

Research Article

Climate Change Awareness, Physical and Psychological Impacts, and Urban Environmental Stressors in Five Cities of Myanmar

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Abstract

Climate change is a major public health challenge affecting physical health, psychological wellbeing, and quality of life. Urban environmental stressors such as traffic congestion, population density, urban heat, air pollution, reduced green spaces, and infrastructure limitations may intensify these impacts. This cross-sectional study investigated climate-change awareness and perceived physical and psychological impacts among 591 residents of Yangon, Mandalay, Naypyidaw, Monywa, and Myitkyina, Myanmar, and explored contextual contributors through a supplementary survey of local representatives. Residents were recruited using convenience sampling through community networks, social contacts, educational institutions, and online distribution; because recruitment was not based on a defined sampling frame, a response rate could not be calculated. Climate awareness, physical impact, and psychological impact were assessed using three-item domains scored on five-point Likert scales. Internal consistency of each domain was assessed using Cronbach's alpha [0.705 – 0.715]. Differences among cities were analyzed using the Kruskal–Wallis test with Dunn–Bonferroni post hoc comparisons, and high-impact versus lower-impact city groups were compared using the Mann–Whitney U test with appropriate effect-size estimates. Multiple linear regression identified factors associated with physical and psychological impact scores. Climate awareness, physical impact, and psychological impact differed significantly among cities (all $p < 0.001$). Awareness was higher in lower-urbanization cities, whereas physical and psychological impacts were higher in higher-urbanization cities. Residence in higher-urbanization cities remained independently associated with greater physical impact ($\beta = -0.332$, $p < 0.001$) and psychological impact ($\beta = -0.329$, $p < 0.001$) after adjustment for demographic factors. Local representatives identified transportation congestion, carbon emissions, urban density, reduced green spaces, air pollution, urban heat, and flooding-related infrastructure problems as important contextual stressors. The findings indicate substantial climate-related disparities across Myanmar cities and support climate-responsive urban planning, sustainable transportation, green infrastructure, air-quality management, and targeted climate-health communication.

The higher-urbanization versus lower-urbanization group differences were small for awareness ($r = 0.20$) and medium for physical ($r = 0.34$) and psychological ($r = 0.31$) impacts. The regression models explained 13.6% of the variance in physical impact and 10.7% in psychological impact, indicating that urban context was an important correlate but explained only part of the observed burden.

Keywords: Climate change, Quality of life, Psychological impact, Physical impact, Myanmar

1. Introduction

Climate change has emerged as one of the most important global public health challenges of the 21st century (Dietz et al., 2020). Increasing temperatures, extreme weather events, environmental degradation, and urban climate stressors have substantially affected human health and quality of life worldwide (United Nations [UN], 2024a; World Health Organization [WHO], 2023). Climate-related exposures have been associated not only with physical health problems such as heat-related illness, dehydration, and reduced work capacity, but also with psychological consequences including stress, anxiety, emotional exhaustion, and reduced wellbeing (Almubarak, 2024; Shukla et al., 2024).

Urbanization and environmental changes may further intensify the health burden associated with climate change. Rapid urban expansion, transportation-related emissions, traffic congestion, reduced green spaces, and population density contribute to the urban heat island effect and environmental stress (Buster et al., 2024; UN, 2024b; Ventriglio et al., 2021). Urban heat can directly increase dehydration, fatigue, sleep disruption, and heat-related illness, while persistent heat exposure may also increase psychological distress through physiological stress, sleep disturbance, and reduced daily functioning. Air pollution provides another pathway: fine particulate matter (PM_{2.5}) and other traffic-related pollutants have been associated with depression, anxiety, and other adverse mental-health outcomes in epidemiological studies (Bereziartua et al., 2026; Braithwaite et al., 2019). These pathways are particularly relevant in densely built urban environments where heat-retaining surfaces, traffic emissions, and limited vegetation can occur together. Previous studies have therefore suggested that highly urbanized areas may experience greater heat-related physical and psychological burden because of increased exposure to environmental heat, air pollution, and infrastructure-related stressors (Buster et al., 2024; WHO, 2023). In contrast, residents

from less urbanized regions may demonstrate greater awareness of environmental and seasonal changes because of closer dependence on natural conditions and agricultural activities (International Panel on Climate Change [IPCC], 2022).

Myanmar is considered highly vulnerable to climate-related environmental changes because of increasing temperatures, flooding, seasonal variability, and rapid urban development (Horton et al., 2016; Tun et al., 2023; Zain et al., 2022; Zin et al., 2019; Lwin & Yoon et al., 2023). However, limited evidence is available regarding how climate change affects the quality of life of residents across different Myanmar cities. In particular, few studies have simultaneously evaluated climate-related awareness, physical burden, and psychological burden using a comparative multi-city approach. Furthermore, evidence explaining why certain cities experience greater climate-related burden remains limited.

Therefore, the present study aimed to investigate climate-change awareness and perceived physical and psychological impacts among residents from five cities in Myanmar, to identify demographic and urban-context factors associated with physical and psychological impact, and to explore contextual factors contributing to climate-related burden through a supplementary survey of local representatives. The study also compared cities classified a priori as high-impact or lower-impact according to their relative urbanization, population concentration, traffic volume, and environmental pressures. The findings may contribute to a better understanding of climate-related quality-of-life disparities across urban and regional settings and support sustainable urban planning, resilient infrastructure, and climate adaptation strategies in Myanmar.

2. Methods

2.1 Study design and participants

This cross-sectional study was conducted to evaluate climate change-related awareness, physical impact, and psychological impact among residents from five cities in Myanmar, including Yangon, Mandalay, Naypyidaw, Monywa, and Myitkyina. These cities were selected to represent different urbanization and environmental contexts across Myanmar (Fig. 1). The study area map was prepared using QGIS (Long Term Release, version 3.40). Administrative boundaries of Myanmar at the country and first administrative levels (states/regions) were obtained from the Global Administrative Areas (GADM) database. Geographic coordinates of the study cities (Naypyidaw, Yangon, Mandalay, Monywa, and Myitkyina) were



Figure 1. Study area of the five cities in Myanmar

compiled into a comma-separated values (CSV) file and imported into QGIS as point features using the WGS 84 geographic coordinate system (EPSG:4326). The final map layout, including city locations, administrative boundaries, scale bar, north arrow, and labels, was created using the QGIS Print Layout tool and exported as a high-resolution figure for publication.

Data were collected using a structured questionnaire survey administered between November 2025 and April 2026. Participants aged 18 years or older who were currently residing in the selected cities were recruited using convenience sampling through community networks, social contacts, educational institutions, and online distribution of the questionnaire within each city. The number of participants recruited was Yangon ($n = 110$), Mandalay ($n = 127$), Naypyidaw ($n = 110$), Monywa ($n = 125$), and Myitkyina ($n = 119$), giving a total of 591 participants. Because the questionnaire was distributed through multiple community and online channels without a defined sampling frame

or denominator of eligible persons approached, a conventional response rate could not be calculated. Individuals who were unable to complete the questionnaire independently were excluded from the study.

2.2 Questionnaire and data collection

The questionnaire was developed based on the World Health Organization definition of quality of life, which includes physical health, psychological state, social relationships, and environmental conditions (WHO, 1997). The present study focused primarily on the physical and psychological domains because these dimensions are directly affected by climate-related stressors. Although standard instruments such as the WHOQOL-BREF assess general quality of life, they do not specifically capture climate-change-related impacts. Therefore, context-specific questionnaire items were self-developed to evaluate perceived climate-related effects among residents in Myanmar. Prior to data collection, the questionnaire was reviewed by university professors and professionals in relevant fields to assess clarity, relevance, and content validity. Internal consistency was assessed using Cronbach's alpha for each three-item domain; the observed values were as follows: climate awareness $\alpha = [0.705]$, physical impact $\alpha = [0.705]$, and psychological impact $\alpha = [0.715]$.

The questionnaire consisted of demographic information, occupational characteristics, education level, and climate-related assessment items. Occupational status was categorized into five groups according to working environment and physical activity level: (1) mostly outdoor work (under sunlight, physically active), (2) outdoor work with moderate physical activity, (3) mixed indoor and outdoor work, (4) indoor work without air conditioning, (5) indoor work with air conditioning (mostly sedentary). The questionnaire included three domains: climate awareness, physical impact, and psychological impact. Climate awareness items assessed participants' perceptions

of climate change, recognition of environmental changes, and awareness of potential health consequences. Physical impact items evaluated perceived heat-related discomfort, fatigue, and other climate-related physical effects. Psychological impact items assessed perceived stress, anxiety, and emotional burden associated with climate-related environmental changes.

Each domain consisted of three questions scored using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Composite scores for climate awareness, physical impact, and psychological impact were calculated as the mean scores of the corresponding items, with higher scores indicating greater perceived awareness or burden.

2.3 Classification of city impact groups

Cities were classified a priori into higher-urbanization cities (Yangon, Mandalay, and Naypyidaw) and lower-urbanization cities (Monywa and Myitkyina) based on their relative degree of urban development, population concentration, and traffic volume. This classification was defined independently of the climate-related awareness and perceived physical and psychological impact scores and was intended to represent urbanization context rather than the magnitude of climate-related impact or individual environmental exposure. Comparisons between the two urbanization groups were performed to examine whether climate-related awareness and perceived burden differed according to urbanization context.

2.4 Supplementary survey of local representatives

A supplementary survey was conducted among local representatives to explore contextual factors contributing to climate-related burden within each city. Five local representatives per city (25 representatives in total) were purposively selected based on their involvement in public health, community administration, environmental management, disaster preparedness, or local leadership activities. The representative questionnaire was administered using online survey procedures during the study period. The representative questionnaire included Likert-scale items evaluating perceived contributors to climate-related burden, including transportation congestion, transportation-related carbon emissions, urban density, reduced green spaces, air pollution, flooding and infrastructure problems, electricity instability, vulnerable populations, and public awareness insufficiency.

The representative questionnaire included Likert-scale items evaluating perceived contributors to climate-related burden, including transportation congestion, transportation-related carbon emissions, urban density, reduced green spaces, air pollution, flooding and infrastructure problems, electricity instability, vulnerable populations, and public awareness insufficiency. Responses were scored using a 5-point Likert scale. Combined domain scores were calculated as follows: Overall climate burden: mean score of B1, B2, and B3, transportation and carbon-emission burden: mean score of B4 and B5, urban density and green-space burden: mean score of B6 and B7, flooding and infrastructure burden: mean score of B9 and B15, vulnerable population burden: mean score of B11, B12, and B13. Air pollution burden, electricity instability burden, and public awareness insufficiency were assessed using B8, B10, and B14, respectively. Open-ended questions were also included to explore perceived causes of climate-related burden, vulnerable population groups, and suggested interventions.

The full questionnaires used for the resident survey and supplementary local representative survey are provided in the Supplementary Materials 1 and 2.

2.5 Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 31 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean $\pm$ standard deviation or median (range), while categorical variables were presented as frequency and percentage. Differences in demographic characteristics among cities were analyzed using the chi-square test for categorical variables and the Mann–Whitney U test for continuous variables. Effect sizes were reported alongside p-values for nonparametric comparisons. Epsilon-squared (ϵ^2) was used as the effect size for Kruskal–Wallis tests, while r was used for Mann–Whitney U tests and calculated as $|Z|/\sqrt{N}$. Effect sizes of approximately 0.01, 0.06, and 0.14 for ϵ^2 and 0.10, 0.30, and 0.50 for r were interpreted as small, medium, and large effects, respectively. A two-sided $p < 0.05$ was considered statistically significant.

Composite scores were calculated as the mean value of the three items within each domain, resulting in a score ranging from 1 to 5, with higher scores indicating greater awareness or perceived impact. Differences in climate awareness, physical impact, and psychological impact composite scores among the five cities were analyzed using the Kruskal–Wallis test followed by

Dunn–Bonferroni post hoc comparisons. Comparisons between higher-urbanization and lower-urbanization city groups were performed using the Mann–Whitney U test. Multiple linear regression analyses were conducted to identify factors associated with physical impact and psychological impact scores. Age, sex, occupation type, education level, and urbanization group were included as independent variables. The current dataset did not include a direct validated measure of social adaptability or adaptation behavior; therefore, no causal or mediation analysis was performed to claim that greater awareness mitigated physical or psychological impact. The observed difference in awareness between city groups is interpreted as an association and not as evidence of a protective effect. For the supplementary representative survey, data were analyzed descriptively and presented as mean $\pm$ standard deviation. Open-ended responses were summarized using thematic grouping. A p-value < 0.05 was considered statistically significant.

3. Results

3.1 Participant characteristics

A total of 591 participants from five cities in Myanmar were included in the study, comprising residents from Yangon (n = 110), Mandalay (n = 127), Naypyidaw (n = 110), Monywa (n = 125), and Myitkyina (n = 119). Participants were recruited using convenience sampling through community networks, social contacts, educational institutions, and online distribution. Participant characteristics are summarized in Table 1. Significant differences were observed among cities regarding occupation type (p = 0.017) and education level (p < 0.001), whereas age and sex distribution did not significantly differ among cities.

Table 1. General characteristics of the participants

^a: Mann–Whitney U test; ^b: Chi-square test. Significant value: p < 0.05. Data are presented as median (range) in age, number of participants (percentage %) in Sex, occupations, and education levels. Type 1: Mostly outdoor work (under sunlight, physically active); Type 2: Outdoor work with moderate physical activity; Type 3: Mixed indoor and outdoor work; Type 4: Indoor work without air conditioning; Type 5: Indoor work with air conditioning (mostly sedentary).

Participants	Yangon (n = 110)	Mandalay (n = 127)	Naypyitaw (n = 110)	Monywa (n = 125)	Myitkyina (n = 119)	p - value
Age	35.5 (23 – 50)	34 (21 – 50)	37 (21 – 50)	36 (21 – 51)	38 (21 – 57)	0.259 ^a
Sex						
Male	45 (41.0%)	61 (48.0%)	54 (49.1%)	67 (53.6%)	57 (47.9%)	0.428 ^b
Female	65 (59.0%)	66 (52.0%)	56 (50.9%)	58 (46.4%)	62 (52.1%)	
Occupations						
Type 1	6 (5.5%)	23 (18.1%)	18 (16.4%)	17 (13.6%)	26 (21.8%)	0.017 ^b
Type 2	26 (23.6%)	23 (18.1%)	21 (19.1%)	32 (25.6%)	34 (28.6%)	
Type 3	26 (23.6%)	25 (19.7%)	20 (18.2%)	23 (18.4%)	22 (18.5%)	
Type 4	22 (20.0%)	28 (22.0%)	13 (11.8%)	25 (20.0%)	18 (15.1%)	
Type 5	30 (27.3%)	28 (22.0%)	38 (34.5%)	28 (22.4%)	19 (16.0%)	
Education levels						
High school	9 (8.2%)	35 (27.5%)	30 (27.3%)	38 (30.4%)	42 (35.3%)	<0.001 ^b
Diploma	21 (19.1%)	17 (13.4%)	19 (17.3%)	29 (23.2%)	25 (21.0%)	
Bachelor	61 (55.5%)	43 (33.9%)	28 (25.5%)	35 (28.0%)	28 (23.5%)	
Master	11 (10.0%)	4 (3.1%)	6 (5.5%)	6 (4.8%)	8 (6.7%)	
PhD	8 (7.3%)	28 (22.0%)	27 (24.5%)	17 (13.6%)	16 (13.4%)	

3.2 Comparison of climate-related composite scores among cities

Significant differences were observed among the five cities for climate awareness, physical impact, and psychological impact scores (all $p < 0.001$). The Kruskal–Wallis tests indicated a medium effect for climate awareness ($\epsilon^2 = 0.07$) and large effects for physical impact ($\epsilon^2 = 0.22$) and psychological impact ($\epsilon^2 = 0.23$). Dunn–Bonferroni post hoc comparisons further identified significant differences between specific city pairs, as indicated by different superscript letters in Table 2.

3.3 Comparison between higher- and lower-urbanization cities

Climate awareness scores were significantly lower in higher-urbanization cities than in lower-urbanization cities (4.32 ± 0.38 vs. 4.47 ± 0.33 , respectively; $p < 0.001$; $r = 0.20$, small effect). Physical impact scores were significantly higher in higher-urbanization cities (4.30 ± 0.35 vs. 3.99 ± 0.52 ; $p < 0.001$; $r = 0.34$, medium effect). Similarly, psychological impact scores were significantly higher in higher-urbanization cities (4.29 ± 0.37 vs. 4.00 ± 0.50 ; $p < 0.001$; $r = 0.31$, medium effect).

3.4 Factors associated with physical and psychological impact scores

Multiple linear regression analysis demonstrated that the residence in higher-urbanization cities was independently associated with greater physical impact ($\beta = -0.332$, $p < 0.001$) and psychological impact ($\beta = -0.329$, $p < 0.001$) after adjustment for age, sex, occupation type, and education level. (Table 4). Education level was significantly associated with physical impact scores ($p = 0.002$), whereas occupation type was not significantly associated with either physical or psychological impact scores. These adjusted associations strengthen the interpretation that urban-context differences were not fully explained by the demographic variables included in the models; however, they do not establish causality.

Table 2. Comparison of composite scores among cities

Outcomes (composite scores)	Yangon	Mandalay	Naypyidaw	Monywa	Myitkyina	p - value	ϵ^2
Climate awareness	4.42 ± 0.36^a	4.35 ± 0.34^{ab}	4.17 ± 0.34^c	4.48 ± 0.33^a	4.47 ± 0.34^a	<0.001	0.07
Physical impact	4.38 ± 0.38^a	4.334 ± 0.29^a	4.18 ± 0.33^b	4.20 ± 0.35^b	3.76 ± 0.58^c	<0.001	0.22
Psychological impact	4.33 ± 0.41^a	4.36 ± 0.32^a	4.17 ± 0.36^b	4.25 ± 0.36^{ab}	3.73 ± 0.50^c	<0.001	0.23

Data are presented as mean $\pm$ standard deviation. p-values were obtained using the Kruskal–Wallis test. Different superscript letters indicate significant differences in Dunn–Bonferroni post hoc comparisons. ϵ^2 , epsilon-squared effect size; values of approximately 0.01, 0.06, and 0.14 were interpreted as small, medium, and large effects, respectively.

Table 3. Comparison of climate-related composite scores between higher-and lower-urbanization cities

Outcomes (composite scores)	High-impact cities	Lower-impact cities	p - value	Effect size (r)
Climate awareness	4.32 ± 0.38	4.47 ± 0.33	<0.001	0.20
Physical impact	4.30 ± 0.35	3.99 ± 0.52	<0.001	0.34
Psychological impact	4.29 ± 0.37	4.00 ± 0.50	<0.001	0.31

Data are presented as mean $\pm$ standard deviation. p-values were obtained using the Mann–Whitney U test. Effect size was expressed as r , calculated as $|Z|/\sqrt{N}$, with values of 0.10, 0.30, and 0.50 interpreted as small, medium, and large effects, respectively. High-impact cities included Yangon, Mandalay, and Naypyidaw, while lower-impact cities included Monywa and Myitkyina.

Table 4. Multiple linear regression analysis for climate-related physical and psychological impact scores

Independent variables	B (Unstandardized)	Standard Error	β (Standardized)	95% CI for B		p-value
				Lower bound	Upper bound	
<i>Physical impact (dependent variable), R2=0.136, p < 0.001</i>						
Age	0.003	0.002	0.046	-0.002	0.007	0.233
Sex	-0.026	0.035	-0.029	-0.095	0.042	0.450
Occupations	-0.005	0.013	-0.017	-0.030	0.019	0.661
Education levels	0.037	0.012	0.124	0.014	0.060	0.002
High/Lower impact cities	-0.307	0.036	-0.332	-0.378	-0.236	<0.001
(Constant)	4.107	0.098		3.915	4.299	<0.001
<i>Psychological impact (dependent variable), R2=0.107, p < 0.001</i>						
Age	0.001	0.002	0.017	-0.003	0.005	0.656
Sex	-0.053	0.035	-0.058	-0.122	0.017	0.136
Occupations	-0.017	0.013	-0.054	-0.042	0.008	0.171
Education levels	-0.009	0.012	-0.032	-0.032	0.014	0.424
High/Lower impact cities	-0.302	0.037	-0.329	-0.374	-0.231	<0.001
(Constant)	4.373	0.099		4.178	4.567	<0.001

B = Unstandardized regression coefficient; β = Standardized regression coefficient; CI = confidence interval.

3.5 Supplementary local representative survey

Findings from the supplementary local representative survey are summarized in Table 5. Representatives from Yangon and Mandalay generally reported higher perceived transportation and carbon-emission burden, urban density and reduced green-space burden, air pollution burden, and flooding and infrastructure burden compared with representatives from lower-impact cities. Electricity instability burden was also perceived as substantial across several cities, particularly in Monywa and Myitkyina.

Open-ended responses from local representatives commonly identified transportation congestion, urban heat, air pollution, reduced green spaces, and flooding-related infrastructure problems as major contributors

to climate-related burden in highly urbanized cities, like Yangon and Mandalay. Older adults, outdoor workers, and low-income populations were frequently perceived as vulnerable groups. Suggested interventions included improvement of public transportation systems, expansion of urban green spaces, strengthening of flood management infrastructure, reduction of environmental pollution, and increased public awareness regarding climate adaptation. These findings represent the perceptions of a small purposively selected group of local representatives. They should not be interpreted as objective measurements of traffic volume, carbon emissions, temperature, air pollution, green-space availability, or infrastructure quality. Rather, they provide contextual hypotheses that may help interpret the resident survey findings.

Table 5. Perceived contributors to climate-related burden according to local representatives

Items	Yangon	Mandalay	Naypyitaw	Monywa	Myitkyina
Overall Climate burden	4.47 ± 0.51	4.27 ± 0.28	4.00 ± 0.24	4.20 ± 0.30	3.07 ± 0.15
Transportation and carbon-emission burden	4.90 ± 0.22	4.50 ± 0.35	3.80 ± 0.91	3.20 ± 0.27	3.20 ± 0.27
Urban density and green-space burden	4.70 ± 0.45	4.30 ± 0.45	4.30 ± 0.45	3.50 ± 0.35	3.70 ± 0.45
Air pollution burden	4.60 ± 0.55	4.20 ± 0.45	4.20 ± 0.45	3.80 ± 0.45	3.40 ± 0.55
Flooding and infrastructure burden	4.40 ± 0.42	4.30 ± 0.45	4.40 ± 0.42	4.10 ± 0.22	3.50 ± 0.35
Electricity instability burden	4.60 ± 0.55	4.20 ± 0.45	4.20 ± 0.84	4.80 ± 0.45	4.80 ± 0.45
Vulnerable population burden	4.53 ± 0.51	4.20 ± 0.30	4.20 ± 0.18	4.20 ± 0.30	4.33 ± 0.41
Public awareness insufficiency	4.20 ± 0.45	4.20 ± 0.45	4.20 ± 0.45	3.80 ± 0.45	4.00 ± 0.71

Data are presented as mean ± standard deviation. Overall climate burden was calculated as the mean score of B1, B2, and B3. Transportation and carbon-emission burden was calculated as the mean score of B4 and B5. Urban density and green-space burden was calculated as the mean score of B6 and B7. Flooding and infrastructure burden was calculated as the mean score of B9 and B15. Vulnerable population burden was calculated as the mean score of B11, B12, and B13. Air pollution burden was assessed using B8. Electricity instability burden was assessed using B10. Public awareness insufficiency was assessed using B14.

4. Discussion

The present study investigated climate change–related impacts among residents from five cities in Myanmar and demonstrated significant differences in climate awareness, physical burden, and psychological burden across urban and regional settings. Residents from highly urbanized cities, particularly Yangon and Mandalay, reported significantly greater physical and psychological impacts associated with climate-related stressors, whereas residents from lower-impact cities demonstrated higher climate awareness scores. In addition, the supplementary survey of local representatives suggested that transportation congestion, carbon emissions, urban density, reduced green spaces, air pollution, and infrastructure-related problems may contribute to the greater burden observed in highly urbanized settings.

The findings regarding increased physical and psychological burden in highly urbanized cities are consistent with evidence from other Southeast Asian settings. In Northeastern Thailand, higher temperatures and exposure to floods or droughts have been associated with increased mental-health challenges (Wongpanarak & Langkulsen, 2024). In northern Vietnam, heatwave periods were associated with increased hospital admissions for mental disorders, particularly during more persistent heatwaves (Trang et al., 2016). Research among outdoor workers in Hanoi has also shown substantial perceived heat-health impacts and has highlighted the importance of knowledge and preventive actions in heat adaptation (Lohrey et al., 2021). These findings provide regional support for the present observation that urban environmental and climate stressors may affect both physical and psychological wellbeing.

Interestingly, climate awareness scores were higher in lower-impact cities such as Monywa and Myitkyina despite lower physical and psychological burden scores. One possible explanation is that residents from less urbanized regions may be more sensitive to environmental and seasonal changes because of closer dependence on agriculture, natural resources, and local environmental conditions. Previous reports from the Intergovernmental Panel on Climate Change have suggested that rural and environmentally dependent populations may demonstrate stronger awareness of environmental variability and climate-related changes because of direct exposure to seasonal and ecological conditions (Dasgupta et al., 2014). This finding highlights that climate awareness does not necessarily correspond directly to perceived physical or psychological burden.

The supplementary local representative survey provided important contextual explanations for the quantitative findings. Representatives from Yangon and Mandalay reported greater transportation and carbon-emission burden, urban density and reduced green-space burden, and air-pollution burden compared with representatives from lower-impact cities. These findings are consistent with regional evidence showing that impervious surfaces are positively associated with land-surface temperature, whereas green space is negatively associated with temperature in the megacities of Bangkok, Jakarta, and Manila (Estoque et al., 2017; Zhao et al., 2014). Evidence from Indonesia also indicates that climate-related hazards can be associated with mental distress and depression among exposed populations (Fajri et al., 2026; Maharani et al., 2025). Similarly, the Philippines has documented persistent mental-health consequences following major climate-related disasters (Alibudbud, 2023). Together, these regional findings support the interpretation that climate exposure and urban environmental conditions can interact to shape health and wellbeing.

Multiple linear regression analysis demonstrated that residence in higher-urbanization cities remained significantly associated with greater physical and psychological burden after adjustment for age, sex, occupation type, and education level. Interestingly, occupation type was not significantly associated with physical or psychological impact scores. Although outdoor occupations are generally considered more vulnerable to environmental heat exposure, the present findings may suggest that broader urban environmental conditions exert stronger influence on climate-related quality of life than occupation alone. This interpretation is supported by previous literature indicating that urban environmental stressors, including transportation congestion, environmental pollution, and infrastructure limitations, may affect large populations regardless of occupation type (IPCC, 2022; Wagner et al., 2026; WHO, 2023).

This study has several strengths. First, it evaluated climate-related awareness, physical burden, and psychological burden simultaneously using a comparative multi-city approach. Second, the inclusion of both resident surveys and supplementary local representative perspectives provided contextual understanding regarding possible contributors to climate-related burden. Third, the study addresses an important research gap regarding climate change–related impacts in Myanmar, where limited evidence is currently available. The multi-city design adds value by demonstrating heterogeneity within Myanmar rather than assuming that climate-related burden is uniform across urban populations. The effect-

size analysis further shows that the between-group pattern was more pronounced for perceived physical and psychological burden than for awareness.

However, several limitations should also be considered. The study used convenience sampling and self-reported questionnaires, which may introduce selection bias and subjective reporting bias. Because recruitment occurred through community and online networks without a defined sampling frame, a response rate could not be calculated. The cross-sectional design does not permit causal inference. The questionnaire was self-developed and specifically designed for the Myanmar context; although expert review supported content validity, formal construct validation was not performed. Internal consistency should be reported using Cronbach's alpha for each domain. In addition, the supplementary representative survey included only five representatives per city and was intended primarily to provide contextual and explanatory perspectives rather than population-level conclusions. Finally, the study did not include a direct measure of social adaptability, adaptation behavior, or objective exposure to temperature/PM2.5. Therefore, the observed higher awareness in lower-impact cities should not be interpreted as quantitative evidence that awareness itself mitigates climate-related burden. Future studies should combine individual awareness measures with objective environmental exposure data and validated measures of adaptation behavior and social resilience.

Despite these limitations, the present findings provide important evidence regarding climate-change-related impact disparities across urban and regional settings in Myanmar. The practical policy implications are directly relevant to climate adaptation. First, highly urbanized cities should prioritize sustainable public transportation and traffic-emission reduction to address congestion and carbon-related exposure. Second, urban greening, protection of existing vegetation, and expansion of shaded public spaces may reduce heat exposure and improve environmental quality (Twohig-Bennett & Jones., 2018); regional evidence from Bangkok, Jakarta, and Manila supports the role of green-space patterns in urban heat mitigation (Estoque et al., 2017; Bolund & Hunhammar., 1999). Third, city governments should strengthen PM2.5 and other air-quality monitoring and integrate air-quality alerts into public-health communication. Fourth, flood-resilient drainage and infrastructure should be prioritized in locations repeatedly identified by local representatives as vulnerable. Finally, climate-health communication should be targeted to vulnerable groups such as older adults, outdoor workers, and low-income populations, while being linked to practical actions rather than awareness alone.

5. Conclusion

This study demonstrated significant differences in climate-change awareness and perceived physical and psychological impacts among residents of five Myanmar cities. Residents of highly urbanized cities experienced greater physical and psychological burden, whereas residents of lower-impact cities demonstrated higher climate awareness. Residence in high-impact cities remained independently associated with greater physical and psychological burden after adjustment for demographic factors. Local representatives identified transportation congestion, carbon emissions, urban density, reduced green spaces, air pollution, urban heat, and infrastructure-related flooding as important contextual stressors. These findings support a multi-sectoral adaptation strategy combining sustainable transportation, urban greening, air-quality management, heat-risk communication, and flood-resilient infrastructure. However, because social adaptability and adaptation behavior were not directly measured, future research should test whether climate awareness translates into concrete protective behaviors and improved resilience.

These findings should be interpreted as between-city differences in perceived burden and as associations with urban context, rather than evidence that urbanization or individual environmental stressors caused the reported outcomes. The representative survey provides perceived contextual explanations, while objective environmental measurements were not available in this study.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request, subject to applicable privacy and ethical restrictions.

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Competing Interests

The authors declare that they have no known competing financial interests, personal relationships, or professional conflicts that could have influenced the work reported in this manuscript.

Consent for Publication

Not applicable. No identifiable personal information, images, or individual participant data are included in this manuscript.

Ethical Consideration

This study was conducted in accordance with the principles of the Declaration of Helsinki. As the study involved an anonymous questionnaire survey with minimal risk to participants and no collection of sensitive personal information, formal institutional ethical review was not required according to applicable local regulations. All participants provided informed consent before participation. Participation was voluntary, and respondents could withdraw at any time without consequence. No personally identifiable information was collected, and responses were analyzed anonymously.

CRedit Authorship Contribution Statement

Myo Thuta: Methodology/Study design; Validation; Formal analysis; Investigation; Resources; Data curation; Writing-original draft; Writing-review and editing; Visualization. **Myo Pa Pa aung:** Conceptualization; Methodology/ Study design; Investigation; Resources; Data curation; Writing-review and editing; Supervision. **Myo Maung Maung:** Conceptualization; Methodology/ Study design; Resources; Writing-review and editing; Visualisation; Supervision; Project administration; Funding acquisition.



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