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Exposure to a natural environment to improve parental wellbeing in parents in a homeless shelter: a multiple baseline single case intervention study

Elise Peters ^a, Dieuwke Hovinga^a, Jolanda Maas^b and Carlo Schuengel ^c

^aDepartment of Education, University of Applied Sciences Leiden, Leiden, Netherlands; ^bDepartment of Clinical, Neuro and Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, Netherlands; ^cAmsterdam Public Health Research Institute, Section of Clinical Child and Family Studies, Vrije Universiteit Amsterdam, Amsterdam, Netherlands

ABSTRACT

The physical environment of a shelter for homeless families may be a stressful place for parents. Exposure to natural environments might help to improve parental wellbeing. This study tested the impact of personalized exposure to a natural environment on wellbeing of parents residing in shelters. Single-case experiments with three families involved repeated and randomized exposure to the indoor environment of the shelter (baseline phases) and to a natural environment (intervention phases). During exposure, basic psychological need fulfillment in parenting as well as parents' overall affective state and satisfaction with life were assessed. Exposure to nature significantly increased basic psychological need fulfillment of parents but did not significantly improve affective state nor satisfaction with life. To contribute to parents' functioning and resilience, professionals may invite families for nature exposure for the support of parents' basic psychological need fulfillment.

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Characteristics of a place can contribute to parents' wellbeing and their ability to fulfill their roles as parents. Places can support parents when parents feel safe in that place, when parents perceive control over and engagement with the place, and when there is enough space for all family members and their daily activities (Cuellar et al., 2015; Haas et al., 2018; Johnson et al., 2009; Kepper et al., 2019). At the same time, places can be stressors. Chaotic places are linked to increased feelings of helplessness and psychological distress in parents, lower warmth and responsiveness in parenting behavior, and lower self-regulation of family members (Deater-Deckard et al., 2012; Evans & Wachs, 2010; Jocson & McLoyd, 2015; Vernon-Feagans et al., 2016). Overcrowded living spaces can limit the possibility for movement, constrict feelings of agency, and contribute to family conflict (Finno-Velasquez et al., 2017; Haas et al., 2018). Unesthetic places are believed to evoke feelings of lower self-worth or depression (Haas et al., 2018). For family support and counseling it is important to understand stressors of a place and evaluate interventions aimed for improvement.

For parents who reside in shelters for homeless families their living place can be a stressor (Alleyne-Green et al., 2019). They report stress due to crowded, noisy, and chaotic living quarters (Azim et al., 2019;

Pable, 2012; Sylvestre et al., 2018), living "in the public eye" from a lack of privacy (Azim et al., 2019), sharing space with other parents with differing parenting values (Holtrop et al., 2015), being limited in maintaining familiar routines (Alleyne-Green et al., 2019) and living by rules and routines that are not intrinsically valued (Anthony et al., 2018; Glenn & Goodman, 2015; Mayberry et al., 2014). On top of that, parents have reported that they felt limited in their possibilities for positive interactions with their child because shelter living spaces lack the design and comfort of a home (Walsh et al., 2009; Walsh et al., 2010) and miss safe and engaging play sites for children (Bradley et al., 2018; Walsh et al., 2010). This has consequences for parents' experienced wellbeing. There is thus a need to find ways to support parents in finding and using better suitable physical environments for parenting.

Regular exposure to nature may offer a supportive environment for parents. Exposure to nature may provide opportunities for time away from the stressors of the indoor shelter environment (Poulsen D et al., 2020), and at the same time offer experiences that are associated with improved wellbeing (Biedenweg et al., 2017; McMahan & Estes, 2015; Razani et al., 2018). For parents in shelters exposure to nature has been associated with the fulfillment of their basic

psychological needs (Peters et al., 2020a; Peters et al., 2020b), which is linked to wellbeing, motivation and engagement (Ryan & Deci, 2017) and has been associated with parental wellbeing and positive parenting practices (Brenning et al., 2019; Brenning & Soenens, 2017; Jungert et al., 2015; Kaap-Deeder J et al., 2019; Mabbe et al., 2018; Slobodin et al., 2020). Exposure to nature may offer an avenue for supporting parents' functioning and resilience while living in shelters. To gain insight in the impact of exposure to nature, controlled studies are needed.

With the current study, we aim to test a proof of principle for the impact of nature exposure on parental wellbeing. Firstly, we aim to determine whether a functional relationship can be observed between exposure to nature and basic psychological need fulfillment of parents. Based on findings in an earlier study (Peters, Maas Peters et al., 2020a) we expected that exposure to nature would enhance basic psychological need fulfillment of parents, resulting in higher need satisfaction and lower need frustration compared to when exposed to the standard indoor setting of the shelter. Secondly, we aim to determine whether a functional relationship can be observed between exposure to nature and determinants of overall wellbeing of the parent, namely satisfaction with life and affective state. Based on McMahan and Estes (McMahan & Estes, 2015), we expected that exposure to nature would enhance parents' affective state, resulting in higher positive affect and lower negative affect. Based on Biedenweg, Scott (Biedenweg et al., 2017) we expected that exposure to nature would enhance parents' overall satisfaction with life.

Method

Design

We conducted a repeated single-case experiment (see Kazdin, 2020; Kratochwill, Hitchcock (Kratochwill et al., 2013), Onghena, 2005) which involved repeated and randomized exposure to the indoor environment of the shelter and exposure to nature, and an assessment of a simultaneous change in the dependent variable. Dependent variables were basic psychological need fulfillment in parenting, affective state of the parent, and parents' satisfaction with life. The study report was based on SCRIBE reporting guidelines (Tate et al., 2016).

The effect of exposure to nature on basic psychological need fulfillment in parenting, affective state, and satisfaction with life was tested using an 8-day multiple baseline experimental design. Measurements were taken during a baseline phase (Phase A) and an intervention phase (Phase B). During Phase A at least three repetitions of a baseline measurement in the standard indoor condition of the shelter were

conducted in order to gauge daily variation in basic psychological need fulfillment in the dependent variable, as well as possible trends preceding exposure to nature. During Phase B, the manipulated variable "nature exposure" was introduced. The single-case experiment was conducted with three families.

To increase the internal validity of the study the start point of the intervention was randomized using the Single-Case Randomization Test package (Bulté & Onghena, 2013), resulting in an arrangement where Phase B started on day 4 for family 1 (AAABBBBB), on day 5 for family 2 (AAAABBBB), and on day 7 for family 3 (AAAAAABB).

Research context

The study is conducted in Dutch shelters. Shelters provide temporary homes for people when they have left their living place and are not capable to maintain themselves in society on their own, with usual support, with informal care, or with help from their social network (Wet Maatschappelijke Ondersteuning, 2015 2021). Three types of shelters can be distinguished: women's shelters for people (men, women, and children) who are victim of abuse and violence, assisted living for people with psychosocial and psychiatric problems, and homeless shelters for people who suffer from home eviction due to e.g. financial problems. This study is conducted in a homeless shelter that specialized in families. The Netherlands government has policy in place to prevent homelessness among families, with financial support to maintain a basic income (such as social security benefit and benefit for unemployed people), financial support for the cost of children (such as child-related budget, supplementary child benefit for parents with low income, childcare allowance, and free education), social support to build stability for the future (such as support in finding a job and support in paying off debts), and local government loans to protect against home eviction (for example to pay off rent delays or to pay for loan deposit). These policies do not prevent all cases of homelessness.

The Netherlands authorities work with Housing First principle (Advies Commissie Toekomst Beschermd Wonen, 2021; Lindovská, 2014; Rijn, 2015; Valente; Tsemberis, 2011) and aim to provide direct permanent housing for homeless families. Reality is that transitional housing is necessary when a permanent home is not immediately available. In 2020, 1650 children and their families were housed in a shelter for homeless families (Valente, 2021). Local government is charged with sheltering homeless families (Wet Maatschappelijke Ondersteuning, 2015 2021). Shelters provide this transitional housing and support clients in the process of finding a permanent home. Emergency shelters are directly available for homeless families in direct need of sheltering, whereafter families

are placed in a family shelter. Families reside in a shelter for the time that is needed to find an affordable permanent home, and shelters hold themselves to a maximum of 18 months in total for this process.

Participants

Families were recruited from a Dutch shelter for homeless families that at the time of the study housed 21 families, which is their full capacity. The aim of the shelter was to provide a temporary home and support families in finding permanent housing. Inclusion criteria were being a parent, living with at least one child in the shelter for the duration of the study, and taking care of the child during data collection hours. Families were excluded from participation when families were assessed as a risk to the researcher's safety, for example, due to problems in anger management. Three families were selected (see Figure 1). Table 1 shows the characteristics of the participating families.

Procedure

A researcher visited the family daily for one hour. During phase A the family carried on as usual, during phase B the researcher arranged personalized exposure to a natural environment. After the one-hour visit and during exposure a research assistant conducted a telephone interview with the participant to assess the parent's need satisfaction, need frustration, and satisfaction with life. After the one-hour visit the researcher filled out a questionnaire on the parent's subjective affective state.

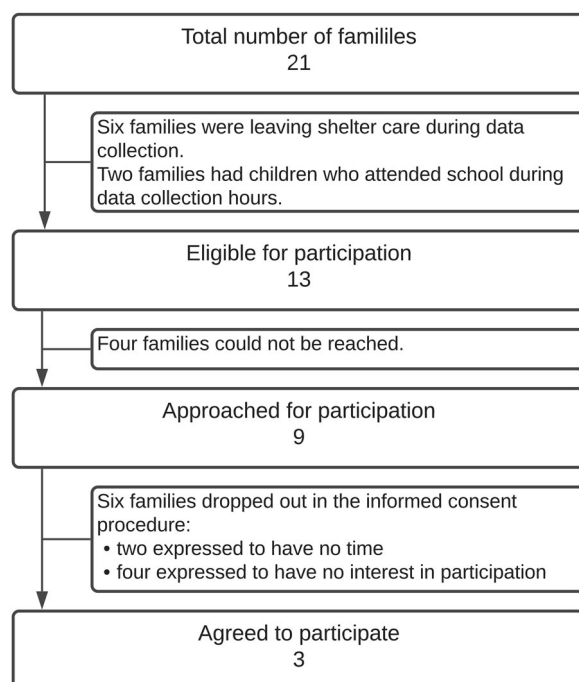


Figure 1. Participant recruitment.

Blinding

Families were informed that the study was conducted to get insight in fluctuations in parental wellbeing for families in shelters. Families knew that a researcher would observe their daily activities and at moments also suggest activities. Families were naïve to specific hypotheses on the effects of nature exposure. Each family was debriefed after data collection.

The telephone interview was conducted by a research assistant who was naïve to the goal and design of the experiment. The data from the telephone interview was inaccessible to the researcher who conducted the experiment. The researcher who conducted the experiment was not naïve to the aim of the study. To blind her from insight in the development of the parent's subjective affective state, she handed the raw data in daily and had no instructions on how to calculate totals.

Procedural fidelity

The experiment was supervised by a coordinating researcher who kept in daily contact with the researcher who conducted the experiment to assess whether the study was implemented as intended throughout the duration of the experiment. On day 2 with Family 1

Table 1. Participant characteristics.

Family composition	Migration background and reason for shelter care	Supply of care
One parent (F) (25-30Y), two children (1-3Y)	Refugees with a permanent residence permit for the Netherlands. In shelter care due to homelessness after divorce.	The shelter supported the family in finding a permanent home and provided welfare work on request. The local government supported the family with the application for benefit and with lessons in Dutch.
Two parents (M/F) (25-30Y and 15-20Y), two children (1-3Y). Father was the participant	First generation immigrants. In shelter care due to homelessness after home eviction for financial reasons.	The shelter supported the family in finding a permanent home and provided help with administrative tasks such as the application for benefit and arranging health care insurance. The national administrative authority commissioned by the Ministry of Social Affairs and Employment supported the father in finding employment.
One parent (F), (25-30Y), two children (1-3Y)	Refugees whose application for asylum is denied. In shelter care pending several court decisions.	The family got social work from the shelter, pro deo legal advice from a law firm, and an allowance from a charity fund. The family received no government support.

(Phase A), the children were not present during the researcher's visit. No measurements were conducted, and the procedure was postponed one day. The research was otherwise implemented as intended.

Measures

Basic psychological need fulfillment in parenting

Daily ups and downs in Basic psychological need fulfillment in parenting were assessed using the Dutch parenting version (Brenning & Soenens, 2017) of the validated Basic Psychological Need Satisfaction and Need Frustration scale (Chen et al., 2015) adapted for daily administration (Brenning et al., 2019). The questionnaire contains six statements on daily satisfaction of the basic psychological need of relatedness (e.g. "Today, I felt connected with my child"), competence (e.g. "Today, I felt confident in what I did for my child"), and autonomy (e.g. "Today, I felt a sense of choice and freedom in the things I did with my child"), as well as statements on the frustration of the basic need of relatedness (e.g. "Today, I felt a distance between my child and me"), competence ("Today, I felt insecure about my abilities with my child") and autonomy (e.g. "Today, I felt forced to do things for my child I did not choose to do"). Items were rated on a scale from 1 (completely not true) to 5 (completely true). Total scores were created by calculating the average of the scores on the six items for need satisfaction and the average of the six items for need frustration. Previous studies with this questionnaire (Brenning & Soenens, 2017; Mabbe et al., 2018; Peters et al., 2020a) reported a Cronbach's alpha between .72 and .83 for need satisfaction, and between .70 and .81 for need frustration.

Wellbeing

The study used two measurements for wellbeing, one based on self-report by the parent and one based on alter report by the researcher, aiming to reduce response bias.

Satisfaction with Life (self-report). Daily satisfaction with life was assessed using one item from the Satisfaction with Life Scale (SWLS) (Diener et al., 1985), in the shortened version and modified for daily administration (Maher et al., 2015). Participants answered the question: "I was satisfied with my life today" by rating it on a scale from 0 (strongly disagree) to 100 (strongly agree). This question refers to the person's internal, subjective assessment of their summarized overall quality of life. Previous studies with the complete SWLS reported a Cronbach's alpha of between .79 and .89 (Pavot & Diener, 2009). The single item used here was the highest loading item in factor analysis of the complete 5-item SWLS (pattern coefficient = .90) and can be used for measuring daily state

(ICC = 40% between-person variance) (Maher et al., 2013).

Affective state (alter report). Daily affective state of the parent was measured with the Dutch version of the Positive and Negative Affect Schedule (PANAS) (Peeters et al., 1996), consisting of 10 adjectives on Positive Affect (active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, strong) and 10 adjectives on Negative Affect (afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared, upset). The researcher indicated her perception of the parent's current affective state after a one-hour visit. The researcher rated the items on a 5-point unipolar response scale from 1 (very slightly or not at all) to 5 (very much) for the question "to what extent you think he/she feels this way right now?". Total scores for positive and negative affect were created by summing the respective items. Previous studies with this questionnaire (Díaz-García et al., 2020 Merz & Roesch, 2011;) report a Cronbach's alpha of between .91 and .92 for Positive Affect and between .87 and .88 for negative affect, and sensitivity to change (Díaz-García et al., 2020).

Intervention

Baseline

During phase A the family carried on as usual. Baseline measurements were conducted while the family was exposed to the indoor setting of the shelter. The indoor setting consisted of a private bedroom with bathroom for the family (measuring 15–20 m²) and two common living rooms and two common kitchens shared with 21 families. All measurements were conducted in the morning between 10 and 12 AM. For all participating families this was the time to start the day with getting dressed, preparing breakfast while the children were playing in the common kitchen, and eating. If the family had spontaneously sought exposure to nature at some point during a baseline day, no measurement would have been conducted, which did not occur.

Intervention

The researcher arranged exposure to nature for the family. Nature exposure was personalized by choosing a suitable form for the particular family at that moment (e.g. when the parent expressed tiredness she suggested to sit on a bench close to the shelter, when the children expressed enthusiasm for football she suggested to play football). Nature exposure consisted of interacting with elements of nature (such as playing with sand and water, or gardening), or perceiving elements of nature (such as listening to bird song, or viewing nature).

The shelter was located in an urban area and had a garden measuring about 500 m² with a vegetable

garden, rabbits, chicken, a climbing frame, a sandpit, a greenhouse, a sitting area, and a biking area. Adjacent to the shelter garden was a public walking path through allotment gardens (approx. 50,000 m²) and a natural playground (approx. 600 m²) with a sandpit, a water pump, a tree hut, swinging ropes, and a sitting area.

The researcher exposed the family to nature during their usual morning routine, e.g. by going outdoors before or after breakfast, or while breakfast was in the oven. For family 1 the exposure to nature consisted of feeding the pet rabbits, free play in the natural playground, watching fish in a pond in the allotment gardens, and gardening in the shelter greenhouse. For family 2 the exposure to nature consisted of playing rough and tumble in the shelter garden, feeding the pet rabbits, gardening in the shelter greenhouse, and chasing a wild rabbit through the allotment gardens. For family 3 the exposure to nature consisted of walking through the allotment gardens, free play in the natural playground, and looking at horses, pony's, goats, and rabbits in the field adjacent to the allotment gardens.

Researcher characteristics

The researcher (female, 52Y) who conducted the experiment had experience in working with children from her background as a preschool- and primary school teacher and worked at the time of the study as a teacher in child development and parenting at a university of applied sciences and as a junior researcher in environmental child psychology. She took a two-year training program in outdoor living and learning preceding this study.

Weather conditions on intervention days

Weather reports (Meteovista, 2019) showed that exposure to nature took place during rainy days (chance of rain in percentages $M = 80.9$, $SD = 32.2$) with windiness (wind force in Beaufort $M = 4$, $SD = 1.1$) and mild temperatures (temperature in degree Celcius $M = 17.9$, $SD = 1.4$). There were no significant differences between weather conditions during baseline days and intervention days (the randomization test's p -value = .69 for temperature, $p = .43$ for rain change, $p = .52$ for windiness).

Ethics

Families were approached for participation by their own care professional. After their informal approval parents were introduced to the researcher. Parents received information regarding the study in writing and information on their rights as participants both in written text and in pictograms. An informed

consent form was read out loud and discussed. An interpreter in the families' native tongue was available over the phone during this process and was used when necessary. After signing the consent form, a copy of the consent form was given to the parents for their records. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Behavioral and Movement Sciences of VU Amsterdam (VCWE-2018-0138) in accordance with the faculty's code of research ethics. All researchers were bound to the Netherlands Code of Conduct for Research Integrity (Association of Universities in the Netherlands, 2021).

Analyses

Data were visually analyzed using the Single-Case Data Analysis Package (De Kumar et al., 2020). A first impression was obtained with a graphical representation of the data. Mean scores were calculated to detect a possible shift in means between Phase A and Phase B. Range bars and trended range lines were visualized to illustrate the variation in the data. When visual analysis of the data indicated an effect of the intervention, the statistical significance of the intervention effect was evaluated using a randomization test (Bulté & Onghena, 2009). First, the test statistic was calculated by measuring the absolute difference between the mean of Phase A and Phase B. Second, the total number of possible assignments was calculated using

$$N! \prod_{i=1}^N k_i$$

with N as number of units and k_i as possible start points for the i -th unit (Bulté & Onghena, 2009). The current design yielded 750 possible randomizations. We tested the null hypothesis (that there was no effect of the intervention) by calculating the test statistic for every possible permutation of the data. Then a p -value was calculated from the proportion of test-statistics that exceeded or equaled the observed test statistic. To calculate the effect size, we used pooled standardized mean difference, as well as the percentage of data in the treatment phase that was higher (or lower, following hypothesis) than the median of the baseline phase, and the percentage of non-overlapping data between baseline and treatment phases.

Results

Basic psychological need fulfillment in parenting

The data are plotted for visual representation. The visual analyses of the mean scores (Figures 2 and 3)

show higher mean scores in Phase B (intervention) than in Phase A (baseline).

Table 2 shows the test statistic measured as the absolute difference between the phase means, the effect size measured by standardized mean difference, and the percentage of the data that was higher or lower (following hypotheses) in the experimental phase than the median of the baseline phase (PEM-scores), the percentage of non-overlapping data between all baseline versus all treatment datapoint comparisons (NAPscores) for each of the outcome measures. As expected from visual analysis, nature exposure enhanced need satisfaction and reduced need frustration. The effect sizes were medium (Parker & Vannest, 2009). The effect of nature exposure on need satisfaction was statistically significant ($p < 0.01$). The effect of nature exposure on need frustration was non-significant ($p > 0.05$). A general p -value for need fulfillment was calculated by statistically combining the p -values for need frustration and need satisfaction. The combined p -value for need fulfillment was significant ($p < 0.05$).

Affective state

The visual analyses of the mean scores (Figures 4 and 5) suggested lack of replicable changes between Phase A and Phase B for positive affect, and a small negative change between Phase A and Phase B for negative affect.

Table 2 shows the test statistic measured as the absolute difference between the phase means, the effect size measured by standardized mean difference, and the percentage of the data that is higher or lower (following hypotheses) in the experimental phase than the median of the baseline phase, for each of the outcome measures. As expected from visual analysis, the effect of nature exposure on positive affect and negative affect is not consistent (Table 2) and the effects were non-significant ($p > 0.05$).

Satisfaction with life

The visual analyses of the mean scores (Figure 6) suggested no consistent changes between Phase A and Phase B for satisfaction with life, with the parent of family 1 reporting higher scores during intervention, the parent of family 2 reporting lower scores during intervention, and the parent of family 3 reporting no change.

Although visual analysis indicated no effect, we chose to perform all planned analyses for comprehensiveness. As expected from visual analysis, the effect of nature exposure on satisfaction with life is contrary to what we hypothesized. Nature exposure did not enhance satisfaction with life (Table 2). The effect of nature exposure on satisfaction with life was non-significant ($p > 0.05$).

Discussion

This study tested a functional relationship between nature exposure and enhanced feelings of basic psychological need fulfillment in parenting and overall wellbeing for parents in shelters. In line with our hypothesis, exposure to nature significantly affected basic psychological need fulfillment. Our hypothesis was based on reported associations between nature exposure and psychological need fulfillment (Peters et al., 2020a). When testing this hypothesis in an experimental design, focusing on the level of individuals rather than groups, and with randomization to minimize the impact of potential confounders, the hypothesis was accepted.

Contrary to hypothesis, we found no effects of nature exposure on the outcome measures for overall wellbeing, to wit, affective state, and daily overall satisfaction with life. Our hypothesis was based on reported associations between nature exposure and improved wellbeing (Biedenweg et al., 2017; McMahon & Estes, 2015) and on reported links between fulfillment of the basic psychological needs and overall wellbeing (Brenning et al., 2019 Ryan & Deci, 2017;). The lack of replicable effects can be understood when we consider the major life changes that characterize the lives of shelter clients. As an example, we were informed that one participant was assigned a permanent home (family 1, day 6), one participant lost a court case (family 3, day 5), and one participant lost a paid job (family 2, day 1), and received news on family members' imminent forced eviction (family 2, day 1). Even these more major life events did not show a clear up or down in the wellbeing measures, which tempers expectations on the sensitivity of these measures for the impact of nature exposure.

For the interpretation of the results, it must be noted that the weather conditions on intervention days were quite poor, with much rain (rain chance in percentage $M = 80.9$, $SD = 32.2$) and windiness (wind force in Beaufort $M = 4$, $SD = 1.1$). Even though preconditions for wet weather conditions were met by using rain boots, umbrellas and sheltering places, weather conditions may have negatively impacted the restorative qualities of being outdoors (Connolly, 2013; Hartig et al., 2007). Future studies may be conducted under weather conditions that may be more conducive to wellbeing than rain (Brooks et al., 2017), to test the impact of weather on the effect of nature exposure.

The supply of care was quite basic in this shelter, with no daytime activities for parents or children. It is possible that the findings on basic psychological need fulfillment in parenting are attributed to participating in a daytime activity rather than nature exposure. We advise future studies to compare

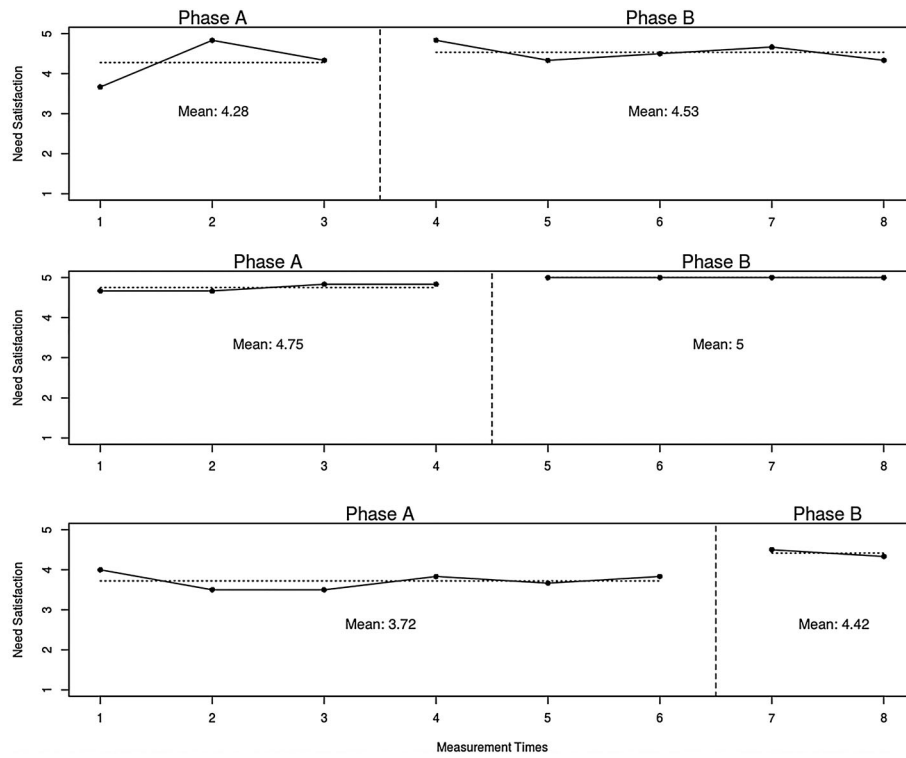


Figure 2. Visual representation of the data collected in Phase A (baseline) and Phase B (intervention) on need satisfaction with mean levels for both phases.

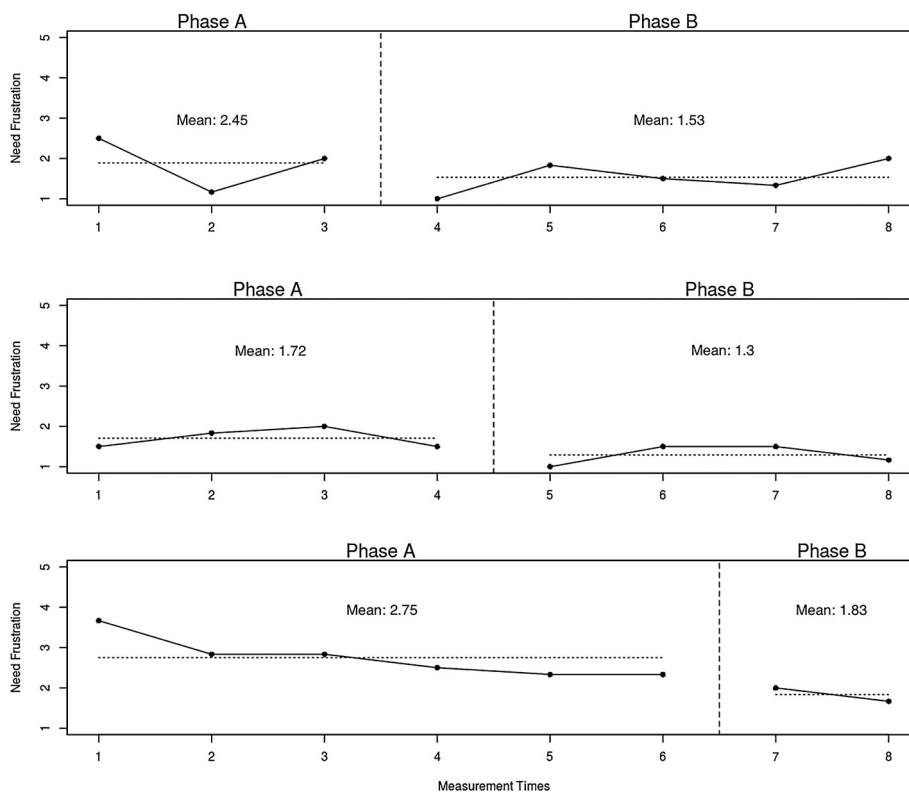


Figure 3. Visual representation of the data collected in Phase A (baseline) and Phase B (intervention) on need frustration with mean levels for both phases.

nature exposure to other family activities to see if the results are attributed to doing any activity that breaks standard routine or to nature activities specifically.

Implications for practice

In an earlier study professionals expressed expectations on the benefits of nature for parenting (Peters

Table 2. Test-statistics (measured as the absolute difference between the phase means), effect sizes (measured by standardized mean difference), PEMscores (the percentage of the data that was higher or lower -following hypotheses- in phase B than the median of phase A), NAPscores (the percentage of non-overlapping data between all phase A versus all phase B datapoint comparisons), the randomization test's p -values, and combined p -values.

Outcome	Test statistic	Effect size	PEMscores	NAPscores	The randomization test's p -value	Combined p -value
Need satisfaction	0.4	2.16	86%	0.88	0.008**	Combined p -value for need fulfillment in general = 0.004**
Need frustration	-0.56	-1.34	93%	0.86	0.056 ns	
Positive affect	3.41	0.62	65%	0.7	0.432 ns	Combined p -value for affect in general = 0.57 ns
Negative affect	3.57	-1.26	85%	0.81	0.536 ns	
Satisfaction with Life	2.97	-0.12	20%	0.49	0.4 ns	

ns = non-significant.

** $p < .01$.

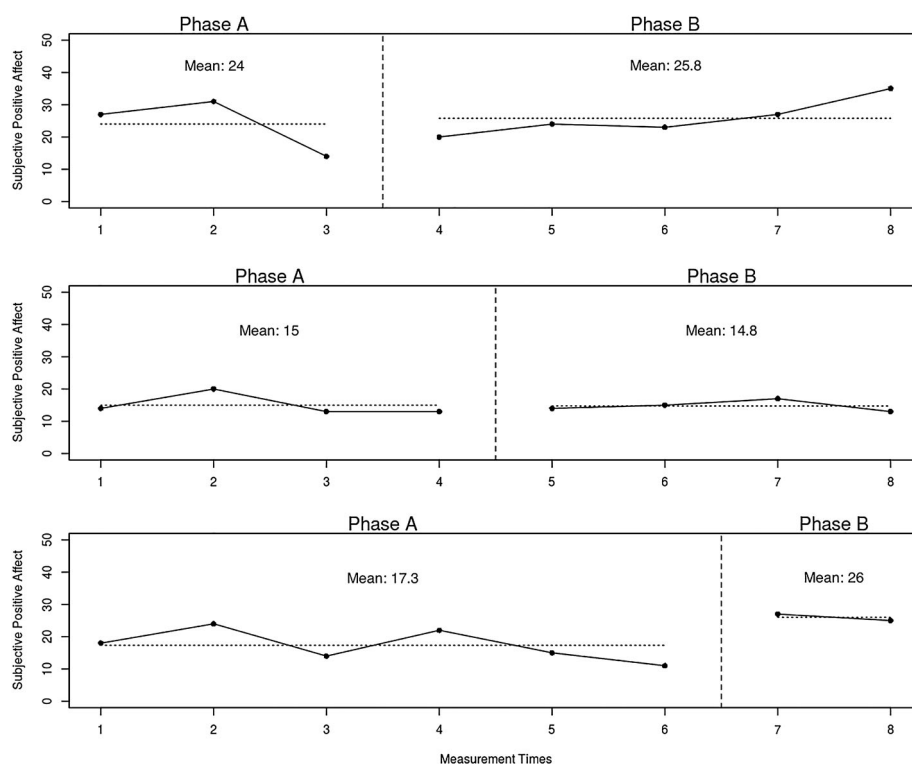


Figure 4. Visual representation of the data collected in Phase A (baseline) and Phase B (intervention) on subjective positive affect with mean levels for both phases.

et al., 2020b). This was tested in this study by facilitating engagement with nature, showing how it impacted the three participating parents. The study results are encouraging for trying out integrating exposure to nature to enhance the support for parents. This implication applies to shelters that work from Housing First and shelters that work from Housing Ready systems, because in both systems it is important that parents are supported to maintain, build, or rebuild their parental functioning to achieve a swift return to independent housing. To be able to choose a suitable form of nature exposure for a family it may be helpful to develop a repertoire of nature activities and to use professional sensitivity to personalize these for a particular family at a particular moment.

The study also demonstrates how single-case experiments can be integrated in child and family welfare practice, using systematically collected evidence to enhance individualized support.

Strengths and limitations

The design of a repeated single-case experiment allowed a study in a real-life context through its flexible design and limited scale, while minimizing the impact of potential confounders by using standardized procedures and principles of randomization. However, confidence in the effects of nature will be enhanced by replicating the effects in additional cases and settings (Kazdin, 2020).

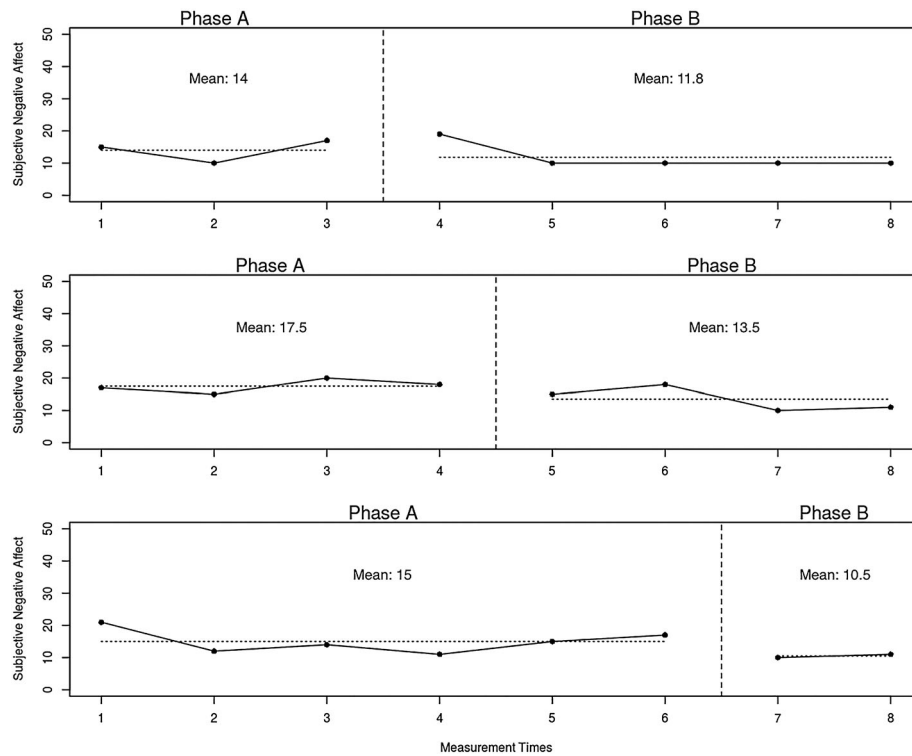


Figure 5. Visual representation of the data collected in Phase A (baseline) and Phase B (intervention) on subjective negative affect with mean levels for both phases.

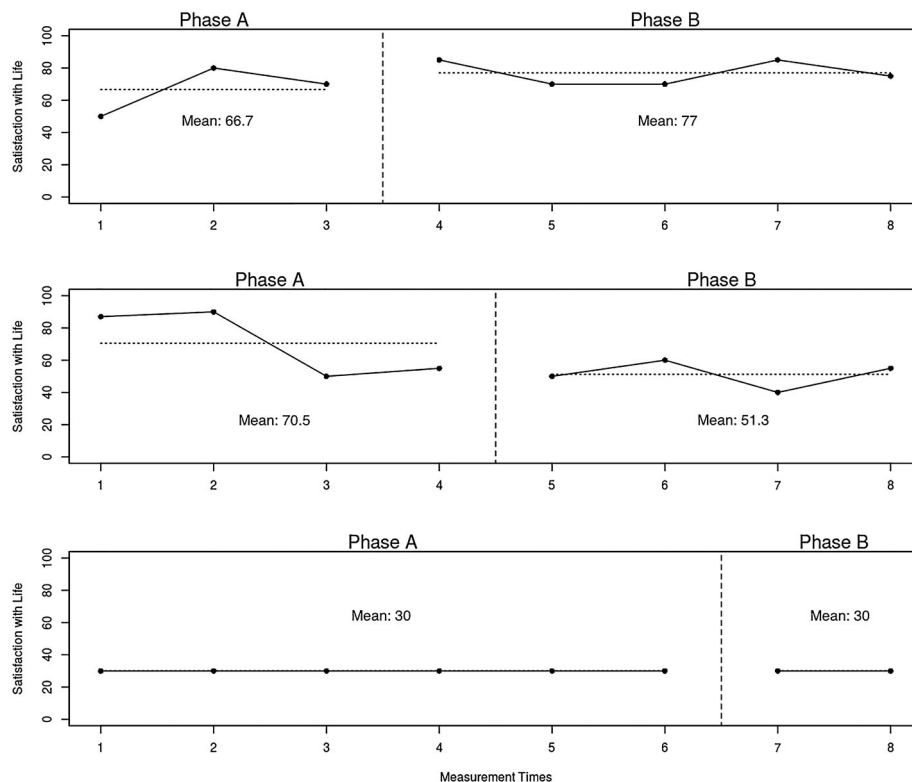


Figure 6. Visual representation of the data collected in Phase A (baseline) and Phase B (intervention) on satisfaction with life with mean levels for both phases.

The study was conducted in the natural setting of a shelter and no manipulations to the physical environments were done, which contributes to the ecological validity. Future research is needed to test effectiveness

when exposure to nature is implemented with existing shelter staff.

During the course of data collection participants were naive for the research question and hypotheses,

but the researcher who assessed parents' affective state was not blind. The wellbeing measures based on researchers' assessment showed the same result as the wellbeing measures based on self-report by the parents, which give limited reason to assume researchers' bias.

Conclusion

This study showed that basic psychological need fulfillment could be enhanced in parents by facilitating exposure to nature. Exposure to nature did not significantly influence overall wellbeing of the parents. When aiming to contribute to parents' functioning and resilience, professionals in homeless shelters can invite families for nature exposure for the support of parents' basic psychological need fulfillment.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributors

Elise Peters, Ph.D.-candidate, works at the University of Applied Sciences Leiden. Her research interest is in physical environments and their affordances for children and families.

Dieuwke Hovinga, Ph.D., is professor in Nature & Child Development, Department of Education, University of Applied Sciences Leiden & Thomas More Rotterdam. With her research group she investigates the relationship between natural environments, their play and learning opportunities and their role in specific educational and care objectives.

Jolanda Maas, Ph.D., is assistant professor who specializes in research on health benefits of nature in different settings (daycare, schoolyards, neighborhoods, universities and hospitals).

Carlo Schuengel, Ph.D., is full professor of clinical child and family studies at Vrije Universiteit Amsterdam. His interest is in parenting, attachment, and their links with mental health.

ORCID

Elise Peters  <http://orcid.org/0000-0003-4467-9740>
Carlo Schuengel  <http://orcid.org/0000-0001-5501-3341>

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