physical activity (White et al., 2014), health behaviours (Martin et al., 2019), use of prescribed medications (Hartig et al., 2007; Helbich et al., 2018; Taylor et al., 2015), use of health services (Maas et al., 2009), sleep (Shin et al., 2020) and BMI (Ying et al., 2015). Again, these citations refer to evidence as to their relationship with blue space exposure (or natural environment exposure more generally).

Last, demographic details were collected on participant's sex, age, work status, ethnicity, dog ownership, car ownership, public transport accessibility, garden access, social contact, household composition, educational attainment, marital status, home location (using an embedded interactive mapping API) and perceived and actual household income. These are all factors that might influence how blue space affects various health outcomes.

Readers are referred to the technical report of the BIS on precise wording and questions included (Elliott & White, 2020). This is not meant as an exhaustive list of useful questions that might be posed when planners decide to survey residents of an area. However, they are meant to illustrate commonly used items, often with established international validity, on a range of health outcomes and environmental factors that may be of interest to the planner. Using such items, a planner can be confident that they are asking questions of potentially meaningful policy interest. Of course, asking all might be time consuming, especially if an online format is not adopted (median completion time of the BIS was 21 minutes), so attention should be paid to which items have most potential utility regarding the physical intervention being proposed or evaluated. For example, if the aim of a physical intervention is to elicit health-enhancing physical activity, they may require more sophisticated physical activity items and may not need to ask items concerning all other aspects of health.

Additional data

After data collection, various data were appended using the respondent's home location, such as the proportion of different land covers surrounding the respondent's home; distances to the nearest coast, water body, or inland waterway; and population density. Such additional data can benefit the planner by identifying areas of a country, city or other area which have relatively better or poorer access to blue spaces. While the BIS used globally consistent land cover data for the purposes of consistent cross-country comparisons, a variety of satellite imagery databases and local land cover maps are available at different spatial resolutions which may better reflect specific land uses at a certain spatial level, and the planner is recommended to seek local sources of such data if it is appropriate to their aims.

Summary

This overview of the content of BIS was intended to demonstrate how a survey might be created, managed, sampled, administered and filled with items of general use to planners. In reality, a variety of options exist for all of these facets of survey design, and the planner interested in health-evidence-based design of blue spaces should first decide on an appropriate question to research (which is of interest to their planning aims) before embarking on how to design, sample or administer a survey or what questions to include. The previous sections were designed to illustrate how BIS was created but also discuss where and why planners might want to consider alternative items and methods. Despite reservations about representativeness of data at a city scale, the following section uses findings from the city of Sofia, Bulgaria, as a means of illustrating how BIS findings (or indeed comparable findings from a bespoke survey in the future) might be useful at a city level for planning purposes.

Application of BIS to Sofia, Bulgaria

As an illustration of how data from the BIS, or a comparable survey, might be beneficial to planners, we outline in the following findings from the city of Sofia, Bulgaria, in terms of resident distances to various types of blue space,

Figure 8.1
Given home locations of the 234 BIS participants who resided in Sofia, Bulgaria
 (Source: The authors)

inequalities in access and details of their recreational visits to blue spaces. A total of 1054 adults were recruited in Bulgaria, of which 234 with valid home geolocation information were based in the capital Sofia (Figure 8.1).

Residential access to rivers and water bodies in Sofia

Using data from ECRINS (European Environment Agency, 2012), we were able to assign people's residential distance to their nearest river or lake (Figure 8.2).

What is apparent is that those living on the east and west of the city have comparatively poor access to rivers compared to those living in the inner city. However, the reverse is true concerning access to other water bodies (e.g. lakes). By exploring the frequency with which respondents visit natural environments for recreation, for instance, we can also determine the relationship between residential proximity and likely contact with those same environments (Figure 8.3).

These predicted probabilities are derived from a statistical model (specifically, a generalised linear model) which regresses the likelihood of someone visiting a river/lake at least weekly on their residential distance from that same space. For lakes, visits appear to relate reasonably well with distance – the closer you live to one, the more likely you

Figure 8.2
Home locations as in Figure 8.1 according to their residential proximity to rivers and inland waterways (left) and lakes and other water bodies (right). Proximity data were taken from the European catchments and Rivers network system dataset
 (Source: The authors)

Figure 8.3
Home locations and proximities as in Figure 8.2 according to the predicted probabilities of reporting having visited the corresponding environment type at least weekly in the past four weeks
 (Source: The authors)

are to visit it. For rivers, however, this is not necessarily the case, with those living further away (i.e. on the outskirts of the city) being no less likely to visit a river at least weekly than those living closer to one.

This simple piece of analysis illustrates that with some GIS and statistical analysis, a planner can begin to identify spatial patterns of where some people in a city may have better access to recreational waters than others, and with the appropriate questions in a city-level survey, they could also identify whether access might be related to actual contact. Such findings could form the basis of siting a physical intervention. Of course, there are likely higher-resolution maps of smaller water bodies and streams at a local level which might explain the patterns seen here (ECRINS is relatively coarse), but nonetheless, local spatial datasets are often freely available.

Figure 8.4
Home locations and proximities as in Figure 8.2 according to the predicted probability of reporting ‘good’ general health
 (Source: The authors)

Figure 8.5
Home locations, proximities and predicted probabilities of ‘good’ health as in Figure 8.4, but for proximity to rivers and inland waterways only and stratified by whether people reported ‘coping’ or ‘not coping’ with their present financial situation
 (Source: The authors)

A key focus of BIS was how access to, and contact with, blue spaces relates to health outcomes. One such question asked about the respondent’s overall perception of their own health, a measure that has previously been associated with both physical and mental health indicators, as well as mortality (Gascon et al., 2017). For the planner interested in health-evidence-based design of blue spaces, it may be interesting to view how residential access to blue spaces relates to such a measure of overall health (Figure 8.4).

For the BIS respondents in Sofia, residential distance to lakes does not appear to relate clearly to one’s overall health. For rivers, it does appear that those living further away from a river also suffer from slightly worse overall health. This may be accounted for by other unmeasured socioeconomic factors. We could therefore observe patterns by people’s perceived financial difficulty (e.g. coping vs not coping with their present income) – another item collected in BIS (Figure 8.5).

This does not reveal a clear pattern – those living further away from a river and suffering worse health do not also appear to be those who report “not coping” with their present income, as one might expect. In other words, in this small sample of participants from Sofia, access to rivers does not appear to be associated with income-related health inequality. Nonetheless, such insights could begin to reveal how health inequalities might be related to access to blue space and therefore help planners decide where a physical intervention will not just bring about better access to water but also potentially address socioeconomic-related health inequality.

Recreational visits to blue spaces in Sofia

BIS also recorded 122 geo-located visits to blue spaces in Sofia (Figure 8.6). Clusters of points can be seen at the fountains in Banski Square and City Garden (Figure 8.7), as well as the Boyanska and Kakach Rivers. Simple questioning of visit characteristics in a survey allows the planner to identify the activities that blue spaces within a city currently afford. The most popular activities recorded at blue spaces in Sofia were walking, socialising and playing with children (Figure 8.8).

Figure 8.6
Heatmap of the 122 visits to blue spaces recorded in BIS which were reported in Sofia, Bulgaria. Clusters of points at the fountains in Banski Square and City Garden, as well as the Boyanska and Kakach Rivers, can be identified (Source: The authors)

Figure 8.7
The fountains at Banski Square, Sofia; seemingly one of the most popular blue space recreation sites in our sample of respondents from the BIS
 (Source: Raki_Man, licensed under the Creative Commons Attribution 3.0 Unported license)

Figure 8.8
Bar chart displaying the frequency with which the most popular recreational activities were reported as the 'main' activity undertaken on a blue space visit recorded in BIS in Sofia, Bulgaria
 (Source: The authors and Anna Wilczyńska)

Figure 8.9
Frequency of reported blue space visits recorded in BIS in Sofia, Bulgaria, according to sex and age group
 (Source: The authors and Anna Wilczyńska)

Figure 8.10
Psychological outcomes associated with blue space visits recorded in BIS in Sofia, Bulgaria, according to sex and age group
 (Source: The authors and Anna Wilczyńska)

By exploring demographic details, the planner can also recognise where inequities in blue space visits may exist across a city and therefore what populations they may wish to target to encourage more demographic parity in visit frequency. In Sofia, for example, slightly more males and younger adults tend to visit blue spaces (Figure 8.9).

These inequalities may not reflect differences in health outcomes associated with those visits, though. BIS also asked a variety of questions concerning the psychological health outcomes of visits to blue spaces. In Sofia, we can see that females often feel happier, more satisfied, more connected to nature and more restored following a visit to a blue

space (Figure 8.10). Older people also appear to feel more satisfied, connected and restored. Therefore, the planner may want to design physical interventions that target the psychological outcomes of male, or younger, visitors.

Again, this section is meant to illustrate that with the correct selection of questions, a city-level survey could inform planners on the visits a certain population currently take to blue spaces, the characteristics of these visits and the characteristics of the people making them. Identification of patterns may help inform the siting of an intervention or the population or setting to be selected, especially if the aim is to reduce inequalities in visits or the health outcomes associated with visits.

The BlueHealth community-level survey

The BCLS was conceptualised as a concise version of the BIS, designed to investigate similar relationships at a community level. As such, much of the content of the survey was identical to that of the BIS, allowing some flexibility for questions of local interest. It is impossible to be too prescriptive about the sampling methods or content of the BCLS because of the local context involved in its use, but the following two sections outline the general recommendations for community-level interventions that were given at the outset of BlueHealth. To demonstrate the flexibility of the BCLS in a local context, the following section illustrates how it was applied in a community-level intervention involving the redevelopment of an urban beach site in a deprived part of the city of Plymouth (United Kingdom) (Bell et al., 2020).

Recommendations for development and sampling

In terms of development, the BCLS is designed for use in pre-post studies of the changes to health that might result from interventions to a blue space. Such an intervention could be a promotion intervention (i.e. supporting people to use an existing space more often) or a physical intervention (i.e. altering or adding to the design of a blue space in some way). It could also be used experimentally (i.e. comparing an 'exposed' group of people who experience an intervention to those not experiencing an intervention) and with either repeat cross-sections of a population (i.e. different people over time) or longitudinally (i.e. the same people over time).

It is not prescriptive about a mode of administration; as with the BIS, face-to-face interview surveying may be considered the gold standard, but resources may only allow for different types of recruitment. As such, the BCLS is designed for multiple modes of administration (e.g. online, postal, telephone, face to face). In the same way, it is not prescriptive about sample size or sampling method. Ideally, a census sample (all members of the population of some area) would be surveyed at multiple time points, but often this is not possible. Instead, random samples of households might lead to a less biased sample of respondents, systematic samples of households (e.g. every other house on a street) could lead to a good geographical spread or opportunistic samples of visitors to a site could be used to garner a large response rate efficiently but could also introduce bias to the sample. The method chosen again depends on what resources are available. Sample size will depend on the population you are trying to generalise the results to; a reasonable number of people should be recruited such that 1) there is sufficient variation in responses to questions to analyse meaningful patterns, and 2) the planner can feel confident that they can speak to the behaviour, attitudes and perceptions of their target population.

The length of the survey will also depend on the sampling method chosen. While there are specific recommendations for content (section 4.2), such questions may take more or less time to complete based on how they are presented to participants and via what mode of administration.

Recommendations for content

As stated earlier, the BCLS was intended to be a concise version of the BIS. It queried people's general and more recent visits to natural environments at the outset. It then questioned a person's most recent visit to the blue space site of interest in the last four weeks (if the respondent had made such a visit). It asked about their perception of the

site's quality, the date of the visit, the duration of time spent at the blue space, activities undertaken and who accompanied the respondent on the visit. It also asked about visit outcomes such as satisfaction; nature connectedness; and perceptions of safety, litter and facilities. Following this (or if the respondent had not made a visit), they were asked about their life satisfaction, satisfaction with their community, well-being, general health and physical activity. Last, they were asked demographic details, including dog ownership, garden access, household composition, work status, ethnicity, marital status, income, sex and age.

The idea behind this more succinct set of questions is that they are sufficient for examining changes to the characteristics of people's blue space visits before and after an intervention and also any concurrent changes in health that might occur as a result of this. Such a survey lends itself to path models which might illuminate the mechanisms by which intervening with a blue space might result in changes to health.

The Teats Hill intervention, Plymouth, United Kingdom

Plymouth is a city with maritime heritage situated in the county of Devon in the southwest of England. The intervention site, Teats Hill, is a small park and beach area within a relatively socioeconomically deprived district of the city. The city council had received funding to improve various natural environments within the city, and Teats Hill was one such site. Prior to the intervention, there was prominent deterioration in the quality of the infrastructure, blocked access to the urban beach by parked cars and overgrown vegetation. Through coordinated stakeholder involvement and public engagement and consultation, a renovation of the site was designed as part of the Blue-Health project. This involved the improvement of the playground, clearing of overgrown vegetation, regular beach cleans, resurfacing of the slipway to the beach with car access prohibited and, most saliently, the construction of a small open-air theatre where the slipway met the beach (Figure 8.11). As the size of the park and beach at Teats Hill was relatively small, these renovations had a fairly major impact on the overall character of the area. The application

Figure 8.11
View of the main intervention at Teats Hill, Plymouth: the open-air theatre
(Source: Lewis R. Elliot)

of the BCLS aimed to explore how this intervention affected the health of the local community, with measurements taken in summer seasons either side of the physical construction of the intervention in winter 2017–2018.

Application of the BCLS to the Teats Hill intervention

In Plymouth, a face-to-face mode of administration of the BCLS was selected, as resources allowed this. In two waves pre- (June–September 2017) and post- (June–September 2018) intervention, systematic samples of the local community were recruited to participate. Specifically, as a primary surveying method, we selected the seven census output areas (a small area geography used in the United Kingdom) that were nearest the Teats Hill site and systematically sampled alternating households in the first wave of data collection and the remaining alternating households in the second wave. We aimed to recruit 300 adults per wave. As this is a relatively high target considering the surrounding area (1000 households in the seven surrounding census areas), we also undertook opportunistic sampling of adults as they were passing through the Teats Hill site once household data collection had been exhausted. All surveys were undertaken by a professional market research company who could sample participants at all times of day to reduce bias in the kinds of people recruited. This demonstrates the flexibility allowed in surveying methods and illustrates that the BCLS can be adapted to the needs and population size of the local setting.

The content of the BCLS was also adapted. While we were keen to keep the duration of the survey to less than 10 minutes because of the need to gain a high response rate, local stakeholders also had priorities in terms of what they wished to find out about the local area and its inhabitants' attitudes and perceptions towards the intervention site. For example, we also asked about people's satisfaction with their safety in general, as this was deemed an important issue for the nearby population. At pre-test, we also presented participants with plans for the site and asked how much they might (in theory) be willing to donate a 'one-off' contribution to a charitable fund to help fund the redevelopment (in practice, we were not seeking donations). This hypothetical exercise was intended to 1) provide a means of assessing the cost-effectiveness of the intervention (i.e. whether the actual cost matched what the surrounding population might have been willing to pay for it), 2) provide an economic way of assessing its benefits (i.e. how does willingness to pay compare with economic valuations of changes in, for example, life satisfaction?) and 3) demonstrate the potential feasibility of crowdfunding to the city council of funding projects like this in the future. Again, this demonstrates that, if time allows, questions of local interest can be added to the survey which enhance and augment the core questions that already exist. This might provide planners with more precise insights that they need to inform specifics of the intended physical intervention.

Illustrative results from the BCLS in Plymouth

In a sample of 640 people, we observed significant improvements in life satisfaction and positive well-being (measured by the WHO5 well-being index) from before until after the intervention (Figure 8.12). Importantly, people's perceptions of the site itself also improved. Our statistical analysis controlled for a series of demographic variables and also how someone was recruited (in their home or at the site), so we know these changes are not due to differences in the measured characteristics of the two samples recruited in each wave.

We can also observe how the outcomes of people's recreational visits to Teats Hill changed from before until after the intervention. We did not observe changes in people's satisfaction with their visit nor how connected to nature they felt (Figure 8.13). There was a marginally significant increase in people's perceptions of the environmental quality of the site on their visit and also a significant increase in how safe people perceived the site to be.

These findings illustrate how a planner can evaluate the effectiveness of their intervention at improving the health of the community or the outcomes of people's visits to the site. Of course, this book presents complementary methods of evaluation of people's interactions with the site itself (Chapter 6), but the BCLS allows surveying of the entire community, whether they visit the site or not, and therefore could allow insights into why people do not choose to visit the site after its renovation as well.

Figure 8.12

Bar chart displaying standardised mean differences between pre-test and post-test measurements according to two psychological outcomes, and perceived site quality. Data are taken from the BCLS results of an intervention conducted in Plymouth, United Kingdom

(Source: The authors and Anna Wilczyńska)

Figure 8.13

Mean changes in visit-related perceptions of nature connectedness, environmental quality, safety, and evaluative well-being from before until after the Teats Hill intervention. Bars represent 95% confidence intervals. Results control for potential confounding variables

(Source: The authors and Anna Wilczyńska)

Figure 8.14

A path model for Teats Hill BCLS data, seeking to explain why the regeneration might have impacted life satisfaction (evaluative well-being)

(Source: the authors and Anna Wilczyńska).

Why might the intervention improve community health and well-being?

The BCLS also allows 'path modelling'. This means we can investigate not just *whether* the intervention had an effect on people's health and well-being but also *why* it might have had such an effect. Figure 8.14 demonstrates one such proposed path model. This looked at the relationship between the regeneration of Teats Hill and evaluative well-being (life satisfaction). Specifically, it looked at whether the improvements seen in life satisfaction from before until after the intervention could be explained by improvements in the perceived quality of the site, satisfaction with safety and satisfaction with community. The positive numbers at the bottom of the figure (labelled 'indirect effects') indicate that improvements in satisfaction with safety and community *did* account, in part, for why life satisfaction also improved after the intervention. This is important because it illustrates that the Teats Hill intervention may have worked through the mechanisms we proposed (i.e. improving people's satisfaction with their community and their safety). Such path models may provide planners with evidence on why an intervention had the effect it did and justify the planning of future interventions on similar grounds.

Summary of the BCLS

This section is intended to show the development of the BCLS and how it was applied in a community-level intervention in Plymouth. The surveying itself has its limitations. For example, despite our systematic sampling, the people we recruited before and after the intervention had some significantly different characteristics: there were significantly more participants in long-term relationships, households without children, households with access to a garden and dog owners in the post-survey compared to pre-survey. While we attempted to control for these factors, characteristics associated with them may have been responsible for some of the results observed and not the intervention itself. Planners must be mindful, therefore, of the limitations associated with surveying people in this way, especially the fact that observed effects may not always be attributable to the intervention. Ideal evaluations of interventions using the BCLS would have a control group who were not exposed to an intervention in order to assess whether improvements occurred even in the absence of an intervention; therefore, reducing potential problems from unmeasured

temporal factors (e.g. better weather in one wave of data collection). They would also ideally recruit the same people before and after the intervention, but this is not always possible. Last, our surveying periods took place a year apart, approximately equidistant from the construction of the intervention itself. This does, however, mean that any effects observed may only be applicable in the short term. If resources allow, planners could assess effects at further, longer-term follow-up periods. To some extent, the other methods presented in this book involving nuanced behavioural assessment, and environmental evaluations, once triangulated with findings from the BCLS, may help to overcome some of these limitations.

Conclusions

This chapter presented the BIS, an international survey of people's recreational contact with blue spaces and health, and how it could be used in a city setting. A comparable survey can inform the siting of an intervention within a city, what demographics are currently 'missing out' on access to blue space, where certain populations might suffer a disproportionate burden of poor health and thus where a blue space intervention might have the potential to contribute to the reduction of health inequalities. It also presented the BCLS, a shortened version of the BIS, designed to be applicable to testing before and after effects of blue space interventions. The BCLS can evaluate whether a blue space intervention can improve the health of a community and explore *why* any changes might occur. The chapter has been brief in outlining the principles of survey design and analysis, and the planner interested in health-evidence-based design of blue space, and evaluation of blue space interventions, might need to better understand these methods if they are to be used in the future. Nonetheless, and especially if triangulated with other methods presented in this book (Chapters 5, 6 and 7), these surveys can better inform the development of blue space interventions and their evaluation.

Note

- 1 NUTS1 refers to a standard by Eurostat for referencing subdivisions of European countries for statistical purposes.

References

- Bell, S., Mishra, H. S., Elliott, L. R., Shellock, R., Vassiljev, P., Porter, M., Sydenham, Z., & White, M. P. (2020). Urban blue acupuncture: A protocol for evaluating a complex landscape design intervention to improve health and wellbeing in a coastal community. *Sustainability*, 12(10), 4084. <https://doi.org/10.3390/su12104084>
- Boyd, F., White, M. P., Bell, S. L., & Burt, J. (2018). Who doesn't visit natural environments for recreation and why: A population representative analysis of spatial, individual and temporal factors among adults in England. *Landscape and Urban Planning*, 175, 102–113. <https://doi.org/10.1016/j.landurbplan.2018.03.016>
- Calogiuri, G. (2016). Natural environments and childhood experiences promoting physical activity, examining the mediational effects of feelings about nature and social networks. *International Journal of Environmental Research and Public Health*, 13(4), 439. <https://doi.org/10.3390/ijerph13040439>
- Day, B., & Smith, G. (2016). *Outdoor recreation valuation ORVal user guide* (p. 27). Department for Environment, Food and Rural Affairs. <http://leap.exeter.ac.uk/orval>
- Dempsey, S., Devine, M. T., Gillespie, T., Lyons, S., & Nolan, A. (2018). Coastal blue space and depression in older adults. *Health & Place*, 54, 110–117. <https://doi.org/10.1016/j.healthplace.2018.09.002>
- Elliott, L. R., & White, M. P. (2020). BlueHealth international survey methodology and technical report. <https://doi.org/10.17605/OSF.IO/7AZU2>

- Elliott, L. R., White, M. P., Grellier, J., Rees, S. E., Waters, R. D., & Fleming, L. E. (2018). Recreational visits to marine and coastal environments in England: Where, what, who, why, and when? *Marine Policy*. <https://doi.org/10.1016/j.marpol.2018.03.013>
- Elliott, L. R., White, M. P., Saran, C., Grellier, J., Garrett, J. K., Scoccimarro, E., Smalley, A. J., & Fleming, L. E. (2019). The effects of meteorological conditions and daylight on nature-based recreational physical activity in England. *Urban Forestry & Urban Greening*, 42, 39–50. <https://doi.org/10.1016/j.ufug.2019.05.005>
- European Environment Agency. (2012). *European catchments and Rivers network system (ECRINS)* [Data]. www.eea.europa.eu/data-and-maps/data/european-catchments-and-rivers-network
- Garrett, J. K., White, M. P., Huang, J., Ng, S., Hui, Z., Leung, C., Tse, L. A., Fung, F., Elliott, L. R., Depledge, M. H., & Wong, M. C. S. (2018). Urban blue space and health and wellbeing in Hong Kong: Results from a survey of older adults. *Health & Place*. <https://doi.org/10.1016/j.healthplace.2018.11.003>
- Gascon, M., Zijlema, W., Vert, C., White, M. P., & Nieuwenhuijsen, M. J. (2017). Outdoor blue spaces, human health and well-being: A systematic review of quantitative studies. *International Journal of Hygiene and Environmental Health*, 220(8), 1207–1221. <https://doi.org/10.1016/j.ijheh.2017.08.004>
- Gelcich, S., Buckley, P., Pinnegar, J. K., Chilvers, J., Lorenzoni, I., Terry, G., Guerrero, M., Castilla, J. C., Valdebenito, A., & Duarte, C. M. (2014). Public awareness, concerns, and priorities about anthropogenic impacts on marine environments. *Proceedings of the National Academy of Sciences*, 111(42), 15042–15047. <https://doi.org/10.1073/pnas.1417344111>
- Grellier, J., White, M. P., Albin, M., Bell, S., Elliott, L. R., Gascón, M., Gualdi, S., Mancini, L., Nieuwenhuijsen, M. J., Sarigiannis, D. A., & others. (2017). BlueHealth: A study programme protocol for mapping and quantifying the potential benefits to public health and well-being from Europe's blue spaces. *BMJ Open*, 7(6), e016188. <https://doi.org/10.1136/bmjopen-2017-016188>
- Hartig, T., Catalano, R., & Ong, M. (2007). Cold summer weather, constrained restoration, and the use of antidepressants in Sweden. *Journal of Environmental Psychology*, 27(2), 107–116. <https://doi.org/10.1016/j.jenvp.2007.02.002>
- Helbich, M., Klein, N., Roberts, H., Hagedoorn, P., & Groenewegen, P. P. (2018). More green space is related to less antidepressant prescription rates in the Netherlands: A Bayesian geospatial quantile regression approach. *Environmental Research*, 166, 290–297. <https://doi.org/10.1016/j.envres.2018.06.010>
- International Wellbeing Group. (2013). *Personal wellbeing index* (5th ed.). Australian Centre on Quality of Life, Deakin University. www.acqol.com.au/uploads/pwi-a/pwi-a-english.pdf
- Maas, J., Verheij, R. A., Vries, S. de, Spreeuwenberg, P., Schellevis, F. G., & Groenewegen, P. P. (2009). Morbidity is related to a green living environment. *Journal of Epidemiology & Community Health*, 63(12), 967–973. <https://doi.org/10.1136/jech.2008.079038>
- Martin, L., Pahl, S., White, M. P., & May, J. (2019). Natural environments and craving: The mediating role of negative affect. *Health & Place*, 58, 102160. <https://doi.org/10.1016/j.healthplace.2019.102160>
- Mitchell, R. J., Richardson, E. A., Shortt, N. K., & Pearce, J. R. (2015). Neighborhood environments and socioeconomic inequalities in mental well-being. *American Journal of Preventive Medicine*, 49(1), 80–84. <https://doi.org/10.1016/j.amepre.2015.01.017>
- Nutsford, D., Pearson, A. L., Kingham, S., & Reitsma, F. (2016). Residential exposure to visible blue space (but not green space) associated with lower psychological distress in a capital city. *Health & Place*, 39, 70–78. <https://doi.org/10.1016/j.healthplace.2016.03.002>
- OECD. (2013). *OECD guidelines on measuring subjective well-being*. OECD Publishing. <https://dx.doi.org/10.1787/9789264191655-en>
- Schultz, P. W. (2002). Inclusion with nature: The psychology of human-nature relations. In P. Schmuck & P. W. Schultz (Eds.), *Psychology of Sustainable Development* (pp. 61–78). Springer. https://doi.org/10.1007/978-1-4615-0995-0_4

- Sen, A., Harwood, A. R., Bateman, I. J., Munday, P., Crowe, A., Brander, L., Raychaudhuri, J., Lovett, A. A., Foden, J., & Provins, A. (2014). Economic assessment of the recreational value of ecosystems: Methodological development and national and local application. *Environmental and Resource Economics*, 57(2), 233–249. <https://doi.org/10.1007/s10640-013-9666-7>
- Shin, J. C., Parab, K. V., An, R., & Grigsby-Toussaint, D. S. (2020). Greenspace exposure and sleep: A systematic review. *Environmental Research*, 182, 109081. <https://doi.org/10.1016/j.envres.2019.109081>
- Taylor, M. S., Wheeler, B. W., White, M. P., Economou, T., & Osborne, N. J. (2015). Research note: Urban street tree density and antidepressant prescription rates – A cross-sectional study in London, UK. *Landscape and Urban Planning*, 136, 174–179. <https://doi.org/10.1016/j.landurbplan.2014.12.005>
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 well-being index: A systematic review of the literature. *Psychotherapy and Psychosomatics*, 84(3), 167–176. <https://doi.org/10.1159/000376585>
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin*, 35(10), 1315–1329. <https://doi.org/10.1177/0146167209341649>
- Wheeler, B. W., White, M., Stahl-Timmins, W., & Depledge, M. H. (2012). Does living by the coast improve health and wellbeing? *Health & Place*, 18(5), 1198–1201. <https://doi.org/10.1016/j.healthplace.2012.06.015>
- White, M. P., Pahl, S., Ashbullby, K., Herbert, S., & Depledge, M. H. (2013). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*, 35, 40–51. <https://doi.org/10.1016/j.jenvp.2013.04.002>
- White, M. P., Pahl, S., Wheeler, B. W., Depledge, M. H., & Fleming, L. E. (2017). Natural environments and subjective wellbeing: Different types of exposure are associated with different aspects of wellbeing. *Health & Place*, 45, 77–84. <https://doi.org/10.1016/j.healthplace.2017.03.008>
- White, M. P., Wheeler, B. W., Herbert, S., Alcock, I., & Depledge, M. H. (2014). Coastal proximity and physical activity: Is the coast an under-appreciated public health resource? *Preventive Medicine*, 69, 135–140. <https://doi.org/10.1016/j.ypmed.2014.09.016>
- Ying, Z., Ning, L. D., & Xin, L. (2015). Relationship between built environment, physical activity, adiposity, and health in adults aged 46–80 in Shanghai, China. *Journal of Physical Activity and Health*, 12(4), 569–578. <https://doi.org/10.1123/jpah.2013-0126>
- Zijlema, W. L., Avila-Palencia, I., Triguero-Mas, M., Gidlow, C., Maas, J., Kruize, H., Andrusaityte, S., Grazuleviciene, R., & Nieuwenhuijsen, M. J. (2018). Active commuting through natural environments is associated with better mental health: Results from the PHENOTYPE project. *Environment International*, 121, 721–727. <https://doi.org/10.1016/j.envint.2018.10.002>