Journal of Environmental Psychology 37 (2014) 1–7

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

Analyzing the mediators between nature-based outdoor recreation and emotional well-being

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ARTICLE INFO

Article history:
Available online 13 November 2013

Keywords:
Outdoor recreation
Nature
Physical activity
Well-Being
Restorative experiences

ABSTRACT

The evidence concerning the relative importance of physical activity, restorative experiences, and social interaction as mediators between exposure to nature and well-being has been inconsistent. We investigated whether there is a relationship between the average time used for nature-based recreation and emotional well-being and whether it is mediated through restorative experiences, social company and the perceived duration of the most recent nature-based recreation visit.

A sample of 3060 Finnish people (38.3% response rate) aged 15–74 years participated in a survey using an internet and a mail questionnaire.

Multiple mediation analysis using bootstrapping revealed an association between the self-reported participation in nature-based recreation and emotional well-being through restorative experiences when adjusting for age, gender, household income, the level of leisure time physical activity, and the frequency of active transportation. The amount of social company or the duration of the most recent nature-based recreation visit did not mediate the association between the average time spent on nature-based recreation and emotional well-being.

The result accords with the evidence of the restorative and well-being effects of nature exposure but more evidence of causality and studies comparing different mediators in different population groups are needed.

1. Introduction

There is plenty of evidence that access and exposure to natural, especially green spaces may enhance the well-being of people living in urban environments. The evidence includes epidemiological studies on green space and decreased mortality (Mitchell & Popham, 2008; Richardson & Mitchell, 2010; Richardson et al., 2012; Takano, Nakamura, & Watanabe, 2002) and decreased morbidity (Maas, Verheij, deVries, Spreeuwenberg, Schellevis, & Groenewegen, 2009), experimental studies indicating physiological, attentional and emotional stress-recovery in green space (Bowler, Buyung-Ali, Knight, & Pullin, 2010), intervention studies indicating positive effects of garden therapy on depressive patients (Gonzalez, Hartig, Patil, Martinsen, & Kirkevold, 2011; Kim, Lim, Chung, & Woo, 2009), and descriptive and experimental studies indicating that favourite nearby places provide stress-alleviating experiences and serve emotion-regulation (Korpela & Ylén, 2009; Korpela, Ylén, Tyrväinen, & Silvennoinen, 2010).

At least three major mechanisms explaining the relationship between the amount of green space in the residential area, access or exposure to green environments, well-being, and health have been hypothesized in recent literature (de Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Maas, Verheij, et al., 2009; van Herzele & de Vries, 2012; Ward Thompson & Aspinall, 2011). These mechanisms include 1) physical activity, 2) restorative, stress-alleviating experiences, and 3) social interaction, cohesion and/or safety. First, green space in one's living environment may lead people to spend a larger part of their spare time outdoors and be physically more active (de Vries et al., 2011). Indeed, there is a body of theoretical and empirical evidence of the importance of environmental influences on neighbourhood walking and physical activity (Giles-Corti & Donovan, 2002; Humpel et al., 2004). However, one study reports no association between the percentage of green space around the

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http://dx.doi.org/10.1016/j.jenvp.2013.11.003

respondent's home and the level of physical activity (Maas, Verheij, Spreeuwenberg, & Groenewegen, 2008).

Second, a consistent finding in experimental studies on restorative environments is that walking in green, natural environments, compared to built environments without natural elements, especially after negative antecedent conditions, such as attentional fatigue (Kaplan & Kaplan, 1989) and psychophysiological stress (Ulrich, 1983), produces greater physiological changes toward relaxation, greater changes to positive emotions and vitality, and faster recovery of attention-demanding cognitive performances (Berman, Jonides, & Kaplan, 2008; Hartig, Evans, Jamner, Davis, & Gärling, 2003; Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2010; Ryan et al., 2010).

Third, green space may also contribute to social cohesion, sense of community and feelings of safety by creating vital neighbourhood spaces for social interaction (Wood & Giles-Corti, 2008). For individuals living in inner-city apartment buildings, well-used, urban green spaces have been linked to stronger ties to neighbours and a greater sense of safety (Kuo, Sullivan, Coley, & Brunson, 1998; Kweon, Sullivan, & Wiley, 1998). More green space in people's living environment has been associated with a greater sense of social safety except in very strongly urban areas (Maas, van Winsum-Westra, Verheij, Spreeuwenberg, & Groenewegen, 2009). Nearby green areas may draw the residents into the spaces near their homes, promote opportunities for social contact and increase informal surveillance, potentially reducing crime (Sullivan, Kuo, & DePooter, 2004). A Dutch study showed that loneliness and perceived shortage of social support partly mediated the relation between the percentage of green space around the respondent's home and health indicators (perceived general health, the number of health complaints and people's self-rated propensity for psychiatric morbidity) (Maas, van Dillen, Verheij, & Groenewegen, 2009).

Studies that have specifically tested the relative importance of all three or even more mediating mechanisms are few and the evidence is inconsistent. A survey study in two urban neighbourhoods ($N = 190$) in Belgium included physical activity, perceived stress, ability to concentrate, which is an aspect of restorative experiences, social cohesion and neighbourhood satisfaction as mediators between greenness of the local environment (availability of nearby green areas and presence of streetscape greenery) and well-being (self-reported general health, somatic complaints and happiness) (van Herzele & de Vries, 2012). The results indicated that only neighbourhood satisfaction was a significant mediator; it fully mediated the relationship between neighbourhood greenness and happiness. An Australian survey study included walking for recreation and transport, social coherence and local social interaction as possible mechanisms between perceived neighbourhood greenness and physical and mental health, including emotional problems (Sugiyama, Leslie, Giles-Corti, & Owen, 2008). The results indicated that recreational walking explained the link between perceived greenness and physical health, whereas the relationship between perceived greenness and mental health was partly accounted for by both recreational walking and social coherence. A Dutch survey study of the residents of 80 neighbourhoods indicated that stress and social cohesion but not physical activity mediated the relationship between the availability of green space and well-being (perceived general health, somatic complaints and mental health status) (de Vries, van Dillen, Groenewegen, & Spreeuwenberg, 2009).

In only one of these studies was a specific measure of restoration used. This was the ability to concentrate, which has been shown to improve in a restorative process (Berman et al., 2008), but was measured with trait-like statements ("Once I am busy with something I am not easily distracted"); no evidence of mediation was reported (van Herzele & de Vries, 2012). Two of the studies measured perceived stress, an antecedent of restoration with trait-like statements "Usually, I feel quite nervous" (van Herzele & de Vries, 2012) or within a recent time-period "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them" (Sugiyama et al., 2008); no evidence of mediation was reported.

Our contribution to this line of research is to include not only restorative experiences as mediators but also to tie them to the most recent nature-based outdoor recreation visit as state-like measures. Our second contribution acknowledges social contacts as a potential mediator measured by social company in the most recent visit. An increasing body of studies has indicated that psychological benefits of outdoor walks may depend on the immediate social context (Johansson, Hartig, & Staats, 2011; Staats, van Gemerden, & Hartig, 2010). Furthermore, previous studies on physical activity as a mediator have used weekly hours (van Herzele & de Vries, 2012), weekly frequency, and daily duration of activity (Sugiyama et al., 2008; de Vries et al., 2009). We used the perceived duration of the most recent nature-based recreation visit as a mediator, because we wanted to tie all our mediators to the most recent visit. Moreover, to our knowledge, there are no studies examining the average time used for nature-based recreation as an independent variable. None of the above measures of physical activity acknowledges the differences in the intensity of different types of physical activity. However, the evidence concerning the relationship between the intensity of physical activity and well-being is scarce and contradictory (Bauman, 2004; Netz, Wu, Becker, & Tenenbaum, 2005; Oweis & Spinks, 2001). Nevertheless, it seems that moderate or high-intensity rather than low-intensity exercise is associated with decreased symptoms of depression and anxiety (Conn, 2010; Ströhle, 2009) although high-intensity exercise may also worsen mood (Peluso & de Andrade, 2005). In this study, the respondents reported the type of activity during their latest nature-based recreation time but we were not able to measure the intensity of physical activity. However, as a control, we measured the self-reported overall level of leisure time and the frequency of active transportation among our respondents.

Our last contribution concerns the types of natural environments. The percentage of greenness in the living environment (used often in the previous studies) does not measure the actual use of green space. Moreover, research on stress restoration has indicated that blue spaces, i.e. water environments, also have restorative impacts (Völker & Kistemann, 2011). Studies on green space in winter, i.e. white space, are practically lacking (Perkins, Searight, & Ratwick, 2011). Thus, we measured nature-based recreation which due to the timing of our surveys could take place both in green, white and blue spaces.

Emotional well-being including happiness has been used as a dependent variable in earlier studies (Sugiyama et al., 2008; van Herzele & de Vries, 2012) but not in a relation to the duration of the most recent nature-based recreation visit as in our study. A meta-analysis comparing measurements of well-being in natural vs. urban environments showed that the most consistent evidence concerned emotional outcome as the strongest restorative outcome of nature exposure; activity in the natural environment produced a significant decrease in negative feelings (anger, sadness, anxiety and fatigue) and increase in positive mood (tranquillity and energy) (Bowler et al., 2010). Thus, we considered emotional well-being as a suitable dependent variable for the current study.

To summarize, we investigated whether there is a relationship between the average time used for active nature-based recreation and emotional well-being and whether it is mediated through restorative experiences, social company and the perceived duration of the most recent nature-based recreation visit. This implies a multiple mediation model (Fig. 1) (Preacher & Hayes, 2008).

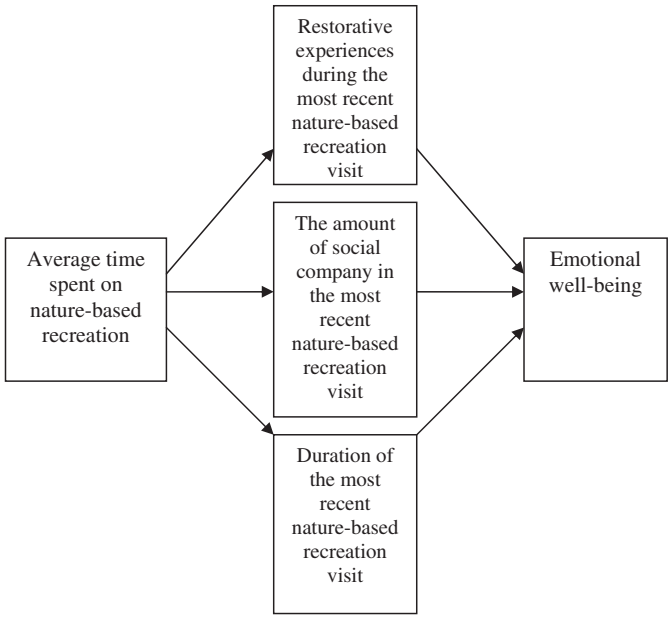

Fig. 1. The multiple mediation model.

Although the evidence concerning the relationships between emotional well-being, age, gender, and household income is complicated and inconclusive (Diener, Suh, Lucas, & Smith, 1999), we decided to adjust for these variables in our model. We also adjusted for the self-reported overall level of leisure time physical activity and the frequency of active transportation.

2. Method

2.1. Sample and procedure

The data for this study were obtained from the Finnish national outdoor recreation demand inventory (LVVI) that is a large survey study measuring outdoor recreation in Finland. In all, Statistics Finland collected six survey rounds of data in 2009–2010. The current data on nature-based recreation and well-being was collected in winter and spring 2009 in two survey rounds. A random sample of Finns aged 15–74 years was drawn from the population register. The overall sample size was 8000 persons and 3060 (38.3%) persons participated in the survey. The data were collected using an internet survey or by mail. In the first round, 63.2% of the respondents responded on the internet, 53.5% were women and 60.2% were over 45 years of age. In the second round, 62.5% responded on the internet, 57.4% were women and 58.7% were over 45 years of age. Ethical permission was not needed for LVVI-study, as national regulations for medical studies exclude postal surveys.

A non-response study with five telephone interview questions was carried out in December 2010 including the non-respondents from the autumn 2010 survey (Virtanen, Nyberg, Salonen, Neuvonen, & Sievänen, 2011). The non-response study was based on a random sample; the number of completed telephone interviews was 301 and the response rate was 41.8%. Note that the non-response analysis is based on a different survey round than in the present study. However, we have no reason to believe that the random samples would be basically different in the year 2010 compared with the year 2009. Based on the interviews, the respondents and non-respondents did not significantly differ with regard to their participation in outdoor recreation. According to the respondents, the most suitable way of answering was the internet. Thus, this mode of responding is not a likely reason of bias in our data; around 84% of Finnish households had an internet connection at the time of the survey (Suomen virallinen tilasto, 2011).

2.2. Measures

From a 20-page questionnaire we used the following variables:

2.2.1. The average time spent on nature-based recreation – the independent variable

The respondents were asked to estimate the time used for nature-based recreation with a single item ("How much of your leisure time do you use for nature-based recreation (e.g. physical activity in nature, berry-picking, fishing, hunting)?") with a four-point Likert scale (1 = not at all or very little, 4 = very much).

2.2.2. Restorative experiences during the most recent nature-based recreation visit – potential mediator

Restorative experiences were measured with the Restoration Outcome Scale (ROS) (Korpela & Ylén, 2009). The scale includes nine items. In accordance with the previous measures and findings of restorative outcomes (Hartig, Lindblom, & Ovefelt, 1998; Staats, Kieviet, & Hartig, 2003), three of the items reflected relaxation and calmness ("I calmed down", "I restored and relaxed", "I got new spirit for my everyday routines"), one item reflected attention restoration ("My concentration and alertness increased"), two items reflected clearing one's thoughts ("I forgot everyday worries", "My thoughts were clarified"), two items reflected subjective vitality ("My vitality and energy increased", "I gained faith in tomorrow"), and one item reflected self-confidence ("I became more self-confident"). The response scale was a 7-point Likert scale from 1 = not at all to 7 = completely. Based on a factor analysis (principal axis factoring, oblique direct oblimin-rotation, KMO = .93, h^2 = .55 – .75, factor loadings = .74 – .87) producing one single factor, we computed a mean summary score (Cronbach alpha = .94) for the ROS.

2.2.3. The amount of social company in the most recent nature-based recreation visit – potential mediator

The respondents were asked first whether they were alone and if not, then "the number of people (including themselves) participating in their most recent nature-based recreation visit" with a 6-point scale (2, 3, 4, 5, 6–10, or over 10 persons). To include aloneness, it was recoded to a 5-point scale (1 = alone, 2 = 1 person with me, 3 = 2 persons with me, 4 = 3 persons with me, 5 = four or more persons with me).

2.2.4. Duration of the most recent nature-based recreation visit – potential mediator

The respondents were asked to estimate the duration open-endedly in hours or minutes or both. Total hours were used in the analyses. This question has been used in a similar national outdoor recreation demand inventory also in the year 2000 (Sievänen, 2001). The most recent nature-based recreation visit included only such nature-based recreation that included physical activity. The following winter and summer activities (selected from a structured list) were included: walking for pleasure or fitness, Nordic walking, jogging, walking or training the dog, orienteering, bicycling or cross-country bicycling, rock-climbing, cross-country horseback riding, golf, cross-country skiing, tour skating, and snowshoeing. Thus, we excluded motorized activities such as snowmobile driving and less intensive activities like sunbathing, picnics, and observing or photographing nature. We compared the distributions of the activities of our two rounds with the

distributions of rounds 1–4 including the similar question and found out that the frequency of walking for pleasure or fitness, Nordic walking, walking or training the dog, and jogging showed no seasonal differences. In the winter survey, cycling and orienteering were underrepresented. In the spring survey, cycling was over represented and cross-country skiing and tour skating underrepresented. Other activities did not show significant seasonal differences.

In this context, we also asked about the physical characteristics of the location of the most recent nature-based visit with yes/no statements about the presence of a lake or a pond, a river or a stream, a forest, grass and plantations, fields or meadows.

2.2.5. Emotional well-being – the dependent variable

Emotional well-being perceived during the last four weeks was measured with five items which comprise the Emotional Well-Being subscale in the Finnish version of the RAND 36-item health survey 1.0 (Aalto, Aro, Aro, & Mähönen, 1995; Hays, Sherbourne, & Mazel, 1993). RAND 36 is a widely used health-related quality of life survey instrument that has been validated in several countries (Hays & Morales, 2001). The convergent and divergent validity and internal consistencies of the scales have been investigated in the Finnish version (Aalto et al., 1995). The items were "Have you been a very nervous person?, Have you felt so down in the dumps that nothing could cheer you up?, Have you felt calm and peaceful?, Have you felt downhearted and blue?, Have you been a happy person?". The original response scale was used; this is a 6-point Likert scale from 1 = all the time to 6 = not at all. For the mean summary score, the scale was recoded to a 0–100 percentage scale (where 100 means high emotional well-being) according to the RAND 36-manual (Aalto et al., 1995).

2.2.6. The overall level of leisure time physical activity – a covariate

The overall level of physical activity was measured with a single self-report question ("How often do you engage in leisure time physical activity that lasts 20 min at minimum and that at least mildly gets you out of breath or causes sweating? Exclude active transportation"). The response scale was a 5-point Likert scale from 1 = less than once a week to 5 = five times per week or more often. In our measure, we used the recommendation of 20 min per activity bout and the response options that have been widely used in previous Finnish population studies (e.g. Peltonen et al., 2008).

2.2.7. The frequency of active transportation – a covariate

The frequency of active transportation was measured with a question "How often do you walk or cycle to work or engage in other types of physical activity while commuting or dealing with everyday tasks (e.g. shopping, running errands)?". The response scale was a 5-point scale from 5 = daily or almost daily around the year, 4 = 2–3 times per week around the year, 3 = daily or almost daily during the summer, 2 = 2–3 times per week during the summer, 1 = less often or infrequently.

2.2.8. Household income – a covariate

Household income was measured with a single question ("How large, on average, is your monthly household income without reducing taxes (= gross income) and including taxable social security benefits?"). The response scale was an 11-point Likert scale from 1 = 1000 euro or less, 2 = 1001–2000 euro, 3 = 2001–3000 euro, 4 = 3001–4000 euro, 5 = 4001–5000 euro etc. to 11 = over 10,000 euro.

Register-based age and gender were included as additional covariates.

2.3. Statistical analysis

In order to achieve adequate statistical power and to assess the mediation hypothesis (the indirect relationship between an independent and dependent variable via mediator variables) with more statistical rigour than in the "traditional" mediator variable approach (based on ordinary regression analyses; Baron & Kenny, 1986), we used non-parametric bootstrap sampling (MacKinnon, 2008; Preacher & Hayes, 2008). To clarify the possibly recursive direction of the relationship between time spent in nature-based recreation and emotional well-being, we also investigated the reversed direction of this relationship (Table 2). Thus, we reversed independent (X) and dependent (Y) variables in our multiple mediation model. This analysis tries to tackle the problem of "conditional probability" by analyzing whether the sizes of the indirect paths ("effects") and the amount of explained variance is equal in both directions (from X to Y, and Y to X).

For both multiple mediation models, we used 5000 bootstrap resamples utilizing an SPSS macro (Preacher & Hayes, 2008). When bootstrapping the sampling distribution of the indirect effects (of X on Y), resamples from the original sample are repeatedly taken and estimates for the indirect effects are derived from the resampled data set. Such a method does not impose the assumption of normality of the sampling distribution, it provides high statistical power and reduces the likelihood of Type I error (MacKinnon, 2008; Preacher & Hayes, 2008). Point estimates and the bias-corrected and accelerated (BCa) 95% confidence intervals of the unstandardized regression coefficients were derived. When the confidence interval does not include a value = 0, the coefficient is significantly different from zero. Although the coefficients are unstandardized, all the mediators of the same $X \rightarrow Y$ effect are quantified in the same metric of the dependent variable allowing for contrast tests of the mediators (Preacher & Hayes, 2008).

3. Results

To test the model of multiple mediators with non-parametric bootstrap resampling, we started with correlating our variables with Spearman's rho (Table 1) because multicollinearity may attenuate the effects of the mediators in a similar fashion as in multiple regression (Preacher & Hayes, 2008). The criterion for acceptable multicollinearity among the mediators was less than 10% of common variance (rho $\leq$ .32). No multicollinearity was detected. Only restorative experiences had significant correlations (positive) to both independent and dependent variables which also correlated positively to each other. All the covariates except gender were significantly correlated to emotional well-being.

Table 2 shows that the model is statistically significant and explains 6.9% of the variation in emotional well-being. The simple relationship ("total effect") between the average time spent on nature-based recreation and emotional well-being is positive and significant (B = .53; *BCa 95% CI* is between .24 and .98, the interval does not include zero). Only restorative experiences mediate the connection between the average time spent on nature-based recreation and emotional well-being. The size of the indirect "effect" from the average time spent on nature-based recreation through restorative experiences to emotional well-being is B = .48 (*BCa 95% CI* is between .20 and .91). Social company and the perceived duration of the most recent nature-based recreation visit were not significant mediators.

Ninety percent of our respondents reported that their most recent nature-based recreation visit included forest, 48% reported the presence of fields or meadows, 54% grass or plantations, 46% a lake or a pond, and 41% a river or a stream.

Table 1
Means, standard deviations and correlations (Spearman rho) between the variables in the mediation model, selected winter and summer activities ($N = 1139 - 1653$ due to missing data).

	M	SD	2.	3.	4.	5.
1. Average time spent on nature-based outdoor recreation (score 1–4)	2.70	.86	.22**	−.08**	.13**	.14**
2. Restorative experiences during the most recent nature-based recreation visit (score 1–7)	4.82	1.03		−.03	.09**	.21**
3. The amount of social company in the most recent nature-based recreation visit (score 1–5)	1.63	.95			.23**	−.02
4. Duration of the most recent nature-based recreation visit (hrs.)	1.38	1.15				.05*
5. Emotional well-being (score 0–100)	77.47	15.45				
Covariates:						
The overall level of leisure time physical activity (score 1–5)	3.29	1.22				.14**
Frequency of active transportation (score 1–5)	3.82	1.40				.08**
Household income (score 1–11)	4.48	2.30				.11**
Age	44.94	15.82				.21**
Gender (0 = male)	Female 58.3%					−.01

* = $p < .05$; ** = $p < .01$.

Because adding several covariates reduced the sample size substantially and while active transportation and leisure time physical activity correlated (rho = .13, $p = .000$), we also ran our main mediation model without commuter and transport-related physical activity. The result remained robust (Adj $R^2 = .089$, $n = 1127$) with a significant relationship ("total effect") between the average time spent on nature-based recreation and emotional well-being ($B = .56$; SE = .17; BCa 95% CI = .28 − .94) and the restorative experiences ($B = .59$; SE = .16; BCa 95% CI = .32 − .96) being the only significant mediator.

When reversing the independent (*X*) and dependent variables (*Y*) (Adj $R^2 = .130$, $n = 820$), the total effect of emotional well-being on the average time spent on nature-based recreation was very small but significant ($B = .002$; SE = .001; *BCa 95% CI* = .0008 − .003). Again, only restorative experiences were a significant mediator with a very small coefficient ($B = .001$; SE = .001; *BCa 95% CI* = .0006 − .003).

Table 2
The bootstrap point estimates (unstandardized regression coefficients B), their standard errors (SE) and 95% confidence intervals (CI, lower and upper bounds) for the indirect effects of the mediation model between the average time spent on nature-based recreation and emotional well-being; selected winter and summer activities ($N = 820$; 5000 bootstrap samples; Adj $R^2 = .069$, $p = .000$).

Mediators	Point estimate, B	SE	Bias-corrected and accelerated (BCa) 95% CI (confidence interval) of the coefficients.	
			Lower	Upper
Restorative experiences during the most recent nature-based recreation visit	.48	.18	.20	.91
The amount of social company in the most recent nature-based recreation visit	.03	.04	−.02	.17
Duration of the most recent nature-based recreation visit	.03	.05	−.04	.17
TOTAL	.53	.18	.24	.98

Note: When the confidence interval does not include a value = 0, the coefficient is significantly different from zero. The model also includes the total effect (TOTAL) which is the simple relation between IV (independent variable) and DV (dependent variable) without controlling for other variables.

4. Discussion

This survey study found an association between the self-reported participation in nature-based recreation and perceived, recent emotional well-being. Nature-based recreation included activities both in green, blue, and white (in the wintertime) spaces. Studies that have specifically tested the relative importance of several mediating mechanisms between nature-based recreation and well-being are still few and the evidence remains inconsistent. This study adds evidence to the importance of restorative experiences as a mediator between the participation in nature-based recreation and emotional well-being. We found evidence that restorative experiences in the most recent nature-based recreation visit but not the amount of social company or the duration of the visit mediated the association between the average time spent on nature-based recreation and emotional well-being. The overall level of leisure time physical activity, the frequency of active transportation, age, gender and household income were adjusted for in the analysis. This result differs from a previous study where attention restoration did not mediate between the greenness of the local environment and well-being. The difference might be due to the fact that in the current study, restorative experiences were measured with state-like items in contrast to items reflecting a general, trait-like ability to concentrate in the previous study (van Herzele & de Vries, 2012). Thus, the present result refers to the importance of experiencing calmness, getting new spirit and vitality for the everyday routines, forgetting everyday worries, clarifying one's thoughts, and gaining faith in tomorrow during nature-based recreation. As these experiences rather than the duration of the visit were important, we might re-recommend our previous idea of "favorite place prescriptions" for public health purposes (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008). In these prescriptions, people are advised to visit natural favourite places in the vicinity and report their experiences in them. The aim is to sensitize people to their physical environment and divert the focus of health counselling away from physical exercise per se in population groups who are inactive or insensitive to exercise prescriptions.

In our data, 90% of the respondents reported the presence of a forest and 46% a lake or a pond in their most recent nature-based recreation visit. In the winter survey round, there was also snow so that our data consists of green, blue and white environments. For environmental management and planning, however, it would be advantageous in future research to get a better and more detailed description of the nature environments which best provide restorative experiences. It is known that the demand for various nature-area qualities is culturally dependent and varies throughout Europe. In Finland, as in Sweden and Norway, people have relatively close bonds to nature and are still familiar with using and experiencing relatively large nature areas, often forests, even in urban areas (Tyrväinen, Mäkinen, & Schipperijn, 2007).

The present negative results concerning social company and the duration of the recreation visit also differ from those studies that have measured similar but not identical mediators: there is

evidence of recreational walking and social coherence as mediating mechanisms between the availability of residential green space and aspects of well-being (Sugiyama et al., 2008; de Vries et al., 2009). Our national, heterogeneous sample including people with various recreation motives may have masked the effect of social company which may be important in some population subgroups such as among elderly women for safety reasons or among "social self-developers" willing to meet new people in nature recreation (see Konu & Kajala, 2012). In general, however, the motives linked to experiencing peace and quietness as well as solitude rank relatively high among Finns (Silvennoinen & Tyrväinen, 2001). Furthermore, as the mediators describe only the most recent recreation visit and we had no information about the typicality of this visit, the relations of our variables may differ from the average situation in the respondents' lives. Thus, we are reluctant to conclude on the basis of the present study that social company or duration of the visit are generally irrelevant or unimportant but further comparative studies in these lines are called for.

Despite the survey was conducted in winter and spring 2009, we found no strong seasonal effects. We compared the frequency of the activities in our two survey rounds with rounds 1–4 including the similar question and found out that the frequency of walking for pleasure or fitness, Nordic walking, walking or training the dog, and jogging showed no seasonal differences – these are among the most popular close-to-home outdoor activities in Finland in all four seasons (Sievänen & Neuvonen, 2011). Thus, our result can most reliably be generalized to these outdoor activities. A more detailed analysis and categorisation of activities according to, for example, their level of intensity is called for in future studies.

Methodological limitations of our study include the sample size which decreased in the mediation models because of missing data and pre-selected activities during the most recent nature-based recreation visit. The data is also biased according to gender and age: females were more active than males and the respondents older than 45 years were more active than the younger age groups to respond to this survey. Thus, the results can not be generalized to the Finnish population without further studies. Other limitations include self-report measures, partly with single items, precluding the assessments of reliability. It is also common knowledge that self-report measures may suffer from social desirability, agreeing and memory bias effects (Cooper, 1998).

Our results also showed that the relationship between nature-based recreation and emotional well-being may go in both directions, but the strength of the indirect path ("effect") from the average time spent in nature-based recreation through restorative experiences to emotional well-being was significantly higher ($B = .48$) than in the reversed model ($B = .002$). Thus, our correlational main result indicates that the longer time in nature-based recreation associated with restorative experiences the better emotional well-being perceived four weeks backwards. However, the direction of this relationship and causality can be adequately solved only by using a longitudinal design, the lack of which is a limitation of our study.

Competing interest

None to declare.

Contributorship statement

All the authors had a substantial contribution to the conception and design, interpretation of data, revising the article draft critically for important intellectual content, and final approval of the version published. There is no one else who fulfils the criteria but has not been included as an author.

No permission from the ethics committee was needed for this study.

Acknowledgements

We are thankful for our colleagues Tuija Sievänen, Eeva Karjalainen, and Eija Pouta who belong to the research team and took part in the planning of the study. We also thank psychology graduate student Sini Kivimäki for preliminary data analysis.

This work used data of the Finnish national outdoor recreation demand inventory (LVVI) which was supported financially by the Ministry of Education and Culture, and the Ministry of the Environment [YTA022].

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