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Title: Why do people exercise in natural environments? Norwegian adults’

motivations for nature-, gym-, and sports-based exercise

Authors: Giovanna Calogiuri \*, Lewis R Elliott

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E-mails: [giovanna.calogiuri@inn.no](mailto:giovanna.calogiuri@inn.no), [L.R.Elliott@exeter.ac.uk](mailto:L.R.Elliott@exeter.ac.uk) Submitted to section: Public Health, <http://www.mdpi.com/journal/ijerph/sections/public_health>

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Dear Lisa Johnsen PhD,

We thank IJERPH for considering our manuscript for publication. We also thank the three anonymous reviewers for their very detailed comments and suggestions which we believe improve the manuscript considerably, and address and overcome weaknesses within the paper.

We include below all of the reviewer’s comments along with our responses to each, italicised and highlighted in blue. In the manuscript we have used tracked changes to illustrate where content has been added, deleted or changed. Please note that due to the reviewer’s suggestions, we have also changed the title of the manuscript to “Why do people exercise in natural environments? Norwegian adults’ motives for nature-, gym-, and sports-based exercise.”

We sincerely look forward to your consideration of this revised manuscript.

Yours sincerely,

The authors

Responses to reviewers’ comments

*Responses highlighted in blue and italics*

**Reviewer #1**

This manuscript describes a survey of physical activity participation and motives among Norwegian adults. The analyses address the differences in motives between multiple domains of leisure time activity with a focus on understanding the role of nature-related motives and participation in green exercise. The manuscript is well-written but requires further clarifications, and considerations of the data.

The rationale for the study and the implications of the findings need strengthening. There is a mention that understanding why people undertake green exercise could help inform promotional efforts, and later that the results can inform how to motivate different sub-populations to engage in green exercise. Other than that, there is no direction on how these data are useful, and this information is needed.

***Authors’ response:*** *We have developed further the rationale for the study and its implications. In particular, we have now added an additional paragraph in the discussions, making some clear suggestions on how the findings of our study can be used to inform promotional efforts by adding a paragraph “Implications” at the end of the discussions (line 403).*

Page 4   State whether any (and if so what) incentives were offered to respondents.

***Authors’ response:*** *All panellists were given a gift card for participation. This has now been entered into the methods section: “Participants each received a gift cards as a reward for completing the survey” (line 107-108).*

Page 4 line 98  The comparison of sociodemographic, residential, and other factors held by the market research company, between respondents and the non-responders is needed in the results. This would help to demonstrate that the sample is representative.

***Authors’ response:*** *We agree with the reviewer that this information is important in order to both to establish any response bias and also to make generalisations to the Norwegian population. Unfortunately the market research company could not provide us with any comparison between respondents and non-respondents in terms of their sociodemographic or residential profile. However, in order to at least establish the representativeness of the sample, we have made some comparisons between the respondents’ characteristics and the Norwegian population using data available on the webpage of the national statistical institute of Norway and in a report by the Norwegian Directorate of Health (line 230-238).*

Given that the survey is conducted for an outdoor recreation organisation, there is potential for selection bias among respondents, and this needs to be identified as far as possible, as well as acknowledged in interpreting the results.

***Authors’ response:*** *Please note that the outdoor recreation organisation in question (i.e. Norsk Friluftsliv) did not carry out the survey, but commissioned it to an external market research company (Ipsos MMI) – which is one of the major market research companies in Norway that has a broad panel of participants. We now realize that this wasn’t clearly stated in the methods section (it was only mentioned under “Conflicts of Interest”, now moved at line 504), so we have now explicitly mentioned the external research company at lines 104-105. Furthermore, respondents do not choose which surveys to complete, they are instead invited by email to participate in particular surveys and these emails do not provide detail on the survey other than a hyperlink.*

*Moreover, the large amount of respondents who engage in green exercise is in line with other figures relative to the Norwegian population (Green et al., 2015; Statistics Norway). Because of these reasons, we are therefore quite confident in assuming that the survey was not affected by a relevant self-selection bias.*

*Green, K., Thurston, M., & Vaage, O. (2015). Isn’t it good, Norwegian wood? Lifestyle and adventure sports participation among Norwegian youth. Leisure Studies, 34(5), 529-546.*

*Statistics Norway. Sports and outdoor activities, survey on living conditions, 2016. Available on* [*http://www.ssb.no/en/kultur-og-fritid/statistikker/fritid*](http://www.ssb.no/en/kultur-og-fritid/statistikker/fritid)

Page 5 line 107 It is unclear why only three activities were labelled leisure time. How would other forms of exercise be classified? Running/walking/cycling in urban areas? Exercise performed at home? It is hard to understand why these wouldn’t also be leisure time physical activities.

***Authors’ response:*** *In the survey from which we retrieved the data, only the following activities were explicitly mentioned: 1) “Organized sports”, 2) “Exercise in the gym”, 3) “Physical activity during work or school time”, 4) “Transportation activity”, 5) “Physical activity with dog or other domestic animal”, and 6) “Walking or exercising in parks, green spaces or other natural environment” (named “green exercise” for the purposes of the study). This list of activities is clearly not comprehensive (e.g., activities such as Running/walking/cycling in urban areas or Exercise performed at home were not listed), as corroborated by the fact that for many respondents, the overall amount of physical activity was greater than the sum of the time spent in the listed activities. We could assume that the physical activity that was unaccounted for consisted potentially in some form of LTPA; therefore, In order to avoid confounding effects, in this study all respondents for whom the majority of typical weekly physical activity was unaccounted for (n=79) were excluded from the analysis. Please note that this was mentioned in the second paragraph of chapter 2.2.1.*

*We now realize that the description of the different activities, as well as all precautions we have taken to overcome possible confounding effects, was not very clear. So we have revised this paragraph and added further clarifications (see lines 126-141)*

*Calogiuri, G., G.G. Patil, and G. Aamodt, Is Green Exercise for All? A Descriptive Study of Green Exercise Habits and Promoting Factors in Adult Norwegians. Int J Environ Res Public Health, 2016. 13(11): p. 1165.*

Page 5   Since organised sport/sport-based exercise often takes place in outdoor natural settings, how can this be a valid separate category from green exercise?

***Authors’ response:*** *Given possible overlaps with sports as well as other instrumental activities (see e.g. walking the dog or engaging in active transport), our measure of GE is defined as a form of LTPA which was perceived by the respondent as qualitatively different than all other forms of activities listed in the questionnaire (see previous comment on the six activities questioned in the survey; note that the option “green exercise” was mentioned last in the list). Such a restrictive definition of GE was applied because in the questionnaire it was not specifically stated whether or not these other forms of PA took place in natural environments. This is surely a limitation, however one may consider that although some sports or instrumental forms of PA can take place in nature, the focus of attention and the overall experience given by purely leisure-time green exercise can be qualitatively different than what occurs in sports – as supported by our findings that did show significant differences between sport-participants and green exercisers, especially in relation to the motive “nature experience”.*

*We recognize however that readers may share similar concerns. We therefore added the following sentence: “We recognise that, for example, sports can also take place in natural environments and therefore be considered green exercise. However, as participants were asked to recall sports participation and “walking or exercising in parks, green spaces or other natural environments” separately, we treat the latter as qualitatively distinct.” (line 126-129)*

Page 13 line 233 and page 17 line 291 The findings relating to instrumental activity need consideration. Could the associations with green exercise participation be confounded by the classification of dog walking and horse-riding as instrumental, which are likely to take place in green environments (as stated earlier - page 5 line 118) and account for the largest amount of total activity (page 10 line 192). Active travel and school/work based activity could also be in natural settings.

***Authors’ response:*** *This point is somewhat related with the issue raised above. Such a possibility is one of the reasons for controlling for “instrumental physical activity” in the logistic regression model. Moreover, as we explain from line 173, because “In Norway it is not uncommon for individuals to exercise their dog for intrinsic reasons (e.g. whilst running or sledding) as well as extrinsic reasons (to exercise the animal) … due to possible overlap with green exercise, those who reported ‘walking/exercising with dog or other domestic animal’ as their primary domain of overall physical activity (n = 148) were excluded from final analysis” thus the chance of such confounding is greatly reduced.*

*However, in order to address your comment, we added the following section in the discussions (line 475-480): “Lastly, our measures of green exercise might have overlapped with other forms of leisure-time or instrumental physical activity, or even under-estimated the extent to which respondents are exposed to nature whilst engaging in different activities. For instance, we could not account for whether the respondents were exposed to nature when commuting to work/school, walking the dog, participating in sports, etc. These arguably more incidental forms of green exercise deserve greater attention in future research.”*

Moreover it is not clear why the odds ratios/95 CIs reported in Table 3 are interpreted as indicating increased and decreased likelihood of green exercise, when they clearly show no increased odds. Two decimal places have been used throughout the table, so should be consistent for this variable.

***Authors’ response:*** *We recognise that the way we have controlled for instrumental physical activity may lead readers to believe that the effects are too small to warrant discussion of increased or decreased odds. However, the small effects and confidence intervals are due to the fact that the variable was entered into the model in minutes, and that minutes of instrumental physical activity recalled ranged from 0 to 3,600. Therefore, the odds ratios represent the increased odds associated with every additional minute of instrumental physical activity recalled (the need for three decimal places was due to our desire to show that these confidence intervals were indeed below or above 1). We now recognise that this is perhaps an inappropriate method of controlling for instrumental physical activity which could mislead the reader as to the magnitude of the effects.*

*Instead, we have taken a new approach by entering instrumental physical activity into the model in hours (i.e. dividing the original variable by 60). As can now be seen in Table 3, the odds ratios and confidence intervals appear more regular and now appear more to justify our discussion of these results. Please note that because entering these new values as tracked changes distorts the appearance of the table, we have not used the tracked changes function but have instead highlighted the values in red and underlined them.*

*We have also edited the method section accordingly (line 192-194).*

Page 16 line 215    It is important to acknowledge the probable selection bias here. The particularly high importance placed on nature experiences identified here, is likely attributable to people interested in outdoor recreation responding to a survey carried out for an outdoor recreation organisation. The low response rate strengthens this possibility, hence the importance of at least providing the data comparing respondents and non-responders.

***Authors’ response:*** *Please see our earlier comment. We do not believe there to be a notable selection bias as the survey was administered by a market research company to a broad demographic of the Norwegian population who were not made aware of the nature of the survey until it began. Furthermore the estimates of green exercise participation are in line with population-level estimates in Norway.*

The terms motivation(s) and motive(s) are seemingly used interchangeably through the manuscript. Each instance needs checking for correct usage, since the terms are not synonyms.

***Authors’ response:*** *Thanks for this comment. We now use the term “motive” throughout the manuscript to refer to the different items (and items groups) that represent the specific reasons/motivational factors for engaging in physical activity. We now recognise that the term “motivation” is used to refer to the broader and more complex forces that lead people to engage in physical activity.*

There are a large number of variables and therefore a considerable number of analyses performed. The potential for some significant findings being due to chance needs acknowledging.

***Authors’ response:*** *We believe that the potential for some significant findings being due to chance is actually fairly limited. This is because the statistical tests used in this study (MANOVA and Nominal logistic regression) are generally not at high risk of Type-I error (they rather expose to a higher risk of Type-II error). Regardless, there are only these two analyses presented, so we do not think this unjustly inflates familywise error considerably. Furthermore, please notice that most variables are also chosen on a theoretical basis (see paragraph 2.2.3), and the significant associations are discussed in relation with previous findings in the literature.*

As well as asking people for their motives for participation, understanding why people do not choose to take part, could be informative in understanding how to promote green exercise.

***Authors’ response:*** *We fully agree with the reviewer. However, in this specific study we have chosen to focus on the motives to engage in green exercise or other domains of LTPA because this is an under-researched topic (as also emphasized by reviewers #2 and #3). We are aware of the importance of barriers or other reasons that lead people not to engage in physical activity, and even made reference to some such barriers in the manuscript (see e.g. the reference to “lack of time” as a major barrier to physical activity, and how this is discussed in relation to the convenience motives in this study; line 446). In relation to green exercise, it is also known that environmental barriers (either physical or perceived) such as safety and accessibility of natural environments are important determinants of whether or not someone participates in green exercise (see e.g. Lee & Maheswaran, 2011). Social factors as well as the specific characteristics and features of natural environments are also important determinants of whether or not people choose to use natural environments for physical activity purposes (Calogiuri & Chroni, 2014).*

*Calogiuri, G., & Chroni, S. (2014). The impact of the natural environment on the promotion of active living: an integrative systematic review. BMC Public Health, 14, 873. doi: 10.1186/1471-2458-14-873*

*Lee, A. C., & Maheswaran, R. (2011). The health benefits of urban green spaces: a review of the evidence. Journal of Public Health, 33(2), 212-222. doi: 10.1093/pubmed/fdq068*

The reference list has many inconsistencies in style that need addressing (e.g. capitalisation; use of full and abbreviated journal titles).

***Authors’ response:*** *Thanks for noticing these inconsistencies. We have now standardised the format and style of the reference list.*

**Reviewer #2**

I thought the idea for this study was very good. From my reading of relevant research, the authors are quite right to say that we know much more about the effects of green exercise than the likelihood of people going after them. In that respect, they identify an important issue and do some valuable work in helping us get a handle on it. So I think this should be published in due course as a useful contribution to addressing this oversight.

However, I do have some suggestions about features that may need some more thought in providing the most considered / interesting account of what can be said based on these findings. I think both of my main concerns here relate to the fact that I’m a geographer, not a psychologist, and so would naturally look at these issues in a slightly different way.

1. Some more subtlety about, or at least a fuller acknowledgement of the potential difference between, nature / green things / fresh air / the outdoors would be very helpful. These are not necessarily the same things and this has implications. Fresh air can be found in non ‘natural’ environments, for example, and the natural doesn’t necessarily mean the green. This is a problem more generally evident in this field of work, but some mention of this would help. This could be dealt with through a little more qualification / explanation in terms of how the literature review data is discussed and perhaps also in places in the empirical discussion.

***Authors’ response:*** *We fully agree with this comment. The term “green exercise” is used here (as in other papers) for simplicity; conflating different forms of physical activity in natural environments not necessarily dominated by the colour green. To better clarify this point we added the following section in the manuscript:*

* *Lines 42-49: “It should be noted that the term green exercise not only refers physical activity taking place in “green” spaces (i.e. environments dominated by the presence of grass and green foliage colours); an increasingly large body of evidence show that physical activity in other natural environments, such as “blue” spaces (i.e. environments characterized by the presence of water)[White et al., 2015] and even “orange” spaces (i.e. landscapes dominated by fall foliage colour) [Paddle & Gilliland, 2016], can also provide equivalent health-effects. Irrespectively on whether green exercise is actually performed in “green” spaces or other types of environments, …”*
* *Line 158-162, where our principle components analysis is discussed: “It should be noted that although the motive “to get fresh air” might not necessarily relate to nature experiences, in this case it correlated well with the other motive “to experience nature”; furthermore, studies in the Norwegian population have previously reported that “fresh air” is often mentioned when Norwegians are asked to describe nature experiences.“*

2. Perhaps more striking to a non-psychologist, however, was the assumption that 1. motivation necessarily leads to action and that 2. the proximity of vegetation can be understood as causative in making exercise happen. If people say they like exercising outside because they like to experience nature, this doesn’t necessarily make the latter the cause. They might have found (for various interesting circumstantial reasons) that park exercise was right for them (women who may be doing this because they can then take their kids with them; older people might not feel welcome in the gym and so come to walk outside) and then subsequently found themselves in a position to state that they enjoyed it because ‘nature’ was around them. Similarly, when it is argued that proximity to green space means that people exercise outside, the issue is surely more complicated than that. More affluent groups, for example, who may already be more likely to exercise / feel an affinity with particular types of outdoor exercise (there are studies, for example, that discuss outdoor recreational running as classed) are also in a position to pay for living near what they perceive to be attractive green environments. So, in that case, it may be the class position as much as the proximity that is making green exercise happen. Finally, people may also exercise in certain environments because that is their habit (rather than because they are ‘motivated’ to do so). This is the argument pursued in the following paper, which deals with the same issue (and so probably needs to be discussed) but in a rather different conceptual and practical way:

Hitchings, R. and Latham, A. 2016. Indoor versus outdoor running: understanding how recreational exercise comes to inhabit environments through practitioner talk. Transactions of the Institute of British Geographers 41.1 503-514.

***Authors’ response:*** *We thank the reviewer for their detailed consideration of what could be deemed some of the core assumptions of this piece of work. Firstly, we recognise that the work is cross-sectional and thus determines associations rather than any causation. This is why in the limitations section (section 4.4) we highlight, as the reviewer suggests, that motivation does not necessarily lead to action: “we cannot ascribe any individual motivation to any particular episode of physical activity.” Nevertheless we also recognise the importance of motivation in having a causative pathway to action. According to a number of behavioural theories such as the theory of planned behaviour and the information-motivation-behavioural skills model, motivation arises from the coalescence of favourable attitudes, favourable subjective normative beliefs, and self-efficacy for changing behaviour. Meta-analyses have revealed that experimentally-induced changes in these antecedents leads to small-medium sized effect sizes in a variety of health behaviour change outcomes including exercise (Sheeran, P., Maki, A., Montanaro, E.j, Avishai-Yitshak, A., Bryan, A., Klein, W. M., ... & Rothman, A. J. (2016). The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: A meta-analysis.) Thus while we realise that motivation does not always lead to action, we realise that there is a causal pathway borne out by a wealth of previous research. We therefore do not feel it is imprudent to suggest that attempting to enhance particular motivations may lead to changing green exercise behaviour.*

*However, there is one instance in the text where we do not explicitly identify the correlational nature of a key finding: “experiencing nature is confirmed to be an important motivation for green exercise.” This has therefore been changed to read: “Experiencing nature is confirmed to be an important correlate of green exercise participation” (line 348-349).*

*The reviewer also questions whether proximity of vegetation can be understood as causative in making exercise happen. We assume this refers to the ‘convenience’ motivation been significantly associated with green exercise participation. Again, the reviewer is correct in saying that we can only make conclusions regarding associations between motivations to do physical activity because it is ‘convenient’ and participation in green exercise. However, we do not believe we make this contention in the paper. Where we discuss the result we state: “Another important motivational factor that distinguished green exercisers from those who mainly engage in gym- and sports-based exercise was “convenience”. This does not suggest that this relationship is causative. Even when we discuss literature that could be said to propose a causative pathway between proximity of vegetation and green exercise attainment, we still do not contend that it is causative: “individuals who live in the proximity of safe and accessible natural environments are more likely to engage in high levels of physical activity.”*

*The reviewer is correct in highlighting that habitual physical activity patterns are not well captured by the motivation items that were provided in the original survey, and that green exercise participation may be the result of an entrenched habit formation, rather than any specific motivation. We now recognise this is a limitation that could not be studied in the present analysis, and so have added the following to the second paragraph of section 4.5: “Furthermore, we recognise that participation in green exercise (or gym- or sports-based exercise) may simply be habitual behaviour, and not motivated by any specific motivation that was captured in the survey. Previous research has identified this to be the case in a sample of recreational runners based in the UK (Hitchings and Latham, 2016) using a qualitative, ethnographic approach, and similar research deserves further attention in the future as an understudied aspect of behaviour formation” (line 452-457).*

Some smaller points that occurred to me:

L34. See above – it’s surely more complicated than this.

***Authors’ response:*** *Indeed the causal relationship is more complicated, but we are not claiming a causal relationship with this line. To assuage the reviewer’s concerns we have added the following sentence: “…, although the link between natural environments, physical activity and health is likely to be complex and it is not yet fully understood [2,3].” See also our response to the reviewer’s previous comment.*

L55. Does a ‘leisure visit’ mean exercise?

***Authors’ response:*** *Not necessarily, but we know from previous research that leisure visits to natural environments, often not undertaken for health or exercise reasons, frequently incur energy expenditure through physical activity which is of a health-enhancing intensity (Elliott et al., 2015 – we cite this paper in the introduction). The physical activity incurred on such visits could be said to be incidental, but could be the same as what participants in the present study are recalling. Hence, while leisure visits are not equal to physical activity, we believe it is not too misleading to discuss them together since they so frequently involve physical activity.*

*Elliott, L.R.; White, M.P.; Taylor, A.H.; Herbert, S., Energy expenditure on recreational visits to different natural environments. Social science & medicine (1982) 2015, 139, 53-60.*

L63. But ART is not the only theory out there that is relevant (though it may be the most popular). I’d be inclined to say that a body of work using this theory has shown x and y…otherwise this paragraph feels rather disconnected from the whole piece.

***Authors’ response:*** *We mentioned ART as it provided a theoretical framework explaining the fact that when people exercise in contact with nature, they might be more prone to direct their attention towards the external environment, as opposed as exercising in indoor settings, in which the attention is often driven towards internal feelings such as exertion and fatigue (Calogiuri, Nordtug, & Weydah, 2015; Harte & Eifert, 1995). We do agree however with the reviewer that the way ART is presented here appears somewhat disconnected. To avoid lengthening this manuscript further, we have removed this section, and rather rely only on the model proposed by Calogiuri & Chroni (2014) as a theoretical framework for our study.*

*Calogiuri, G.; Chroni, S., The impact of the natural environment on the promotion of active living: An integrative systematic review. BMC Public Health 2014, 14, 873.*

*Calogiuri, G.; Nordtug, H.; Weydahl, A., The potential of using exercise in nature as an intervention to enhance exercise behavior: Results from a pilot study. Perceptual and motor skills 2015, 121, 350-370.*

*Harte, J.L.; Eifert, G.H., The effects of running, environment, and attentional focus on athletes catecholamine and cortisol-levels and mood. Psychophysiology 1995, 32, 49-54.*

L141. Why is ‘because I have to’ a ‘body oriented benefit’ (could be affective)?

***Authors’ response:*** *Hypothetically, yes. However, please notice that the grouping of the items was performed using a principle components analysis, which clearly matched this item together with other “body-oriented” beliefs (notice also that this item had the second highest factor loading in the category). This suggests that, in this case, “I have to” rather relates to body-oriented beliefs (e.g. “I have to because I know it is healthy”).*

L51. Is this reference about exercise? More generally, I’d say the literature review would do well to keep its focus on exercise (otherwise there are very many qualitative studies of the perceived benefits of being in nature that could be discussed)

***Authors’ response:*** *We appreciate that sometimes we discuss literature on leisure visits, while at other times we refer to literature explicitly on physical activity in natural environments and that these could appear conflated. However, as with our earlier response, these references are carefully chosen as we know that leisure visits frequently incur physical activity (albeit often incidentally) which is of a health enhancing intensity. These references are also chosen as such visits could well be the kinds of physical activity experiences that are recalled by the respondents in the present study (rather than structured exercise experiences).*

L216. One of the things that was interesting in this chart was how education level didn’t seem to make a difference in terms of how much nature experience is prioritised in Norway. I think this paper may suggest a different situation in the UK:

Burton N, Khan A and Brown W 2012 How, where and with whom? Physical activity context preferences of three adult groups at risk of inactivity British Journal of Sports Medicine 46 1125–31

***Authors’ response:*** *We do agree with the reviewer. However, because the focus of this paper is on motivation, we choose not to discuss this issue here (education was treated as a potential confounder only, not a key predictor). There has however been recently published findings in IJERPH based on this same dataset in which the issue is explored more thoroughly:*

*Calogiuri, G.; Patil, G.G.; Aamodt, G., Is green exercise for all? A descriptive study of green exercise habits and promoting factors in adult norwegians. International journal of environmental research and public health 2016, 13, 1165.*

L226. I read this as telling me that Norwegians seem to agree with the evidence that green environments can leads to positive affect. This is potentially something to return to in discussion of implications (working with what both scientists and publics already seem to know etc.)

***Authors’ response:*** *Indeed, the reviewer’s contention is borne out in the popular Friluftsliv (outdoor recreation) philosophy in Norway, and this perhaps deserves ethnographic exploration in future work. However, we are not sure that our data confirm this same contention, principally because of their cross-sectional nature. We understand however that this sentence might be somewhat misleading, so we have rephrased as follows: “Finally, higher importance assigned to “affective benefits” was associated with…” (Line 270-272).*

L303. Here I find myself asking whether these exercisers were motivated by the presence of greenery at the start. Following the logic of the studies mentioned earlier that hint at how people can feel good about green exercise in a way that then encourages them to keep going, I feel the study could be telling us about how different ‘tribes’ of green and non-green exercisers may have developed in Norway (which leads to some interesting suggestions in terms of public engagement).

***Authors’ response:*** *We agree with this reflection, and actually there are studies indicating that positive attitudes towards nature do not necessarily precede the choice to visit natural environments and engage in green exercise, but rather this is the result of a more complex process that involves exposure to nature as well as previous experiences in nature especially during childhood. In such a scenario, nature experiences, positive affect, feelings about nature and motivation to engage in green exercise would be better described by a circular (self-sustaining) model, like the one presented by Calogiuri & Chroni (2014). Furthermore, we only look at motivations generally and preferred leisure-time physical activity domains generally, therefore, as we state in our limitations, we cannot ascribe any individual motivation to any particular episode of physical activity.*

*Calogiuri, G., 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 2016, 13, 439.*

*Calogiuri, G.; Chroni, S., The impact of the natural environment on the promotion of active living: An integrative systematic review. BMC Public Health 2014, 14, 873.*

*Mayer, F.S.; Frants, C.M.; Bruehlman-Senecal, E.; Dolliver, K., Why is nature beneficial?: The role of connectedness to nature. Environment and Behavior 2009, 41, 607-643.*

*Thompson, C.W.; Aspinall, P.; Montarzino, A., The childhood factor: Adult visits to green places and the significance of childhood experience. Environment and Behavior 2007.*

L312. See my earlier point about how it’s more complicated than proximity.

***Authors’ response:*** *We agree that proximity (or ‘convenience’ in our nomenclature) of ‘green-ness’ does not cause physical activity. We only ever contend throughout the paper that there is an association between motivations for physical activity generally, and preferred leisure-time physical activity domains generally. As we explain in the limitations: “we cannot ascribe any individual motivation to any particular episode of physical activity” (see also our earlier comment to this reviewer’s second major point). As we also explain in our earlier response; despite this, we recognise the importance causal influences of motivation on behaviour that are demonstrated in numerous other studies in behavioural science.*

L398. Personally I found the ending rather flat. I wonder whether the findings could be pushed further in terms of how they suggest specific populations could be engaged (especially in view of the journal title). Could we make green environments more attractive to those who want to work on their bodies? Or should we give up on the gym rats because they’ll never learn the enjoyments of exercise outside? What ideas for effective green exercise promotion do the authors see as coming out of their findings? I imagine that we should emphasise how these results are specific to Norway too (there’s more to be done in terms of understanding the same issues elsewhere).

***Authors’ response:*** *We have now added a new section in which we discuss in a clearer way how the findings of this study could be used in future efforts to promote green exercise (Section 4.4, from line 403).*

**Reviewer #3**

This is a very well presented article addressing the important and under-researched issue of what motivates people to engage in green exercise. I found the article to be engaging throughout and could find no major issues requiring substantive correction.

The Introductory section presents a good overview of the topic leading to clear presentation of the research questions that underpin the work. The Methods section is very detailed and describes an analytical strategy that appears to make the most of the data deployed in the study. The Results are also clearly presented and the remainder of the paper provides a strong level of reflection on the results and limitations of the work.

I therefore recommend the paper to be suitable for publication following a few minor corrections:

1. Line 39-40: I feel it would be more accurate to state that “promotion of green exercise is likely to relieve some of the health and economic burdens placed on society through inactivity as well as promote health in a broader sense.”

***Authors’ response:*** *We have made the requested change (line 49-51).*

2. Typo Line 337 - currently states: “Males, those with higher education, those who have small children in the household, those who live in rural areas and those who engage in greater amounts of instrumental physical activity during a regular week were more likely to engage in green exercise than in gym- based exercise.” However, on Line 232 it is stated that: “Being male, of lower education, having young children in the household, living in a rural area and engaging in more instrumental physical activity in a typical week were associated with a higher likelihood of green exercise compared to gym- based exercise.”

3. I would be inclined to assume, in regards to the conflicting statements on educational attainment mentioned above, that the statement on Line 337 is the correct one. However, if this isn’t the case, could the authors please add a few sentences explicitly reflecting on the possible reasons why those with lower educational attainment may be more likely to undertake green exercise compared to gym-based exercise?

***Authors’ response:*** *Thanks for noticing these typos – it was indeed lower education that predicted green exercise, as stated at line 232. We have now corrected the sentence at line 388. Please notice that, as remarked by the sentence “These findings are in line with, and at the same time extend, previous analyses in the same sample [Calogiuri, Patil, and Aamodt, 2016]” (line 397-398), this manuscript is related to another publication in IJERPH which explored more thoroughly the relation between green exercise and a number of socio-demographic variables. To avoid redundancies and to maintain the focus on the motivation issue, we have therefore chosen not to discuss in this manuscript the possible reasons explaining such associations.*

*An explanation for such phenomenon that was provide in Calogiuri, Patil, and Aamodt (2016), is that exercising in the gym is likely to be more subjected to a social gradient. For example, exercising in a gym requires (in most cases) a fee that some may consider costly; on the other hand, in Norway most people have access to natural environments where they can walk or exercise free of charge (this might be especially the case if one consider that educational accomplishment is often associated with a person’s economic status). Moreover, figures in the Norwegian population show that individuals with lower educational accomplishment are less engaged with structured exercise, but apparently green exercise is yet offer to these individuals the opportunity to engage in some physical activity.*

*Calogiuri, G.; Patil, G.G.; Aamodt, G., Is green exercise for all? A descriptive study of green exercise habits and promoting factors in adult Norwegians. International journal of environmental research and public health 2016, 13, 1165.*

4. Typo Line 327 – currently states: “as a suitable arenas for their exercise” Should it be “as suitable arenas…” or “as a suitable arena…” ?

***Authors’ response:*** *Thanks for noticing this typo, which we have now corrected (line 378).*

5. A minor stylistic point, but use of the italicised font in Tables 2 and 3 is, in my opinion, quite difficult to read.

***Authors’ response:*** *Thanks for reporting this. Should this manuscript proceed to publication, we will consult with the editor and publishers as to how to present the table content.*