

Research Article

Near-Home Greenery, Environmental Stressors, and Parental Stress: A Mixed-Methods Field Study Using Environmental Monitoring and Walking Interviews

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KEYWORDS

near-home greenery
parental stress
emotional stress
environmental stressors
NDVI
walking interviews
environmental monitoring
urban environmental inequality

ABSTRACT

Parental stress is increasingly understood as a multidimensional phenomenon shaped not only by psychological and socioeconomic factors but also by the physical environments in which everyday parenting occurs. However, empirical evidence linking near-home greenery, objectively measured environmental stressors, and parental stress remains limited, particularly in environmentally underserved communities. This mixed-methods field study, conducted in Arab residential towns and neighbourhoods in Israel, examines how residential vegetation density influences emotional and parental stress and whether reductions in environmental stressors constitute key underlying mechanisms. The study included 147 participants who completed all study components. Data were collected during the summer months (May–October 2024). Near-home greenery was quantified using the Normalized Difference Vegetation Index (NDVI). Environmental stressors (noise, carbon monoxide concentration, and thermal load) were measured in situ during walking interviews conducted around participants' homes. Emotional stress and parental functioning were assessed using validated questionnaires, and qualitative interviews captured lived experiences of environmental stress and restoration. Higher NDVI levels were associated with lower noise exposure, reduced air pollution, and attenuated thermal load. Parents living in greener environments reported lower emotional stress and higher perceived parenting competence, with emotional stress mediating the effects of environmental quality on parental outcomes. Qualitative findings showed that near-home greenery supports everyday emotional regulation through shade, quiet, and micro-restorative encounters, while parents in vegetation-poor areas actively created greenery as a coping strategy. These findings demonstrate that living in greener residential environments reduces parental stress through measurable environmental pathways and lived experience, highlighting near-home greenery as a critical public health and planning resource.

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ARTICLE INFO

Received: 17 December 2025 | Revised: 26 January 2026 | Accepted: 28 January 2026 | Published Online: 5 February 2026

DOI: <https://doi.org/10.65773/ure.2.90>

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1. Introduction

Parental stress is increasingly recognized as a multidimensional phenomenon shaped not only by individual and familial characteristics, but also by the physical environments in which everyday parenting occurs [1,2]. While psychological and socioeconomic determinants of parental stress have been widely examined, evidence from environmental psychology and public health indicates that near-home environmental exposures can shape emotional regulation, stress accumulation, and parental functioning [3-5].

Emotional stress is closely linked to continuous exposure to environmental stressors such as heat, noise, and traffic-related air pollution, rather than to isolated events [6,7]. Field-based studies further show that everyday exposures influence emotional, cognitive, and physiological stress responses, with measurable effects on autonomic regulation [8,9]. For parents—particularly those living in dense, vegetation-poor environments—stress can accumulate through repeated, everyday exposure to environmental burdens that directly shape caregiving experiences [1,2].

Near-home greenery may play a decisive role in stress regulation by reducing environmental loads (e.g., heat, noise, and air pollution) and providing micro-restorative encounters embedded within daily routines [10-12]. This distinction is especially salient in Arab towns and neighbourhoods, where limited green infrastructure, high residential density, and climatic stress often converge [1,13]. The present study integrates spatial vegetation indicators, objective environmental monitoring, and walking interviews to examine how near-home greenery shapes emotional and parental stress through measurable and experiential pathways.

2. Theoretical Background

2.1. Environmental Stress Theory

Environmental Stress Theory posits that chronic exposure to adverse physical conditions—including noise, heat, air pollution, and crowding—erodes coping capacity and emotional regulation over time [6,7]. For parents whose daily routines are spatially anchored around the home and neighbourhood, such exposures become embedded in everyday caregiving, shaping emotional availability and perceived parental competence.

2.2. Stress Reduction Theory

Stress Reduction Theory proposes that exposure to natural environments elicits rapid affective and physiological stress recovery rooted in evolutionary adaptive responses [11,12]. Natural elements, such as vegetation, reduce sympathetic arousal and support positive affect, often before conscious cognitive appraisal.

2.3. Attention Restoration Theory

Attention Restoration Theory emphasizes cognitive recovery through exposure to environments that engage involuntary attention, allowing directed attention to rest [14,15]. For parents, whose daily lives involve sustained multitasking and vigilance, near-home greenery may provide micro-restorative opportunities embedded in routine activities.

2.4. Integrative Framework

Together, these theories suggest that near-home greenery influences parental stress through interacting pathways: (1) reducing environmental stressors, (2) supporting physiological regulation, and (3) facilitating emotional and cognitive recovery.

3. Methods

3.1. Study Design and Theoretical Alignment

This study employed a mixed-methods, field-based design grounded in Environmental Stress Theory, Stress Reduction Theory (Ulrich), and Attention Restoration Theory (Kaplan & Kaplan). The design integrates subjective stress measures, objective environmental exposure data, spatial vegetation indicators, and qualitative walking interviews to examine how near-home greenery shapes emotional and parental stress through measurable and experiential pathways.

In line with Environmental Stress Theory, heat, noise, and air pollution were conceptualized as chronic environmental stressors that elevate baseline emotional stress [6,7]. Stress Reduction Theory informed the hypothesis that near-home greenery reduces physiological and emotional arousal by attenuating these stressors [11,12]. Attention Restoration Theory further framed greenery as a cognitive and emotional resource supporting recovery from attentional fatigue during everyday parenting routines [14,15].

3.2. Study Population and Residential Settings

Participants were Arab parents residing in towns and neighbourhoods characterized by varying levels of vegetation cover, residential density, and exposure to environmental stressors. These environments ranged from relatively green residential areas to vegetation-poor, dense, and climatically harsh settings, typical of many Arab localities in Mediterranean and semi-arid regions.

Eligibility criteria included: (1) being a parent of at least one child living in the household; (2) residence in the neighbourhood for at least one year; (3) ability and willingness to participate in a walking interview around the home; and (4) willingness to wear or be accompanied by portable environmental monitoring devices. All participants provided written informed consent, and the study was conducted in accordance with ethical standards for research involving human participants.

A total of 150 parents were recruited for the study. Of these, 147 participants completed all study components and were included in the final analyses. Data collection was conducted during the summer months (May–October 2024).

3.3. Psychological and Parental Stress Measures

3.3.1. Emotional Stress

Emotional stress was measured using the Pearling and Schooler Emotional Stress Scale [16]. The scale assesses sustained emotional strain, including feelings of fatigue, irritability, overload, and difficulty coping with daily demands. Consistent with the theoretical framework, emotional stress was treated as an embodied, environmentally sensitive manifestation of parental stress, reflecting ongoing regulatory load rather than isolated emotional states.

3.3.2. Parental Stress and Functioning

Parental stress and functioning were assessed using the Parenting Sense of Competence (PSOC) scale [17], which captures parents' perceived efficacy and satisfaction in their parenting role.

3.4. Environmental Exposure Assessment Using Portable Monitoring Devices

3.4.1. Rationale

Environmental stressors were measured in situ using portable devices during walking interviews. This approach captures real-life exposure to stressors and aligns with previous field experiments demonstrating differential environmental loads across urban contexts [10].

3.4.2. Noise Exposure

Environmental noise was measured continuously during walking interviews using portable noise monitoring devices, recording sound pressure levels in decibels (dB). Mean noise exposure was calculated for each walking route. Noise represents a chronic environmental stressor associated with increased emotional strain and reduced attentional capacity [6].

3.4.3. Air Pollution Exposure

Air pollution was assessed using portable carbon monoxide (CO) monitors, providing continuous measurements of traffic-related air pollution during the walking interviews. The average CO concentration was calculated for each participant's route. CO was selected as an indicator of near-road air pollution, consistent with prior field-based research [10,9].

3.4.4. Thermal Load (Heat Stress)

Ambient temperature and relative humidity were measured using portable temperature and humidity loggers. A thermal load index (heat index) was calculated to represent perceived heat stress.

3.5. Near-Home Greenery Assessment

3.5.1. NDVI (Normalized Difference Vegetation Index)

Near-home vegetation density was quantified using the Normalized Difference Vegetation Index (NDVI) derived from satellite imagery [18,19]. NDVI values were calculated within a 100–300 m buffer zone around each participant's home, capturing vegetation exposure in areas frequently encountered during daily routines and walking interviews.

NDVI imagery was derived from satellite data captured during the same period as the fieldwork (May–October 2024), ensuring temporal alignment between spatial vegetation indicators and environmental exposure measurements.

3.5.2. Observed and Reported Greenery

To complement NDVI, additional indicators of local greenery were documented, including the presence of trees and planted vegetation along the walking route, a private home garden or planted courtyard, and the continuity of shade and vegetated surfaces.

3.6. Qualitative Component: Walking Interviews

3.6.1. Theoretical Rationale

Walking interviews were used to capture embodied, place-based experiences of stress and restoration in situ, consistent with place-based approaches to understanding everyday environments [20].

3.6.2. Procedure and Interview Focus

Walking interviews were conducted in the immediate residential environment along routes chosen by participants that reflected everyday parental movement. During each walk, environmental stressors were measured continuously, and semi-structured prompts explored emotional stress, parenting experiences, perceived effects of heat/noise/air quality, the significance of trees and shade, and coping strategies such as planting and maintaining vegetation. Interviews lasted approximately 30–60 minutes and were audio-recorded with consent.

3.7. Data Analysis

3.7.1. Quantitative Analysis

Descriptive statistics were used to characterize psychological, environmental, and spatial variables. Multivariate regression models examined: (1) associations between NDVI and environmental stressors; (2) associations between environmental stressors and emotional stress; and (3) emotional stress as a mediator between environmental conditions and parental stress. Mediation was assessed using a standard regression-based approach [22].

3.7.2. Qualitative Analysis

Interview transcripts were analysed using thematic analysis [21]. Themes were developed iteratively, with attention to alignment between experiential accounts and measured environmental conditions.

3.7.3. Integration of Methods

Integration occurred at the interpretive stage, where quantitative environmental and psychological findings were contextualized using qualitative insights from walking interviews.

4. Results

4.1. Environmental Measurements by Ndvi Level

Residential environments were categorized into low-NDVI and high-NDVI areas based on a median split of near-home NDVI values calculated within a 200 m buffer around participants' homes. Environmental measurements collected during walking interviews revealed systematic and significant differences in ecological stressors between these environments.

Table 1. Environmental measurements during walking interviews by NDVI level

Environmental variable	Low NDVI	High NDVI	p-value
Noise (dB, mean $\pm$ SD)	69.4 $\pm$ 5.8	61.2 $\pm$ 4.9	< .001
CO concentration (ppm)	2.8 $\pm$ 0.9	1.6 $\pm$ 0.7	< .001
Ambient temperature ($^{\circ}$ C)	32.7 $\pm$ 2.1	29.4 $\pm$ 1.8	< .001
Heat index	36.1 $\pm$ 2.6	31.8 $\pm$ 2.3	< .001

Walking routes in high-NDVI environments were characterized by significantly lower noise exposure, reduced traffic-related air pollution, and attenuated thermal load, compared with low-NDVI areas, consistent with the theorized microclimatic and environmental-buffering functions of vegetation [11][12].

4.2. Emotional Stress and Parental Stress Outcomes

4.2.1. Emotional Stress by NDVI Level

Parents residing in high-NDVI environments reported significantly lower emotional stress compared to those living in low-NDVI areas.

Table 2. Emotional stress and parental competence by NDVI level.

Outcome measure	Low NDVI	High NDVI	p-value
Emotional stress (Pearlin scale)	62.1 $\pm$ 13.7	48.6 $\pm$ 12.1	< .001
PSOC score	60.4 $\pm$ 11.9	72.3 $\pm$ 10.4	< .001

4.2.2. Environmental Stressors as Predictors of Emotional Stress

Multivariate regression models examined relationships between environmental stressors and emotional stress.

Table 3. Regression predicting emotional stress.

Predictor	B	SE	β	p
NDVI	-10.2	1.9	-.36	< .001
Noise (dB)	0.41	0.08	.28	< .001
CO (ppm)	3.10	0.95	.21	.001
Heat index	0.72	0.21	.19	.002
Crowding index	3.90	1.20	.17	.003

Model $R^2 = .44$.

4.2.3. Emotional Stress as a Mediator of Parental Stress

Mediation analysis indicated that emotional stress significantly mediated the relationship between NDVI and parental stress (PSOC), consistent with a pathway in which environmental conditions shape parenting outcomes through emotional regulation [22].

Figure 1 summarizes the conceptual mediation pathway identified in this study, illustrating how near-home greenery reduces environmental stressors, which, in turn, lower emotional stress and enhance parental functioning.

Conceptual Mediation Pathway

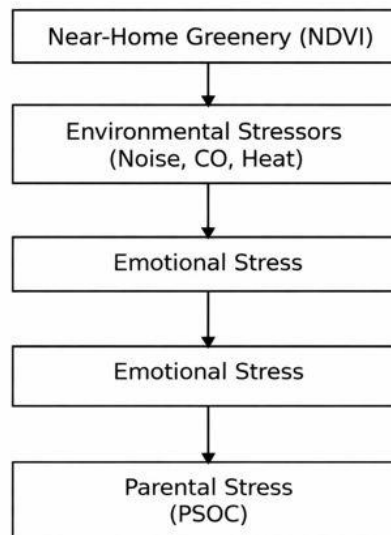


Figure 1. The conceptual mediation pathway.

4.3. Qualitative Themes from Walking Interviews

Themes are summarized below with illustrative quotes.

Theme 1: Environmental stress is experienced as parental stress. Parents described heat, noise, and air pollution as triggers of emotional dysregulation that affected patience and emotional availability, consistent with chronic stressor exposure in Environmental Stress Theory [6,7].

Theme 2: Near-home greenery enables everyday emotional regulation. Parents described automatic calming responses when walking on greener streets, consistent with Stress Reduction Theory [11,12].

Theme 3: Shade and microclimate as key mechanisms. Parents linked trees and shade to thermal relief, consistent with vegetation-related microclimatic buffering [11,12].

Theme 4: Noise and air pollution as invisible but felt stressors. Parents described bodily and attentional impacts of traffic-related exposures [6,10].

Theme 5: Planting greenery as an active parental coping strategy. In low-NDVI settings, parents described planting as a coping practice and as a local agency.

Theme 6: Greenery supports parenting identity and competence. Parents explicitly linked calmer environments to feeling like better parents, consistent with the stress–regulation mechanism implied by the integrated framework [11,14].

5. Discussion

This study provides evidence that near-home greenery shapes emotional and parental stress through both measurable environmental mechanisms and lived, embodied experience. The convergence between (i) objectively measured reductions in environmental stressors, (ii) lower emotional stress and higher parenting competence, and (iii) qualitative accounts of everyday regulation supports the integrated theoretical framing [6,11,14].

Consistent with Environmental Stress Theory, parents living in greener environments experienced lower exposure to chronic stressors (noise, air pollution, thermal load) within a short walking distance of home [6,7]. Consistent with Stress Reduction Theory, parents described rapid, sensory calming responses to greenery and shade, and these accounts mapped onto measured differences in environmental load [11,12]. In line with Attention Restoration Theory, parents described increased patience, mental clarity, and emotional self-regulation during routine activities in greener environments [14,15].

6. Limitations

Several limitations should be acknowledged. First, although the sample size ($n = 147$) was adequate for mixed-methods field research, the relatively moderate number of participants may limit the generalizability of the findings to other populations and urban contexts. Second, the cross-sectional design precludes strong causal inferences, and longitudinal studies are needed to examine long-term effects of near-home greenery on parental stress. Third, environmental measurements were conducted during the summer months (May–October 2024), and exposure patterns may vary across different seasons. Finally, the study focused on Arab communities in Israel, which may limit direct transferability to other cultural and socio-spatial settings. Future research should examine similar mechanisms in diverse urban contexts.

7. Policy and Planning Implications

The findings position near-home greenery as preventive public health and climate-adaptation infrastructure. Equitable tree planting and shaded pedestrian routes in residential streets may reduce everyday exposure to heat, noise, and traffic-related pollution, and in turn support parental emotional regulation and family well-being [11,12]. Supporting household- and community-level greening initiatives may also strengthen local coping capacity in underserved neighbourhoods.

8. Conclusion

Parental stress is deeply embedded in everyday residential environments. Near-home greenery is associated with lower exposure to environmental stressors and lower emotional stress, and emotional stress emerges as a central mechanism linking ecological conditions to parental functioning. Designing greener residential environments represents a tangible, scalable intervention to support parental capacity, emotional health, and intergenerational well-being.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of Tel Aviv University and was conducted in accordance with institutional and international ethical standards for research involving human participants. Written informed consent was obtained from all participants before participation.

Funding

This research received support from: (1) Ministry of Science & Technology, Israel; (2) Lois and Martin Whitman Scholarship Fund, Tel Aviv University; (3) Tami Steinmetz Center for Peace Research (Scholarship Honors Award), Tel Aviv University; (4) Smaller Winikow Scholarship Honors Award, Keren Kayemeth LeIsrael – Jewish National Fund (KKL-JNF); and (5) Doctoral Fellowship, Porter School of Environmental Studies, Tel Aviv University. The funders had no role in study design, data collection, analysis, interpretation, or manuscript preparation.

Competing Interests

The author declares no competing interests.

Data Availability

Data supporting the findings of this study are available from the corresponding author upon reasonable request. NDVI exposure data were derived from publicly available satellite imagery and standard NDVI computation methods [18,19]. Questionnaire responses and processed analytic files can be provided in anonymized form in accordance with ethical approval.

Acknowledgements

The author expresses gratitude to Ziad Saadi, Roaa Saadi, Jumana Saadi, Tarek Saadi, Retal Saadi, Hazem Hubashy, and Fatma Hubashy for assistance during the study.

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