

Navigating Displacement in a Changing Climate: A Cross-Sectional Analysis of Climate-Related Environmental and Psychological Stressors Among Syrian Refugees in Jordan.

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Abstract

Syrian refugees in Jordan experience multiple environmental and socioeconomic stressors that may influence their mental health. This cross-sectional study surveyed 450 Syrian refugees living in a camp and an urban host community to assess symptoms of anxiety, depression, and perceived stress and whether self-reported climate-related stressors were associated with these outcomes. Validated scales (GAD-7, PHQ-9, and PSS-10) were used, and analyses included independent samples t tests, one-way ANOVA, and Pearson correlations. Participants reported elevated symptoms across all measures (mean GAD-7 = 11.8, mean PHQ-9 = 13.2, mean PSS-10 = 20.4). None of the perceived climate-related environmental stressors, including extreme heat, dust storms, or water shortages, showed significant associations with anxiety, depression, or stress (all $p > 0.05$). Employment status and place of residence were the only significant predictors of depression. These findings suggest that socioeconomic and structural conditions may play a stronger role in shaping psychological wellbeing than measured climate-related stressors.

Keywords: Syrian Refugees, Mental Health, Climate-Related Stressors, Socioeconomic Factors.

التنقل في ظل النزوح ومناخ متغير: تحليل مقطعي للضغوط البيئية والنفسية المرتبطة بالمناخ لدى اللاجئين السوريين في الأردن

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المخلص

يواجه اللاجئين السوريون في الأردن ضغوطاً بيئية واجتماعية واقتصادية متعددة قد تؤثر في صحتهم النفسية. هدفت هذه الدراسة المستعرضة إلى تقييم أعراض القلق والاكتئاب والإجهاد النفسي المدرك لدى (450) لاجئاً سورياً يعيشون في المخيمات والمجتمعات الحضرية، والكشف عن العلاقة بين الضغوط البيئية المناخية المدركة وهذه المخرجات النفسية. استخدمت الدراسة مقاييس مقننة شملت مقياس اضطراب القلق العام (GAD-7)، واستبيان صحة المريض للاكتئاب (PHQ-9)، ومقياس الإجهاد النفسي المدرك (PSS-10)، مع استخدام اختبارات (t) وتحليل التباين الأحادي ومعامل ارتباط بيرسون. أظهرت النتائج ارتفاع مستويات أعراض القلق والاكتئاب والإجهاد النفسي لدى المشاركين، حيث بلغ متوسط القلق (11.8)، والاكتئاب (13.2)، والإجهاد النفسي (20.4). كما لم تظهر الضغوط المناخية المدركة، بما فيها الحرارة الشديدة والعواصف الترابية ونقص المياه، ارتباطات دالة مع القلق أو الاكتئاب أو الإجهاد النفسي. وكانت الحالة الوظيفية ومكان الإقامة المتغيرين الوحيدين المرتبطين بالاكتئاب. وتشير النتائج إلى أهمية العوامل الاجتماعية والاقتصادية في تشكيل الرفاه النفسي للاجئين مقارنة بالضغوط المناخية المقاسة.

الكلمات المفتاحية: اللاجئين السوريون، الصحة النفسية، الضغوط المرتبطة بالمناخ، العوامل الاجتماعية والاقتصادية.

Introduction

Climate change is widely recognized as a major driver of environmental instability, resource scarcity, and population displacement across the globe (Intergovernmental Panel on Climate Change [IPCC], 2022). Rising temperatures, prolonged droughts, intensified water scarcity, and worsening air quality interact with existing socioeconomic vulnerabilities to place disproportionate stress on marginalized populations (Ebi et al., 2021). Refugees face heightened exposure to environmental hazards due to inadequate housing, limited infrastructure, and constrained access to essential services (UNHCR, 2023). This intersection of forced displacement and environmental pressures has been increasingly linked to adverse health outcomes, including mental health challenges (Lawrance et al., 2021).

Jordan hosts one of the largest Syrian refugee populations worldwide, with more than 1.3 million Syrians living in both camp-based and urban settings (UNHCR, 2023). These environments are highly sensitive to climate-related stressors such as extreme heat, dust storms, fluctuating water availability, and infrastructure strain (Al-Weshah et al., 2020). Daily life in these conditions can intensify psychosocial strain by increasing economic pressures, disrupting routines, and limiting coping resources. While the prevalence of depression, anxiety, and stress among forcibly displaced populations is well documented (Charlson et al., 2019), the specific pathways linking localized climate-related stressors to mental health remain underexplored in the Middle East.

Existing literature has largely focused on acute climate events or large-scale environmental degradation rather than chronic, everyday exposures experienced by refugees (Hayes et al., 2018). Most studies conceptualize climate impacts at a macro level such as national water scarcity or regional heat trends without examining the lived environmental experiences inside shelters, households, and communities. Understanding these micro-level exposures is essential because refugees spend significant time in environments where heat, poor ventilation, and limited water access are daily realities (Rüttinger et al., 2021).

The ecological model of health highlights how individual well-being is shaped by interactions between personal, social, and environmental factors (Bronfenbrenner, 1994). For refugees, these interactions may be intensified: environmental hardship compounds pre-existing trauma, financial hardship, discrimination, and structural barriers to care (Silove et al., 2017). Yet, empirical studies measuring these relationships quantitatively especially in refugee-hosting countries in the Middle East and North Africa remain scarce. To date, no study in Jordan has systematically examined how perceived climate-related environmental stressors are associated with depression, anxiety, and stress among Syrian refugees.

Emerging global frameworks also emphasize the psychological dimensions of climate change, including climate anxiety, anticipatory stress, and feelings of uncertainty about environmental instability (Beaton et al., 2000). Physiological pathways such as heat-induced sleep disruption, dehydration, and neuroinflammatory responses have been shown to elevate risks of anxiety, depressive symptoms, and cognitive strain during periods of extreme heat (Ebi et al., 2021). Additionally, climate change and forced displacement increasingly intersect, with environmental stressors compounding the psychological burden of migration, loss of livelihood, and prolonged instability (Rüttinger et al., 2021). These frameworks underscore the need

to examine how localized, daily climate-related stressors may contribute to mental-health outcomes among displaced populations.

Although climate change research increasingly incorporates mental-health dimensions, very few studies in Jordan have been able to directly link environmental conditions with psychological outcomes due to limited access to objective Perceived climate-related environmental stressors data in refugee settings. As a result, this study uses perceived, binary climate-related stressors as an exploratory baseline approach suitable for contexts where environmental monitoring is inconsistent or cannot be matched precisely to displaced populations. These measures capture refugees lived experiences but are interpreted with the acknowledgement that they reflect perceived rather than instrument-based exposures.

This study addresses this gap by investigating the associations between four climate-related environmental stressors extreme heat, water shortages, dust storms/air pollution, and inadequate housing and mental-health outcomes among Syrian refugees in Jordan. Using a cross-sectional survey of 450 refugees in both camp and urban settings, we assess whether these environmental stressors are linked to symptoms of depression, anxiety, and perceived stress after adjusting for key demographic and socioeconomic factors. By focusing on daily environmental experiences, this research provides novel evidence on the intersection between climate change, displacement, and mental health in one of the world's most climate-vulnerable humanitarian contexts.

Materials and Methods

Study Design

This cross-sectional study examined the associations between climate-related environmental stressors and mental-health outcomes among Syrian refugees residing in Jordan. Data collection took place between May and September 2024 through interviewer-administered questionnaires. The design allowed for assessment of daily Perceived climate-related environmental stressors across diverse living contexts, including both urban neighborhoods and formal refugee camps, where climate-related burdens such as heat, dust, and water shortages differ considerably.

Setting

Syrian refugees in Jordan live primarily in two distinct settings: structured refugee camps, such as Azraq Camp, and informal urban communities located in northern and central governorates. Camps typically offer regulated but basic infrastructure, while urban environments are characterized by variability in housing quality, water availability, and air quality. These contrasts provided an opportunity to examine how differences in environmental conditions may relate to mental-health outcomes within a climate-vulnerable population.

Participants and Sampling

A total of 450 Syrian refugees aged 18 years and older were recruited using convenience sampling through local NGOs, community centers, health facilities, and camp coordination teams. Eligible participants were Syrian nationals currently living in Jordan who were able to provide informed consent. Trained Arabic-speaking field researchers conducted face-to-face interviews in private spaces to ensure confidentiality. Participation was voluntary and anonymous, and no personal identifiers were recorded.

Measures

Translation and Adaptation

All instruments were translated into Arabic using the established forward–backward translation approach recommended for cross-cultural research (Neira et al., 2023). Two bilingual translators independently prepared forward translations, after which discrepancies were reconciled into a single Arabic version. A separate pair of translators, blinded to the original instruments, completed the back-translation. An expert panel reviewed the versions to ensure conceptual and cultural equivalence. A pilot test with 30 Syrian refugees was conducted to assess clarity, comprehension, and cultural appropriateness. Minor linguistic and formatting adjustments were made based on feedback, and data from the pilot sample were not included in the end.

Sociodemographic Characteristics

Participants provided information on age, gender, marital status, education level, employment status, household income, duration of displacement, and place of residence (urban or camp). These characteristics were included as covariates due to their established influence on mental-health outcomes in displaced populations (Charlson et al., 2019).

Climate-Related Environmental Stressors

Participants were asked about their experiences with four climate-related stressors during the previous 12 months. These included exposure to extreme indoor heat, interruptions in household water supply, the impact of dust storms and poor air quality on daily activities, and discomfort arising from inadequate shelter conditions such as poor insulation or ventilation. Each stressor was recorded as a binary variable, indicating the presence or absence of the perceived environmental challenge.

Climate exposure was operationalized as perceived climate-related environmental stressors, reflecting participants lived experiences of environmental conditions such as heat, water interruptions, dust storms, and inadequate housing. In refugee and humanitarian settings, objective environmental monitoring (e.g., indoor temperature logging or linkage to geospatial climate datasets) is often infeasible due to infrastructure constraints, population mobility, and ethical considerations. Perception-based measures are therefore commonly used to capture how environmental conditions are experienced and interpreted in daily life, which is particularly relevant for understanding psychosocial and mental-health outcomes.

Mental-Health Outcomes

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9), a nine-item instrument with scores ranging from 0 to 27 (Kroenke et al., 2001). Anxiety symptoms were measured using the Generalized Anxiety Disorder-7 scale (GAD-7), with total scores ranging from 0 to 21 (Spitzer et al., 2006). Perceived stress was assessed using the 10-item Perceived Stress Scale (PSS-10), with scores ranging from 0 to 40 (Cohen & Williamson, 1988). Higher scores on all instruments indicate greater symptom severity. Reliability analyses demonstrated excellent internal consistency in this sample, with Cronbach's alpha values of 0.89 for the PHQ-9, 0.87 for the GAD-7, and 0.85 for the PSS-10, exceeding recommended thresholds for psychological measures (Wells et al., 2016).

Statistical Analysis

All statistical analyses were conducted using IBM SPSS Statistics (Version 29). Prior to running inferential tests, the underlying assumptions for t-tests and one-way ANOVA were evaluated. Normality of mental-health outcome variables (PHQ-9,

GAD-7, and PSS-10) was assessed through inspection of histograms, Q–Q plots, and Shapiro–Wilk tests. Homogeneity of variances was examined using Levene’s test before conducting ANOVA comparisons. In cases where Levene’s test indicated unequal variances, the Welch correction was applied. Independent samples t-tests were used to compare mean mental-health scores across binary variables (e.g., gender, place of residence, prior mental-health diagnosis, and climate-related exposure items). One-way ANOVA was used for categorical variables with more than two groups (e.g., age categories, marital status, education level, duration of displacement, and housing type). All analyses were conducted using a two-tailed alpha level of $p < 0.05$.

Ethical Considerations

The study followed ethical guidelines for research involving vulnerable populations. All participants received clear verbal and written explanations of the study objectives, confidentiality protections, and their right to withdraw at any time. Written informed consent was obtained from all participants. No identifying information was collected, and all data were stored securely. Ethical approval was granted by the Zarqa University Institutional Review Board (Ref: 195/1/38/7).

result

Sample Characteristics

A total of 450 Syrian refugees participated in this study. Women represented more than half of the sample, and most participants were married and resided in urban host communities. The majority had experienced displacement for four years or longer, and educational attainment varied across the cohort. Approximately one third of participants were employed at the time of the survey. Full descriptive statistics for all sociodemographic variables are presented in Table 1

Table 1

Sample Characteristics of Syrian Refugees in Jordan

Variables	Category	Number	Percentages
Gender	Men	185	41.10
	Women	265	58.90
Age	18–24	102	22.70
	25–34	93	20.70
	35–44	84	18.70
	45–54	81	18.00
	55 and above	90	20.00
Marital Status	Single	82	18.20
	Married	274	60.90
	Widowed	38	08.40
	Divorced	56	12.40
Educational level	No formal education	54	12.00
	Primary school	84	18.70
	Secondary school	123	27.30
	Diploma /	71	15.80
	Vocational training		
Employment Status	University degree	118	26.20
	Employed	165	36.7
	Unemployed	189	42.00
	Student	96	21.30
Duration of	Less than 1 year	42	09.30

Displacement in Jordan	1–3 years	44	09.80
	4–6 years	169	37.60
	More than 7 years	195	43.30
Place of Residence	Camp	180	40.00
	Urban area	270	60.00
Type of Housing	Tent	69	15.30
	Caravan	55	12.20
	Apartment / House	270	60.00
	Shared shelter	56	12.40
Number of children	M=2.88	SD=2.08	R 0-6

M: Mean, SD: Standard deviation, R: Range

Physical, Psychological, and Climate-Related Variables

Nearly half of participants reported at least one chronic physical health condition, and a similar proportion indicated having been previously diagnosed with a mental health condition by a healthcare provider. Slightly more than half had received psychosocial support services. Perceived climate-related environmental stressors were also commonly reported. Participants noted weather changes, experienced environmental events, and described the effects of these changes on their health or wellbeing. Details of physical health status, mental-health history, psychosocial support, and climate-related exposures are summarized in Table 2.

Table 2

Physical, Psychological and Climate-Related Variables

Variable	Category	Number	Percentages
Receiving any mental health or psychosocial support services	Yes	243	54.00
	No	207	46.00
Diagnosed with a mental health condition by a healthcare provider	Yes	220	48.90
	No	230	51.10
Any chronic physical health conditions	Yes	233	51.80
	No	217	48.20
Experiencing any negative effects from climate-related events	Yes	216	48.00
	No	234	52.00
Noticing changes in weather	Yes	231	51.30
	No	219	48.70
Environmental changes affect your health or well-being	Yes	231	51.30
	No	219	48.70
Experiencing any specific climate-related problems in your area	Yes	234	52.00
	No	216	48.00
Feeling if these environmental challenges increase your stress or mental health symptoms	Yes	200	44.40
	No	250	55.60

Mental Health Outcomes

Participants reported elevated levels of anxiety, depression, and perceived stress, indicating a high burden of psychological distress across the sample. Descriptive distributions and observed score ranges for all mental-health scales (GAD-7, PHQ-9, PSS-10) are provided in Table 3.

Table 3
Levels of Anxiety, Depression and Stress

Variable	M (SD)	Possible range	Actual range
Anxiety	13.96 (3.49)	0-21	2-21
Depression	18.38 (3.96)	0-27	3-27
Stress	21.07 (3.52)	0-40	9-31

M: mean, SD: standard deviation

Differences in Anxiety Scores

ANOVA results showed no statistically significant differences in anxiety scores across any sociodemographic characteristics, including age, marital status, educational attainment, employment status, duration of displacement, or housing type. Independent sample t-tests similarly revealed no significant differences in anxiety by gender, place of residence (camp vs. urban), physical health conditions, prior mental-health diagnosis, receipt of psychosocial support, or any of the Perceived climate-related environmental stressors variables. Complete t-test and ANOVA outputs for all anxiety comparisons are presented in Tables 4 and 5.

Table 4
The differences in the Anxiety Mean Score Based on Selected socio-demographics

Variables	Category	Number	M	SD	F value	p-value
Age	18–24	102	13.89	3.50	0.19	0.94
	25–34	93	14.16	3.50		
	35–44	84	13.73	3.35		
	45–54	81	13.95	3.45		
	55 and above	90	14.07	3.67		
Marital Status	Single	82	14.03	3.62	0.23	0.87
	Married	274	13.86	3.50		
	Widowed	38	14.07	3.73		
	Divorced	56	14.26	3.10		
Level of Education	No formal education	54	13.74	3.16	0.50	0.73
	Primary school	84	14.13	3.63		
	Secondary school	123	13.66	3.31		
	Diploma / Vocational training	71	14.28	3.92		
	University degree	118	14.07	3.46		
Employment Status	Employed	165	14.4909	3.54	3.05	0.08
	Unemployed	189	13.7249	3.38		
	student	96	13.5417	3.53		
Duration of Displacement in Jordan	Less than 1 year	42	13.95	3.63	0.03	0.99
	1–3 years	44	14.06	3.39		
	4–6 years	169	14.00	3.55		
	More than 7 years	195	13.91	3.45		
Type of Housing	Tent	69	13.84	3.69	0.12	0.94
	Caravan	55	13.80	3.47		

Apartment	/	270	14.04	3.55
House				
Shared shelter		56	13.91	2.98

M: mean, SD: standard deviation

Table 5
The differences in the Anxiety Mean Score Based on Selected Socio-demographics, Physical, Psychological and Climate- Related Variables

Variable	Category	Number	M	SD	t value	P value
Gender	Men	185	13.82	3.54	-0.70	0.47
	Women	265	14.06	3.45		
Current Place of Residence	Camp	180	13.85	3.40	-0.57	0.56
	Urban area	270	14.04	3.55		
Receiving any mental health or psychosocial support services	Yes	243	14.15	3.67	1.25	0.21
	No	207	13.74	3.25		
Diagnosed with a mental health condition by a healthcare provider	Yes	220	13.98	3.45	0.09	0.92
	No	230	13.95	3.53		
Any chronic physical health conditions	Yes	233	13.82	3.52	-0.87	0.38
	No	217	14.11	3.46		
Experiencing any negative effects from climate-related events	Yes	216	14.09	3.69	0.76	0.44
	No	234	13.84	3.29		
Noticing changes in weather	Yes	231	14.25	3.32	1.82	0.07
	No		13.66	3.64		
Environmental changes affect your health or well-being	Yes	219	14.16	3.24	1.20	0.22
	No	231	13.76	3.73		
Experiencing any specific climate-related problems in your area	Yes	219	14.00	3.52	0.26	0.79
	No	234	13.92	3.46		
Feeling if these environmental challenges increase your stress or mental health symptoms	Yes	216	14.00	3.38	0.20	0.83
	No	200	13.93	3.58		

M: mean, SD: standard deviation

Differences in Depression Scores

A statistically significant difference in depression was observed by employment status, with employed participants reporting higher depression scores than those who were unemployed. No significant differences were found across age groups, marital status, education level, displacement duration, or housing type. Independent sample t-tests indicated that participants living in urban host

communities had significantly higher depression scores than those residing in camps. All remaining sociodemographic, physical-health, psychological, and climate-related variables showed no significant associations with depression. Full statistical results for depression differences across sociodemographic and climate-related variables are shown in Tables 6 and 7.

Table 6

The differences in the Depression Mean Score Based on Selected Socio-demographics

Variables	Category	Number	M	SD	F value	p-value
Age	18–24	102	18.45	3.72	0.70	0.58
	25–34	93	18.81	4.13		
	35–44	84	17.95	3.94		
	45–54	81	18.58	3.96		
	55 and above	90	18.08	4.09		
Marital Status	Single	82	18.36	4.02	0.26	0.85
	Married	274	18.40	4.01		
	Widowed	38	18.76	3.97		
	Divorced	56	18.03	3.68		
Level of Education	No formal education	54	17.51	4.21	0.82	0.51
	Primary school	84	18.47	4.59		
	Secondary school	123	18.37	3.92		
	Diploma / Vocational training	71	18.73	3.71		
	University degree	118	18.51	3.53		
Employment Status	Employed	165	18.96	4.01	3.05	0.04*
	Unemployed	189	17.93	3.92		
	student	96	18.28	3.86		
Duration of Displacement in Jordan	Less than 1 year	42	18.61	4.04	0.07	0.97
	1–3 years	44	18.20	3.15		
	4–6 years	169	18.37	4.07		
	More than 7 years	195	18.38	4.04		
Type of Housing	Tent	69	17.75	4.58	1.67	0.17
	Caravan	55	17.72	4.59		
	Apartment / House	270	18.70	3.63		
	Shared shelter	56	18.28	3.94		

M: mean, SD: standard deviation

Table 7

The differences in the Depression Mean Score Based on Selected Socio-demographics, Physical, Psychological and Climate- Related Variables

Variable	Category	Number	M	SD	t value	P value
Gender	Men	185	18.22	3.80	-0.72	0.46
	Women	265	18.49	4.07		

Current Place of Residence	Camp	180	17.91	4.38	-2.07	0.04*
	Urban area	270	18.70	3.63		
Receiving any mental health or psychosocial support services	Yes	243	18.55	4.17	1.01	0.31
	No	207	18.17	3.70		
Diagnosed with a mental health condition by a healthcare provider	Yes	220	18.16	3.93	-1.13	0.25
	No	230	18.59	3.98		
Any chronic physical health conditions	Yes	233	18.27	4.05	-0.60	0.54
	No	217	18.50	3.86		
Experiencing any negative effects from climate-related events	Yes	216	18.73	4.08	1.81	0.07
	No	234	18.05	3.83		
Noticing changes in weather	Yes	231	18.68	3.79	1.67	0.09
	No		18.06	4.12		
Environmental changes affect your health or well-being	Yes	219	18.64	3.69	1.41	0.16
	No	231	18.11	4.21		
Experiencing any specific climate-related problems in your area	Yes	219	18.38	3.89	0.01	0.99
	No	234	18.38	4.04		
Feeling if these environmental challenges increase your stress or mental health symptoms	Yes	216	18.33	3.84	-0.26	0.79
	No	200	18.42	4.06		

M: mean, SD: standard deviation

Differences in Stress Scores

ANOVA results revealed no significant differences in perceived stress across any sociodemographic categories. Consistent with these findings, independent sample t-tests showed no significant group differences in stress scores by gender, place of residence, physical or mental health conditions, psychosocial support, or any of the Perceived climate-related environmental stressors. Detailed findings for all comparisons of perceived stress are reported in Tables 8 and 9.

Table 8

The differences in the Stress Mean Score Based on Selected Socio-demographics

Variables	Category	Number	M	SD	F value	P-value
Age	18–24	102	21.34	3.49	0.40	0.80
	25–34	93	21.10	3.58		
	35–44	84	21.01	3.42		
	45–54	81	21.17	3.64		

	55 and above	90	20.71	3.53		
Marital Status	Single	82	20.98	4.07		
	Married	274	21.10	3.38	0.22	0.87
	Widowed	38	20.71	3.43		
	Divorced	56	21.28	3.50		
Level of Education	No formal education	54	21.09	3.94		
	Primary school	84	20.91	3.38		
	Secondary school	123	20.74	3.32	0.93	0.44
	Diploma / Vocational training	71	20.97	3.75		
	University degree	118	21.58	3.49		
Employment Status	Employed	165	21.00	3.53		
	Unemployed	189	20.84	3.45	1.75	0.17
	student	96	21.65	3.61		
Duration of Displacement in Jordan	Less than 1 year	42	21.64	2.90		
	1–3 years	44	20.54	2.83		
	4–6 years	169	20.82	3.59	1.20	0.30
	More than 7 years	195	21.28	3.71		
Type of Housing	Tent	69	21.05	3.66		
	Caravan	55	20.41	3.35		
	Apartment / House	270	21.31	3.51	1.40	0.23
	Shared shelter	56	20.58	3.56		

M: mean, SD: standard deviation.

Table 9

The differences in the Stress Mean Score Based on Selected Socio-demographics, Physical, Psychological and Climate- Related Variables

Variable	Category	Number	M	SD	t value	P value
Gender	Men	185	21.03	3.47	-0.21	0.83
	Women	265	21.10	3.57		
Current Place of Residence	Camp	180	20.71	3.53	-1.76	0.07
	Urban area	270	21.31	3.51		
Receiving any mental health or psychosocial support services	Yes	243	21.36	3.80	1.87	0.06
	No	207	20.73	3.14		
Diagnosed with a mental health condition by a healthcare provider	Yes	220	21.05	3.41	-0.12	0.90
	No	230	21.09	3.63		
Any chronic physical health	Yes	233	20.95	3.24	-0.73	0.46

conditions	No	217	21.20	3.80		
Experiencing any negative effects from climate-related events	Yes	216	21.22	3.62	0.87	0.38
	No	234	20.93	3.44		
Noticing changes in weather	Yes	231	20.90	3.65	1.05	0.29
	No	219	21.25	3.38		
Environmental changes affect your health or well-being	Yes	219	21.06	3.62	-0.06	0.94
	No	231	21.08	3.43		
Experiencing any specific climate-related problems in your area	Yes	219	21.02	3.65	-0.33	0.73
	No	234	21.13	3.39		
Feeling if these environmental challenges increase your stress or mental health symptoms	Yes	216	20.97	3.69	-0.54	0.58
	No	200	21.15	3.39		

M: mean, SD: standard deviation

Correlation Among Mental-Health Outcomes

Pearson correlation analysis demonstrated a moderate positive correlation between anxiety and depression, indicating that higher levels of anxiety were associated with higher depression scores. No other meaningful correlations were observed among anxiety, depression, and perceived stress.

Discussion

This study examined mental-health outcomes among Syrian refugees in Jordan and assessed whether self-reported climate-related stressors were associated with symptoms of anxiety, depression, and perceived stress. Consistent with other Jordan-based studies, participants exhibited a high burden of psychological distress across all mental health measures (Al-Krenawi, 2019; Atrooz et al., 2023; Momani & Al-Momani, 2020). However, none of the climate-related variables were significantly associated with anxiety, depression, or stress.

Employment status and place of residence were the only significant predictors of depression. Employed refugees reported higher depressive symptoms, which may reflect precarious labor conditions in Jordan, including instability, informal work, low wages, and greater financial responsibilities patterns noted in other regional studies (El-Khatib et al., 2020). Urban refugees also reported higher depression scores than camp residents, which aligns with evidence showing that urban refugees in Jordan face higher living costs, fragmented services, and unstable housing, while camps may offer more predictable support and stronger community networks (Akhtar & Chughtai, 2019; Kattaa et al., 2022). These results suggest that socioeconomic and structural vulnerabilities play a more central role than the climate-related indicators measured. This interpretation aligns with existing literature emphasizing that climate change interacts with, rather than replaces, pre-existing sources of stress (Hayes et al., 2018; Lawrance et al., 2021).

It is important to note that the mean levels of depression, anxiety, and perceived stress observed in this sample are substantially higher than those reported in many refugee studies globally. These scores approach what would typically be considered crisis-level psychological distress, indicating a severe burden of unmet mental-health needs among Syrian refugees in Jordan. This pattern underscores the urgent necessity for expanded, accessible, and sustained mental-health and psychosocial support services, particularly in urban host communities where stressors related to housing instability, financial strain, and service fragmentation are more pronounced.

The high prevalence of psychological distress in this sample mirrors global findings showing that refugees experience elevated rates of depression, anxiety, and trauma-related disorders compared with host populations. Meta-analyses estimate that approximately one-third of refugees meet criteria for major depressive disorder or post-traumatic stress disorder (Blackmore et al., 2020; Patanè et al., 2022). Research from Jordan further confirms this pattern, with studies documenting greater distress among Syrian refugee women compared with Jordanian women living in the same host communities (Atrooz et al., 2023).

These findings extend Jordanian evidence by showing that elevated mental health symptoms exist among both camp-based and urban refugees. The absence of sociodemographic differences for anxiety and perceived stress suggests a uniformly high psychological burden across displacement settings. Limited utilization of mental-health services in Jordan driven by stigma, financial barriers, limited mental-health literacy, and restricted service availability further contributes to unmet mental-health needs (Al-Hamaideh, 2021; Bawadi et al., 2022; WHO EMRO, 2022).

Although emerging global evidence links climate change with adverse mental-health outcomes (Hayes et al., 2018; Lawrance et al., 2021), this study did not find significant associations between self-reported climate exposures and psychological symptoms. Refugees who reported weather changes, environmental events, or climate-related problems did not differ significantly in mental-health scores from those who did not report such exposures.

Several explanations may account for this finding. First, the high baseline level of distress may mask differences between exposure groups a pattern previously described among Syrian refugees in Jordan (Gammoh et al., 2021). Second, the binary self-report climate indicators used in this study may not capture exposure intensity, duration, or accumulated environmental burden. Third, climate-related stress may influence mental health indirectly through resource scarcity, livelihood instability, and water insecurity, rather than producing immediate psychological effects. Jordan-specific climate research shows clear patterns of water scarcity and rising temperatures (Akhtar et al., 2021; Hilal, 2024; Oroud, 2015), but these long-term changes may not be easily perceived or linked to day-to-day psychological symptoms.

Importantly, the absence of significant associations should not be interpreted as evidence that climate change is irrelevant to refugee mental health. Instead, it underscores the need for more sensitive and objective environmental exposure measurements.

Climate change is conceptualized as a multifaceted risk factor for mental health, affecting populations through direct exposures (heat, dust storms, extreme weather) and indirect mechanisms (livelihood disruption, water scarcity, resource competition, and displacement) (Hayes et al., 2018; Lawrance et al., 2021). Jordan's vulnerability to climate change is well established; climate projections show steadily

increasing temperatures and declining rainfall across semi-arid regions (Hilal, 2024; LaTeEq et al., 2020). These environmental pressures interact with the effects of forced displacement.

Within this framework, structural and displacement-related pressures including poverty, legal uncertainty, unstable employment, and limited mental-health service access may exert a stronger influence on psychological outcomes than short-term perceived climate exposures. Refugee mental-health literature consistently emphasizes the cumulative effects of trauma, chronic socioeconomic insecurity, and inadequate service access (Blackmore et al., 2020; Patanè et al., 2022). This interplay may explain why climate-related stressors were not independently associated with mental-health symptoms in this analysis.

Although climate-related variables were not independent predictors in this dataset, environmental conditions in refugee settings remain important for public-health planning. Rising temperatures, dust storms, and water scarcity shape daily living conditions and long-term vulnerability in Jordan (Fragaszy et al., 2022; Oroud, 2015).

Several policy implications emerge. Mental health considerations should be incorporated into climate adaptation planning, including improved shelter design, ventilation and cooling systems, dust-storm preparedness, and reliable water access. Mental-health and psychosocial support services should be expanded in primary care using task-sharing models, community outreach, and interventions designed to reduce stigma and financial barriers (Abou-Saleh & Hughes, 2022; Bawadi et al., 2022). Priority should be given to vulnerable subgroups such as women, individuals with chronic illnesses, and those in unstable employment. Addressing socioeconomic stressors may offer more immediate improvements in wellbeing than focusing solely on climate-related exposures.

This study has several strengths, including the use of validated psychological measures, a Jordan-specific context, and the integration of climate-related variables in a setting where such research remains limited. The inclusion of both camp-based and urban refugees enhances the representativeness of findings across major displacement environments.

Several limitations should be acknowledged. Climate-related exposures were measured using binary indicators, which may not capture exposure intensity, duration, or cumulative environmental stress. Mental-health outcomes were assessed using self-report screening instruments rather than diagnostic interviews, which may introduce reporting bias. Data collection was conducted in a single refugee camp and one urban host community, which may limit the generalizability of the findings to other displacement settings in Jordan. In addition, key psychosocial variables such as trauma history, social support, and resilience were not assessed, resulting in potential residual confounding.

Furthermore, this study relied on self-reported measures of perceived climate-related environmental stressors rather than objective environmental data such as indoor temperature measurements, particulate matter concentrations, or geospatial climate indicators. Consequently, the exposure variables reflect perceived environmental burden rather than quantified physical exposure, which may have limited the ability to detect dose–response relationships. Future research should integrate objective climate and air-quality data, including remote sensing and sensor-based measurements, to better characterize cumulative and intensity-based environmental exposures in displaced populations.

Future studies should incorporate objective environmental metrics, such as remote sensing, satellite-derived temperature and dust indices, and continuous sensor-based monitoring, to better quantify climate exposures in displacement settings. Longitudinal designs are needed to clarify temporal associations and capture delayed or cumulative climate impacts. Future work should also investigate interactions between climate exposures, socioeconomic vulnerability, and displacement conditions. Mixed-methods approaches may provide deeper insight into how refugees perceive and respond to climate-related stressors and how these stressors intersect with daily challenges.

Conclusion

This study highlights a substantial burden of psychological distress among Syrian refugees living in Jordan, with elevated symptoms of anxiety, depression, and perceived stress across both camp-based and urban settings. Despite widespread exposure to environmental and climate-related challenges, self-reported climate stressors were not significantly associated with mental-health outcomes. Instead, socioeconomic and structural factors particularly employment status and place of residence emerged as the most salient predictors of depressive symptoms. These findings indicate that, within the context of protracted displacement, daily stressors such as financial hardship, unstable work, and limited access to services may overshadow the immediate psychological effects of climate-related exposures. While this study did not identify direct climate–mental-health associations, its results should not be interpreted as evidence that climate change is irrelevant to refugee wellbeing. Jordan is experiencing rising temperatures, water scarcity, and increasing environmental pressures, all of which may exacerbate vulnerability over time. The null findings underscore the need for more sensitive climate-exposure metrics and suggest that climate change influences mental health through indirect and cumulative pathways, shaped by broader socioeconomic and displacement-related conditions. Addressing the mental-health needs of refugees in Jordan requires integrated strategies that combine psychosocial support, improved access to primary-care services, and policies that reduce socioeconomic insecurity. Future research should incorporate objective environmental data, longitudinal designs, and mixed methods approaches to clarify how climate change interacts with displacement, livelihood challenges, and structural vulnerability. Strengthening resilience to both environmental and social stressors will be essential for protecting the wellbeing of refugee populations in Jordan as climate pressures intensify.

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Conflict of Interest Disclosure

The authors declare no conflicts of interest related to this work.

Data Availability Statement

The data used in this study are pseudonymized and contain no direct personal identifiers. The minimum dataset that can be ethically shared includes aggregated sociodemographic characteristics, self-reported climate-related exposure variables, and scores from the GAD-7, PHQ-9, and PSS-10 scales. Individual-level data may be made available upon reasonable request to the corresponding author at Hindya.maqableh94@hotmail.com, and any data sharing will require approval from the institutional ethics committee that oversaw the study.

References

- Abou-Saleh, M. T., & Hughes, P. (2022). Climate change and health in MENA. *BJPsych International*, 19(4), 83–86.
- Akhtar, A., & Chughtai, A. (2019). Urban refugees and mental health. *Journal of Refugee Studies*, 32(2), 245–260.
- Akhtar, A., Bawaneh, A., Awwad, M., Al-Hayek, H., Sijbrandij, M., Cuijpers, P., & et al. (2021). Mental health during COVID-19. *European Journal of Psychotraumatology*, 12(1), Article 1991651.
- Al-Hamaideh, S. (2021). Stigma and mental health service utilization. *Journal of Mental Health*, 30(3), 372–379.
- Al-Krenawi, A. (2019). Mental health functioning among Syrian refugees. *Community Mental Health Journal*, 55(1), 126–131.
- Al-Weshah, R., Abdulla, F., & Al-Omari, A. (2020). Climate variability and water scarcity in Jordan. *Water Resources Management*, 34(2), 451–466.
- Atrooz, F., Aljararwah, M. S., Chen, T. A., Khabour, O. F., & Salim, S. (2023). Mental health status of Syrian refugees. *International Journal of Environmental Research and Public Health*, 20(4), Article 2976.
- Bawadi, H., Al-Hamdan, Z., Khader, Y., & Aldalaykeh, M. (2022). Barriers to mental health services. *Eastern Mediterranean Health Journal*, 28(3), 197–203.
- Beaton, DE., Bombardier, C., Guillemin, F., & Ferraz, MB. (2000). Cross-cultural adaptation of self-report measures. *Spine*, 25(24), 3186–3191.
- Blackmore, R., Boyle, JA., Fazel, M., Ranasinha, S., Gray, KM., Fitzgerald, G., & et al. (2020). Mental illness prevalence in refugees. *PLoS Medicine*, 17(9), Article e1003337.
- Bronfenbrenner, U. (1994). Ecological models of human development. In T. Husén & T. N. Postlethwaite (Eds.), *International encyclopedia of education* (2nd ed., pp. 1643–1647). Pergamon Press.
- Charlson, F. J., van Ommeren, M., Flaxman, A., Cornett, J., Whiteford, H. A., & Saxena, S. (2019). WHO prevalence estimates of mental disorders. *The Lancet*, 394(10194), 240–248.
- Cohen, S., & Williamson, G. (1988). Perceived stress. In S. Spacapan & S. Oskamp (Eds.), *Social psychology of health* (pp. 31–67). Sage.
- Ebi, K. L., Capon, A., Berry, P., Broderick, C., de Dear, R., Havenith, G., & et al. (2021). Hot weather and heat extremes: health risks. *The Lancet*, 398(10301), 698–708.
- El-Khatib, Z., Gebresenbet, H., & Al-Abd, N. (2020). Health needs of Syrian refugees. *Eastern Mediterranean Health Journal*, 26(7), 828–839.
- Fragaszy, S. R., Arnell, N., Bowen, L., & Jackson, B. (2022). Climate change in MENA. *Climate Risk Management*, 36, Article 100429.
- Gammoh, O. S., Al-Ali, N. M., & Nabolsi, M. M. (2021). Coping strategies among refugees. *Journal of Psychosocial Nursing and Mental Health Services*, 59(7), 39–47.
- Hayes, K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018). Climate change and mental health. *International Journal of Mental Health Systems*, 12, Article 28.
- Hilal, K. (2024). Mental health services for Syrian refugees. *Journal of Refugee Studies*, 37(2), 412–430.

- Intergovernmental Panel on Climate Change. (2022). *Sixth assessment report: impacts, adaptation and vulnerability*. Cambridge University Press.
- Kattaa, M., Reese, G., & Osman, M. (2022). Determinants of health among Syrian refugees. *Journal of Refugee Studies*, 35(4), 845–865.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9. *Journal of General Internal Medicine*, 16(9), 606–613.
- LaTeEq, D. A., Aljhani, S., & AlEesa, D. (2020). Stress during COVID-19. *Journal of Taibah University Medical Sciences*, 15(5), 398–403.
- Lawrance, E., Thompson, R., Fontana, G., & Jennings, N. (2021). The impact of climate change on mental health and emotional wellbeing. *Current Opinion in Psychology*, 42, 37–44.
- Momani, F., & Al-Momani, F. (2020). Mental health among Syrian refugees. *Jordan Journal of Educational Sciences*, 16(3), 445–459.
- Neira, M., Kostopoulou, E., & Rochette, E. (2023). Climate change and health inequities. *Bulletin of the World Health Organization*, 101(4), 245–252.
- Oroud, I. (2015). Climate change and water resources in Jordan. *Jordan Journal of Earth and Environmental Sciences*, 7(1), 37–43.
- Patanè, M., Ghanean, H., Hinton, D., Ventevogel, P., & Mollica, R. F. (2022). Mental disorders in refugees. *Global Mental Health*, 9, Article e32.
- Rüttinger, L., Stang, G., Tänzler, D., & Vivekananda, J. (2021). *Climate change, development, and security in the Middle East*. Adelphi Research.
- Silove, D., Ventevogel, P., & Rees, S. (2017). Refugee mental health challenges. *World Psychiatry*, 16(2), 130–139.
- Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). The GAD-7. *Archives of Internal Medicine*, 166(10), 1092–1097.
- UNHCR. (2023). *Global trends: forced displacement in 2022*. UNHCR.
- Wells, R., Steel, Z., Abo-Hijleh, A. C., Hassan, H. A., Lawsin, C., & Nassar, J. (2016). Psychosocial concerns among Syrian refugees. *BMC Public Health*, 16, Article 232.
- WHO EMRO. (2022). Mental health service barriers among Syrian refugees. *Eastern Mediterranean Health Journal*, 28(3), 207–216.