**Response to reviewers**

Dear Professor Pearce,

We thank you and the two reviewers for the very helpful and constructive comments. We address each of the points in turn below. Our response is given in an indented paragraph in italics. We hope that you find our responses satisfactory and that the manuscript is now acceptable for publication. We are happy to make further changes if required.

Many thanks,

Jo Garrett

**Reviewer 1**

P5 might like to see some additional justification as to the splitting up of the 5 point SR Health answer into two classes and why two rather than the original five?

*We have added the following explanation: “As a result of the very low sample sizes in some categories (“Very bad” n = 2; “Very good” n = 26) and negative skew in responses”*

Converting the quite rich scores from WHO-5 into two scores above and below 50 felt initially the same but it was good to see a little more argument as to why this was chosen (in comparison to > or < 28).

*We have added an explanation for dichotomising that “responses were left-skewed” for clarity.*

And on page 6 why was the 6 value chosen as the cut-off for the MENE scores.

*We have added the following explanation: “We chose the value of 6 because it a) included those respondents who typically responded with “Agree” or “Strongly agree” to each question and b) resulted in appropriate sample sizes for each group (high n = 420; low n = 280).”*  On page 7 …might it have been possible, or did you consider using more than the very broad districts identified in Supp. Fig. 1 – I suspect there’s quite a difference between the blue spaces on the northern and southern sides of HK Island not to talk about how different islands like Lamma, Lantau or Cheung Chau are to the eastern side of the mainland territories. That sort of geographic subtlety seems missing to me.”

*There was a total of 18 districts in the questionnaire. Many of these had small sample sizes preventing robust analysis of all 18 districts. We have added the following text in response to this comment: “we categorised these into four groups to account for low sample sizes in some districts (e.g. Central and Western district, Hong Kong Island n = 8).*”

Also in same paragraph there is mention of the measures of physical functioning, activity and access to private spaces and might like to have seen a few more sentences on these as possible confounders?.

*The following text has been included “These potential confounders have been found to be related to health and wellbeing (Awata et al., 2007; Fonta et al., 2017; Mammen and Faulkner, 2013; McMahon et al., 2017; Nielsen and Hansen, 2007; Poitras et al., 2016). Furthermore, with regard to physical functioning, visits to the coast have been found to be more likely if respondents did not have an illness or disability (Author et al., 2014).”*

Stats, sampling and reporting very solid but they feel like the swamp the text and the textual reporting is quite short and perhaps even a little partial in how it describes the stats. For e.g. in Table 5 there is reference to water contact and safety which are not that fully discussed prior to this so a better matching up/explanation in the text would help

*The following explanation was added to the method section: “The variable “water contact” categorised visits as having water contact (swimming, fishing or on a boat/ferry) or not.”*

*With regards to an explanation of safety, this was already included in the method Respondents “were also asked to rate four characteristics of their nearest blue space: a) safety, b) presence of wildlife, c) whether it is generally free from litter and d) whether it has good facilities”*

*Added to results:*

*RQ2*

*“Perceived safety was significant only in the unadjusted model and presence of litter was not significant in either unadjusted or adjusted models (Table 3).”*

*RQ3*

*“Visit duration was approximately evenly distributed amongst all categories. Most visits were of medium activity intensity (n = 537) with fewer either high or low (high n = 87, low n = 66). There were also very few visits which were categorised as having water contact (n = 28).”*

*“Water contact was not significant in either unadjusted or adjusted models.”*

 Page 19 – second paragraph – at the end it feels like there needs to be some more content – perhaps a consideration of specific local context, environment or even cultural factors that might make HK different not just to a global north city, but also other East Asian settings?

*Added “Alternatively, this lack of relationship between walking distance to blue spaces and health outcomes may be affected by characteristics of Hong Kong, such as the presence of an excellent public transport system, including buses and metro system”*

On page 20 you also pick up on key psychological measures and again would have liked to see these discussed earlier in the text.

*We assume the reviewer is referring to “likely due to other processes such as stress relief, attention restoration and social cohesion”. We have added the following text to the introduction, also in response to a comment from reviewer 2: “Potential pathways linking green spaces to health have been categorised as reducing harm, restoring capacities and building capacities (Markevych et al., 2017). Blue spaces may offer benefits through similar mechanisms. Reducing harm includes reducing the effects from air and noise pollution which have been found to mediate the relationship between green space and mental health in Barcelona (Gascon et al., 2018). Restoring capacities includes attention restoration and physiological stress recovery (Markevych et al., 2017). Visits to the coast are perceived to be more restorative as compared to other natural environments (White et al., 2013). Finally, building capacities includes offering opportunities for physical activity and social interactions both of which may be important in blue spaces. Coastal environments were associated with the greatest amount of energy expenditure in comparison to other natural environments (Elliott et al., 2015) and one third of visitors responded that spending time with friends or family was the most important benefit they received from a visit to (freshwater) blue space (de Bell et al., 2017).”*

*Three main pathways linking green spaces to good health have been propose (Markevych et al., 2017): reducing harm (e.g. mitigating noise pollution; Gascon et al., 2018), restoring capacities (e.g. through stress alleviation; Ward Thompson et al., 2012), and building capcities (e.g. through supporting physical activity; Astell-Burt, Feng, & Kolt, 2014). In a similar way, blue spaces can confer benefits through similar mechanisms: reducing harm (e.g. by mitigating heat-related mortality; Bukart et al., 2015), restoring capacities (e.g. through reliving stress; White et al., 2013), and building capacities (e.g. through supporting health-enhancing physical activity; Elliott et al., 2015).*

Would also like a better explanation of what you mean by wildlife in relation to blue space specifically – when I think about wildlife in blue space I think fish, dolphins etc, though I suspect you mean wading birds etc. but would be good to clarify.

*We have added to method “No examples were provided for wildlife and could refer to any species perceived to be present”*

 Conclusions very cursory and need to be fuller – and to think back to the lack of a fuller geographical depth in the text. A reference to waterfronts and other aquatic settings seems a limited listing especially given the quite interesting blue spaces in a city that is in essence an assemblage of harbours, islands and ferries

*The following paragraph was added to the method to provide some geographical context: “****Location***

*Hong Kong is a unique location within which to study nature interactions and health and wellbeing. It is one of the most densely populated countries in the world; the district Kwun Tong is the densest with 57,250 people per square km (Census and Statistics Dept, 2015). However, there is also much countryside and 40 % is designated as country park or special area for nature conservation (Agriculture, 2016). Hong Kong consists of multiple islands and there is a wide range of aquatic environments including urban waterfronts; fountains and ponds in parks; inland rivers, waterfalls and reservoirs; as well as beaches and bays. Aquatic areas of specific interest include a UNESCO Global Geopark, Hong Kong Wetland Park and several marine parks.”*

*We have added a summary of the main findings to the conclusion: “In summary, in a sample of predominantly older adults in Hong Kong those who visit blue spaces regularly were more likely to have good mental wellbeing and those who had a view of blue space were more likely to report good general health. The environmental qualities related to blue space visit frequency were presence of wildlife and presence of good facilities. Finally, both duration and activity intensity were found to be related to the wellbeing outcome from a single visit along with perceived safety and presence of wildlife.”*

*And later in the conclusion: “Despite the high availability of blue spaces in Hong Kong, over a quarter of our sample said they never visited blue space. Further research is needed to find out if interventions to blue spaces, such as improvements to facilities or biodiversity, would result in population level gains in mental wellbeing.”*

**Reviewer 2**

1.     The ‘Highlights’ section could be more clearly stated and more consistent with key points in the discussion section.

*The highlights are highly restricted in length. We have included highlights that correspond to the main findings of the paper. However, we have edited the first three in order to be easily understood.*

**Highlights**

* A view of blue space from the home was related to better self-reported health

Amended:

* *A view of blue space from the home was related to good self-reported health*

Initial

* Intentional exposure to blue spaces was associated with higher wellbeing

Amended

* *Visiting blue spaces regularly was associated with high wellbeing*

Initial

* Wildlife and good facilities at local blue spaces related to intentional exposure

Amended

* *Presence of wildlife and good facilities at blue spaces related to visiting regularly*

2.     Specificity is needed throughout – e.g. in Abstract, last sentence – can you specify ‘key’

*We have made several changes in response to this comment:*

***Abstract***

*“For key location populations” changed to “for a predominantly older local population.”*

***Method***

*“for health overall” added to “However, an older adult sample is itself interesting because of research showing: a) the importance of mental health for health overall in older age”*

*“Monitor of Engagement with the Natural Environment” added to “four items drawn from the English Monitor of Engagement with the Natural Environment (MENE) survey”*

*The aspects of wellbeing were specified in the following sentence: “These were: ‘it made me feel happy’ and ‘it made me feel anxious’ together representing positive and negative experiential wellbeing; ‘I found the visit worthwhile’ reflecting eudaimonic wellbeing; and ‘I was satisfied with the visit’ representing evaluative wellbeing”*

*“(examples given: parking, footpaths, toilets)” added to “d) whether it has good facilities”*

**Discussion**

*“results were mixed” changed to “results varied according to exposure type”*

3.     The introduction lacks conceptual discussion.  What theories support your work?

*We have added the following paragraph discussing the framework in relation to health benefits from green space and the potential blue space relevance. “Potential pathways linking green spaces to health have been categorised as reducing harm, restoring capacities and building capacities (Markevych et al., 2017). Blue spaces may offer benefits through similar mechanisms. Reducing harm includes reducing the effects from air and noise pollution which have been found to mediate the relationship between green space and mental health in Barcelona (Gascon et al., 2018). Restoring capacities includes attention restoration and physiological stress recovery (Markevych et al., 2017). Visits to the coast are perceived to be more restorative as compared to other natural environments (White et al., 2013). Finally, building capacities includes offering opportunities for physical activity and social interactions both of which may be important in blue spaces. Coastal environments were associated with the greatest amount of energy expenditure in comparison to other natural environments (Elliott et al., 2015) and one third of visitors responded that spending time with friends or family was the most important benefit they received from a visit to (freshwater) blue space (de Bell et al., 2017).”*

How do you specifically define ‘urbanization’ in this case?

*“This growth of urban living, or” was added to “This growth of urban living, or urbanisation, also poses challenges to human health”*

Blue space?

*“proximity to aquatic environments (‘blue spaces’ e.g. coastlines, lakes, rivers)” changed to “to aquatic environments, termed blue space in this paper (e.g. coastlines, lakes, rivers)”*

4.     The references used in the first paragraph of the introduction are older – are there any more recent (last 5 years) references that could be used here

*Liu et al., 2017; Mustafić et al., 2012 and McLellan et al., 2018 added to paragraph*

5.     On page 3 – within the sentence that starts with “Nor do we understand…”  Specify what you mean by ‘they’.

*We have changed “They” to “green and blue spaces”*

6.     In the subsequent sentence on p.3 – the wording could be editing for flow/clarity – e.g. …, “despite rapid urbanization”

*Edited as suggested*

7. Again, the subsequent sentence – please specify ‘some of these issues’ – what are you specifically referring to here?

*Added: “in particular the paucity of research in this topic in Asia and the use of geographical measures of green/blue space”*

8.     In the last paragraph of the introduction – I am not clear on why you have references cited at the end of your research questions? Could they be moved to support other statements or is there rationale for this?

*Paragraph edited to have either references in separate sentences or phrases. ”* *We focused on three key research questions. First, to what extent is self-reported general health and wellbeing in Hong Kong related to an individual’s exposure to the city’s blue spaces? We explore three different types of exposures: indirect (view from the home), incidental (work commute) and intentional (recreational visit) contact (Cox et al., 2017a; Cox et al., 2017b; Keniger et al., 2013).? Second, which environmental factors predict blue space visit frequency in Hong Kong? Environmental characteristics of nature have been found to be related to visit frequency around the world (Arnberger and Eder, 2015; Koppen et al., 2014; Morris et al., 2011; Reynolds et al., 2007; Schipperijn et al., 2010)? Third, are some visit and environmental characteristics associated with better short-term recalled wellbeing outcomes, as also has been found elsewhere (Shanahan et al., 2016; Author et al., 2013c)? An overview of the research questions is provided in Figure 1.”*

9.     Under the methods section– sample/participants – can you specify that it was a convenience sample?

*We have edited as suggested and sentence now reads “Participants were a convenience sample of 1000 adult Hong Kong residents”*

10.  In the materials and methods section – can you specifically discuss the psychometrics of each of the survey tools/instruments you used to measure your variables?

*In the description of the WHO-5 measure we have added “These items have been confirmed to each measure a unique dimension (Blom et al., 2012; Lucas-Carrasco et al., 2012; Topp et al., 2015). The WHO-5 correlates with measures of depression, psychological distress and suicide (Garland et al., 2018; Thelin et al., 2017; Sisask et al., 2008; Topp et al., 2015).”*

*We have also added the Cronbach’s alpha details for the WHO-5 index: “(Cronbach’s alpha = 0.89, 95 % CI = 0.88 – 0.90)”*

*The Cronbach’s alpha was already included for the composite wellbeing outcome used for the third research question but we have added “bespoke” in “A bespoke composite score” to clarify it has not been used elsewhere in the literature.*

11.  Could you specify what you mean by ‘good facilities’.

*“(examples given: parking, footpaths, toilets)” were added to method. These are the examples provided in the questionnaire.*

12.  On p. 5 under ‘Exposures’ section,  second paragraph, first sentence, there is some editing needed and misplacement of a bracket.  In the third sentence, same paragraph, the c) and d) statements should be in past tense for consistency

*Sentence edited: “For the second and third research questions, participants were asked to focus specifically on the blue space closest to their home, and therefore the one most likely to be visited frequently (Schipperijn et al., 2010).”*

*The statements are written as they were in the questionnaire, which was in the present tense.*

13. On p. 7, the 3rd paragraph under ‘Exposures’, third paragraph, last sentence needs editing – and is repeated in the Discussion. Perhaps delete in the ‘Exposures’ section and use only in the ‘Discussion’ section.

*Deleted in the exposures section as suggested.*

14.  On p. 8, under the Research question 1 – several additional sentences are needed to briefly introduce the results here.

*Introductory sentence expanded: “Statistical results for health (self-reported health) and wellbeing outcomes (WHO-5) as a function of the various blue space exposures can be seen in Table 2 (see Supplementary Table 6 for full models). We present results for models both unadjusted and adjusted for sociodemographics and other variables (see Supplementary Table 6 for full model results; including all covariates).”*

15.  The ‘Discussion’ could be synthesized a bit more, with a deeper conversation comparing and contrasting your results with others’.

*We thank the reviewer for their comments, we have added further discussion and references.*

*Added: “A view of the sea, and other natural environments, was associated with reduced annoyance from road noise in Hong Kong (Leung et al., 2017) which may represent one such pathway.”*

*“However, Volker et al., (2018) also find that while perceived walking distance and blue space use were significantly related in a cross-sectional survey in two German cities, when blue space use and perceived walking distance were included as predictors in the same model, blue space use attenuated the effect of perceived walking distance. They therefore also suggest that perceived walking distance may not be an appropriate metric when assessing health outcomes in relation to blue space (specifically inland waters).”*

*Water has previously found to be important in perceived restorativeness of scenes (White et al., 2010) and, in comparison to other environment types, coastal visits were associated with greatest restoration from recent nature visits (White et al., 2013) which can mediate the relationship with mental health (de Vries et al., 2013).*

*Previous studies have found relationships between visiting green space and measures of both health and mental health (Sulander et al., 2016; van den Berg et al., 2016). However, in their study investigating ‘green’ space visits and mental health, van den Berg et al., 2016 included all natural elements in their definition of green spaces which included water bodies.*

*“In contrast, we find visiting blue space was associated with wellbeing but was unrelated to general health.” Added: “Similarly, Volker et al., (2018) also found that blue space use was related to mental health and unrelated to physical health in a survey in one German city”*

*“Previous research spanning survey, experimental and field work in Europe and Hong Kong has also highlighted the importance of both wildlife and facilities in relation to nature visits (Lee et al.,2015; McCormack et al., 2010; Schipperijn et al.,2010; Veitch et al., 2012; Wan & Shen 2015; White et al., (2017).”*

*“Safety was also not elicited as important by users of green spaces in Hong Kong (Wan & Shen 2015).”*

*“Perceived species richness was found to be related to self-reported wellbeing in river side locations in Sheffield, UK (Dallimer et al., 2012).”*

I don’t think there is a need to refer again to your research questions here.

*We thank the reviewer for their comment but feel that keeping the research questions helps to structure the discussion, enables clear understanding that the research questions specified in the introduction have been answered and discussed and enables the reader to easily follow the paper.*

Also, in the third paragraph – specify which outcome variables you controlled.

*“with self-reported health and wellbeing” added to “That the associations remained with self-reported health and wellbeing after controlling for key socio-demographic factors such as age, occupation and income”*

Editing is needed for some sentences – e.g. first paragraph 3rd sentence, as well as flow between sentences – e.g. last 3 sentences in first paragraph.

*First paragraph, third sentence now edited in line with comments from reviewer 1: “With respect to research question 1, the associations between health and wellbeing and blue space exposures, results varied according to exposure type”*

Also the 5th paragraph, 3rd sentence – “The lack of relationships…” needs to be more clear.

*“between blue space visit frequency” added to: “The lack of relationships between blue space visit frequency and feelings of safety or incivilities”*

16.  Study Limitations – in the second limitation, I don’t think it is accurate to state that the results of this study are consistent with the experimental studies – this is leap and needs to be reworded or removed for accuracy.

*“between views of nature and health” and “findings between blue space visits and wellbeing” added for clarity in the following: “despite this, our results are consistent with both experimental findings between views of nature and health (Li and Sullivan, 2016; Wang et al., 2016) and longitudinal findings between blue space visits and wellbeing (MacKerron and Mourato, 2013)”*