Heatwave Impact and Coping Strategies in Public Schools of Madhesh Province - A Perception Study

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FOREWORD

Climate change is an urgent global challenge characterized by rising temperatures and unpredictable weather patterns worldwide. In Nepal, the impacts are strikingly evident: temperatures soar above 40 degree Celsius in Terai, the 2024 post-monsoon flooding has inundated the Kathmandu valley, glacial lake outbursts have become frequent, snowmelt in the mountains has accelerated, and prolonged droughts have intensified. These escalating hazards affect millions, particularly those in the Terai region, due to its riverine geography and extreme heat. Indirect impacts are also increasing, varying by the vulnerabilities of individuals, communities, and sectors.

In Madhesh Province, extreme weather events, such as heatwaves, have disrupted the quality of education in recent years, affecting the health and performance of both students and teachers. As development organizations, we prioritize education and support for vulnerable groups, especially children. We remain committed to understanding and addressing the challenges they face in the context of a changing climate.

The report, "Heatwave Impact and Coping Strategies in Public Schools of Madhesh Province - A Perception Study," explores the lived experiences of students and teachers in Madhesh Province and evaluates the adaptation strategies currently in place to address this hazard. As such data were previously unexplored, this report emerges at a critical juncture, just before the 2025 heatwave season.

We aim to address the institutional gaps identified in this report by raising awareness about heatwave challenges at the local and national levels and collectively advocating for responsive policies and actions across all three tiers of government. The goal is to emphasize the need for collaborative efforts among stakeholders and to support community-led adaptation strategies, with schools as the focal point of change.

We extend sincere appreciation to the study participants, enumerators, and the teams at Mercy Corps and Aasaman Nepal for their contributions in highlighting these issues. We are confident that this work will lay the foundation for building more resilient school communities and safeguarding the right to quality education by prioritizing the well-being of both students and teachers.

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EXECUTIVE SUMMARY

Heatwaves have emerged as an increasingly prominent hazard. Climate projections indicate a future with more frequent warm days and prolonged hot spells, disrupting learning for millions of children worldwide. This trend is evident in Nepal, particularly in Madhesh Province, which is highly susceptible to heatwaves. However, limited data on this hazard's effects in Nepal make planned interventions challenging. Consequently, responses in Madhesh Province are largely based on past experiences. School closures and schedule adjustments serve as primary system-wide adaptation measures. Public schools, in particular, struggle to ensure students' physical, mental, and academic well-being amid this climate extreme due to limited resources. This study addresses this gap by examining the impact of heatwaves on children's education in Madhesh Province.

This study aims to: a) investigate how extreme heat disrupts school operations and education delivery, b) identify specific vulnerability indicators of public schools to heatwaves, and c) assess existing adaptive practices in public schools for managing heatwave risks.

To achieve these objectives, a mixed-methods approach was adopted for data collection. Multistage random sampling was conducted, first by sampling the total number of public schools in Madhesh Province (3,466) using a 95% confidence interval and a 5% margin of error, and second, by applying proportionate sampling across districts with high and low hazard status. This yielded a sample of 347 public schools across 79 municipalities. Data were collected using semi-structured interviews and Focus Group Discussions (FGDs) just before the onset of summer in 2025, from February 7 to February 28. The questionnaire was divided into five thematic areas for detailed analysis. Representatives from the School Management Committee (SMC) were selected for interviews, while FGDs included teachers, parents, and gender-disaggregated student groups across all districts. A validation workshop was conducted after collecting initial findings, involving representatives from the Office of the Chief Minister and the Council of Ministers, the Provincial Planning Commission (PPC), the Education Development Directorate (EDD), municipal education officers, and intergovernmental agencies, including the United Nations (UN). Feedback from the workshop was incorporated into the report to ensure contextual relevance, alignment with policy priorities, and reflection of multi-stakeholder perspectives for enhanced credibility and usability.

Findings revealed critical gaps in public schools' preparedness and adaptation to extreme heat, with significant implications for health and education. Awareness of extreme heat varied widely, and widespread infrastructure limitations - such as inadequate roofing, insufficient drinking water access, and lack of safe transportation - severely disrupted school operations. These challenges worsened health outcomes for children and teachers in 91.2% of the sampled schools. Heatstroke and exhaustion were among the most frequently reported health impacts. Additionally, 95.7% of schools lacked in-house medical support, leaving them ill-equipped to manage emergencies. These limitations profoundly affected education, with increased absenteeism during hot periods and declining classroom engagement. Girls and children with pre-existing health conditions were particularly vulnerable. Limited vegetation around schools further exacerbated heat exposure, amplifying these adverse effects. Although some ad-hoc measures, such as morning or online classes, have been introduced in 62.8% of schools, they remain reactive and lack integration into broader preparedness frameworks. Similarly, only 9.5% of schools have disaster management plans or health emergency containment measures in place.

The study highlights the need to bridge institutional and community-level knowledge gaps on heatwaves. Municipal governments play a crucial role in strengthening public school resilience, yet policy-driven reforms remain limited. Immediate action is urgent for 58% of schools identified as highly vulnerable under six major data controls. Economically feasible and practical interventions are recommended for these schools to yield significant short-term return on social investments.

KEY TERMINOLOGIES

To avoid misinterpretation, operational definitions of key terms used in the report are provided below:

Heatwave
A period when the local temperature exceeds the 95th percentile of historical temperatures for three or more consecutive days.

Extreme Heat
Any day when the temperature exceeds the 95th percentile of the historical average local temperature.

Hot episodes
Periods when outdoor temperatures are high enough to cause physical or mental discomfort.

Summer season
This report defines June to August as the summer season, consistent with the seasonal distribution in the Nepalese context.

Coping capacity
The ability of individuals, organizations, and systems to use available skills and resources to manage adverse conditions, such as risks or disasters.

Exposure
The presence of people, infrastructure, housing, production capacities, and other tangible human assets in hazard-prone areas.

Vulnerability
Characteristics or circumstances that reduce the ability of individuals or systems to respond to the consequences of a disaster.

Vulnerability Indicators
Measurable factors or variables that reflect characteristics or circumstances reducing the ability of individuals or systems to anticipate, cope with, resist, or recover from the impacts of a disaster.

ABBREVIATIONS

ADB	Asian Development Bank
CMA	Canadian Medical Association
CSS	Comprehensive School Safety
DOE	Department of Education
DPRP	Disaster Preparedness and Resilience Plan
DRR	Disaster Risk Reduction
EWS	Early Warning System
FGD	Focus Group Discussion
GEDSI	Gender Equality, Disability and Social Inclusion
GFDRR	Global Facility for Disaster Reduction and Recovery
GHHIN	Global Heat Health Information Network
IPCC	Intergovernmental Panel on Climate Change
MoEC	Ministry of Education and Culture
MoEST	Ministry of Education, Science, and Technology
MoFE	Ministry of Forest and Environment
MoIACL	Ministry of Internal Affairs, Communication and Law
NDRRMA	National Disaster Risk Reduction and Management Authority
NIHHIS	National Integrated Heat Health Information System
PPC	Provincial Planning Commission
SMC	School Management Committee
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WBG	World Bank Group
WHO	World Health Organization
WMO	World Meteorological Organization

INTRODUCTION

The rise in global temperatures is altering the Earth's atmospheric circulation patterns, triggering cascading disruptions in natural cycles and increasing the intensity and frequency of natural hazards (USGS, 2024). According to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2021; IPCC, 2023), unavoidable increases in multiple climate hazards pose significant risks to ecosystems and human populations in the near term (2021-2040). These risks, driven by factors such as vulnerability, exposure, socioeconomic development, and adaptation capacity, are projected to intensify with the simultaneous occurrence of multiple climate and non-climatic risks, cascading across sectors and regions, potentially leading to new impacts and risks from year 2042 to 2100. Extreme heat, in particular, is expected to surpass critical health thresholds more frequently by mid-century under a 2°C warming scenario (IPCC, 2021). Under these conditions, approximately 36.9% of the global population could face heatwave-related stress once every five years (Dosio et al., 2018).

Extreme heat manifests in diverse and interconnected ways. Combined with low humidity, it can trigger secondary hazards such as wildfires, droughts, and urban heat islands, disproportionately affecting livelihoods and exacerbating socioeconomic inequalities (C2ES; Maughan et al., 2012; Sobolewski et al., 2020; Gimeno-Sotelo et al., 2024). Prolonged heat episodes can induce atmospheric blocking patterns—persistent high-pressure systems that trap hot air, inhibit precipitation, and drive heatwaves (NOAA; WMO). Defined as extended periods of abnormally high temperatures exceeding the 85th percentile of historical records for three or more consecutive days (USEPA; WHO; WMO), heatwaves have become increasingly frequent, intense, and spatially extensive. Empirical evidence confirms this trend: between 2016 and 2020, an average of 98 heatwave events occurred annually worldwide, compared to 75 events per year from 1979 and 1983 (Luo et al., 2024). Future projections suggest that, even under the lowest-emission scenarios, heatwave frequency could double in regions such as Latin America and India by mid-century, with frequency surpassing intensity in the Indian subcontinent by the century's end (Singh & Mall, 2023; Ramarao et al., 2024). Developing nations, particularly in South and Southeast Asia, face disproportionate exposure to heatwave risks. High humidity in the Indian subcontinent, combined with prolonged heat episodes, poses acute health threats due to increased frequency and reduced return periods (UNDRR; Domeisen et al., 2022).

The repercussions of heatwaves extend beyond direct health impacts - such as heat exhaustion, burns, dehydration, and heatstroke - to exacerbate chronic conditions, mental health challenges, and mortality (WHO; CMA; GHHIN; Cramer et al., 2022). Between 2000 and 2019, an estimated 489,000 heat-related deaths occurred annually, with Asia and Europe accounting for 45% and 36% of these fatalities, respectively (Zhao et al., 2021). Vulnerable populations, including the elderly, children, pregnant women, low-income households, outdoor laborers, high-rise dwellers, and individuals with pre-existing health conditions or disabilities, bear the brunt of these impacts (GPE; NIHHIS; RedCross; UNDP; UNICEF; WBG; Lala & Hagishima, 2023; Kang et al., 2024). Systemic factors, such as limited access to heat-adaptive measures, constrained purchasing power, and urban geometries that trap heat, further strain public health systems and widen inequities in adaptive capacity (WHO).

In Nepal, climate projections indicate a future with more frequent warm days and prolonged hot spells. Madhesh Province is identified as facing 'very high' threats from climate extremes, with districts such as Bara, Parsa, Rautahat, and Saptari registering elevated heat hazard risks, as seen in Figure 1 (MoFE, 2021). Temperature records from the summer of 2024 show that major cities in Madhesh consistently exceeded 36°C, prompting the Department of Hydrology and Meteorology (DHM) to issue 11 special bulletins warning of extreme heat. Under a 2°C warming scenario, the number of extremely hot days in Madhesh could increase by 5–8% by mid-century (Government of Nepal, NAP). Sah and Chitrakar (2023) validate these trends through community-level perceptions and an analysis of temperature data from 1977 to 2017 in Bara. Their findings note an average of 3.4 heatwaves per year, with a peak of nine in 2007, and indicate a slight upward trend in both heatwave frequency and maximum temperature, often clustering in consecutive years.

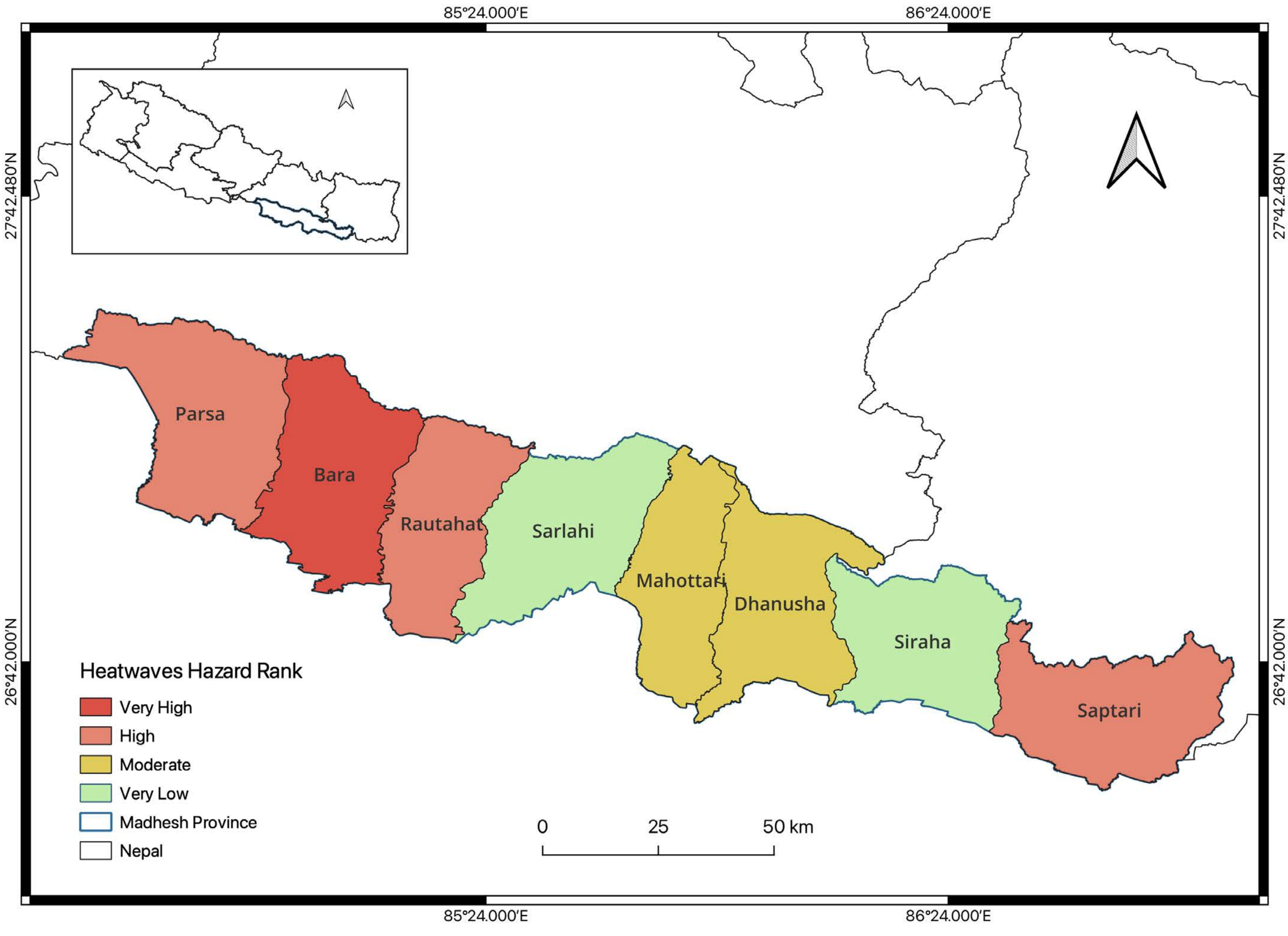

Figure 1: Heatwaves Hazard Rankings
Source: MoFE, 2021

Despite policy efforts, such as the Hydrology and Meteorology Policy (2024), the Federal Disaster Risk Reduction and Management Act (2017, amended 2019), and the Madhesh Provincial Disaster and Climate Risk Reduction and Management Policy (2019), heatwaves remain under-prioritized compared to floods and landslides due to their slow onset and less visible impacts. These frameworks recognize heatwaves as natural hazards and advocate for Early Warning Systems (EWS), but implementation falters due to limited technical expertise and budgets. The National Disaster Risk Reduction and Management Authority's (NDRRMA) 2024 Heatwave Action Plan exemplifies this gap, as it continues to face significant challenges in execution. Additionally, sector-specific strategies in education, agriculture, livestock, industry, and forestry are inadequate (Policy Analysis - Heat). Strategic documents like the Disaster Risk Reduction (DRR) Strategic Action Plan (2020–2030) and the Disaster Preparedness and Resilience Plan (DPRP, 2024) in Madhesh omit heatwaves from their lists of priority disasters, despite acknowledging their cascading effects, such as droughts and forest fires. This oversight stems from limited data on heatwave-induced socioeconomic losses, thresholds, awareness, and budget allocations for heat-preventive practices.

In Madhesh, responses to heatwaves are often reactive and education-centric, reflecting inadequate strategies for long-term adaptation. School closures and schedule readjustments often serve as the primary system-wide adaptation measure. While expedient, these actions disrupt academic continuity and lack integration into comprehensive adaptation frameworks. The Comprehensive School Safety (CSS) Framework (2022–2030), aligned with the Sendai Framework for DRR and Sustainable Development Goals (SDGs), identifies extreme heat as a climatic hazard and outlines guiding principles for school safety through its three pillars. However, despite its adoption by approximately 8,000 schools nationwide (23% of total), implementation in Madhesh remains negligible (GARRRES; Field Observations; Ministerial Discussions).

This study addresses a critical research gap, as heatwaves in Nepal, particularly their effects on education, remain underexplored. Focusing on Madhesh Province, a region experiencing increasing durations of warm spells and rising annual maximum temperatures, this research examines the adverse impacts of heatwaves on primary and secondary schools, emphasizing children's heightened susceptibility to extreme weather events. Additionally, given that public schools have limited access to resources, the primary objective is to evaluate their coping capacity to adapt to heatwave risks. Specifically, the study aims to:

- Investigate how extreme heat disrupts public school operations and education delivery.
- Identify specific vulnerability indicators of public schools to heatwaves.
- Assess existing adaptive practices in public schools for managing heatwave risks.

By generating evidence on these dimensions, this research seeks to inform targeted adaptation strategies, enhance resilience in the education sector, and contribute to the broader discourse on climate change impacts in vulnerable regions of Nepal.

METHODS AND MATERIALS

Study Area

The study encompasses all eight districts of Madhesh Province - Bara, Parsa, Rautahat, Siraha, Sarlahi, Saptari, Dhanusa, and Mahottari — covering 79 municipalities. Geographically, the province is located between approximately 22.9734°N and 78.6569°E, with an elevation range of 1,000 to 3,000 feet above sea level (Adhikari et al., 2025). Covering an area of 9,661 km^2, Madhesh Province is one of Nepal's smallest provinces but ranks among the most densely populated, with a population of 6,114,600 according to the 2021 Census (CBS, 2021). The province features significant altitudinal variation and diverse topography, resulting in distinct climatic zones characterized by dry and wet monsoon seasons. Summer temperatures can exceed 40°C, while winter temperatures may drop to approximately 5°C. The region receives an average annual rainfall of 1,100 to 2,100 mm (Shrestha et al., 2022).

Madhesh Province has 3,466 public schools: 416 lie in Saptari, 488 in Siraha, 473 in Dhanusa, 392 in Mahottari, 511 in Sarlahi, 391 in Rautahat, 429 in Bara, and 366 in Parsa (MoEC, 2024). The literacy rate for the population aged 5 years and older is 63.5% (CBS, 2021). Male literacy rate is 72.5% whereas female literacy rate is 54.7%. Only 6% of the province's total budget (2.90 billion NPR) is allocated to the education sector, where 74% is directed for salaries and allowances, 10% for operational expenses, 9% for school grants and scholarships, 6% for equipment, building, and construction, and 1% for miscellaneous expenses (ADB, 2021).

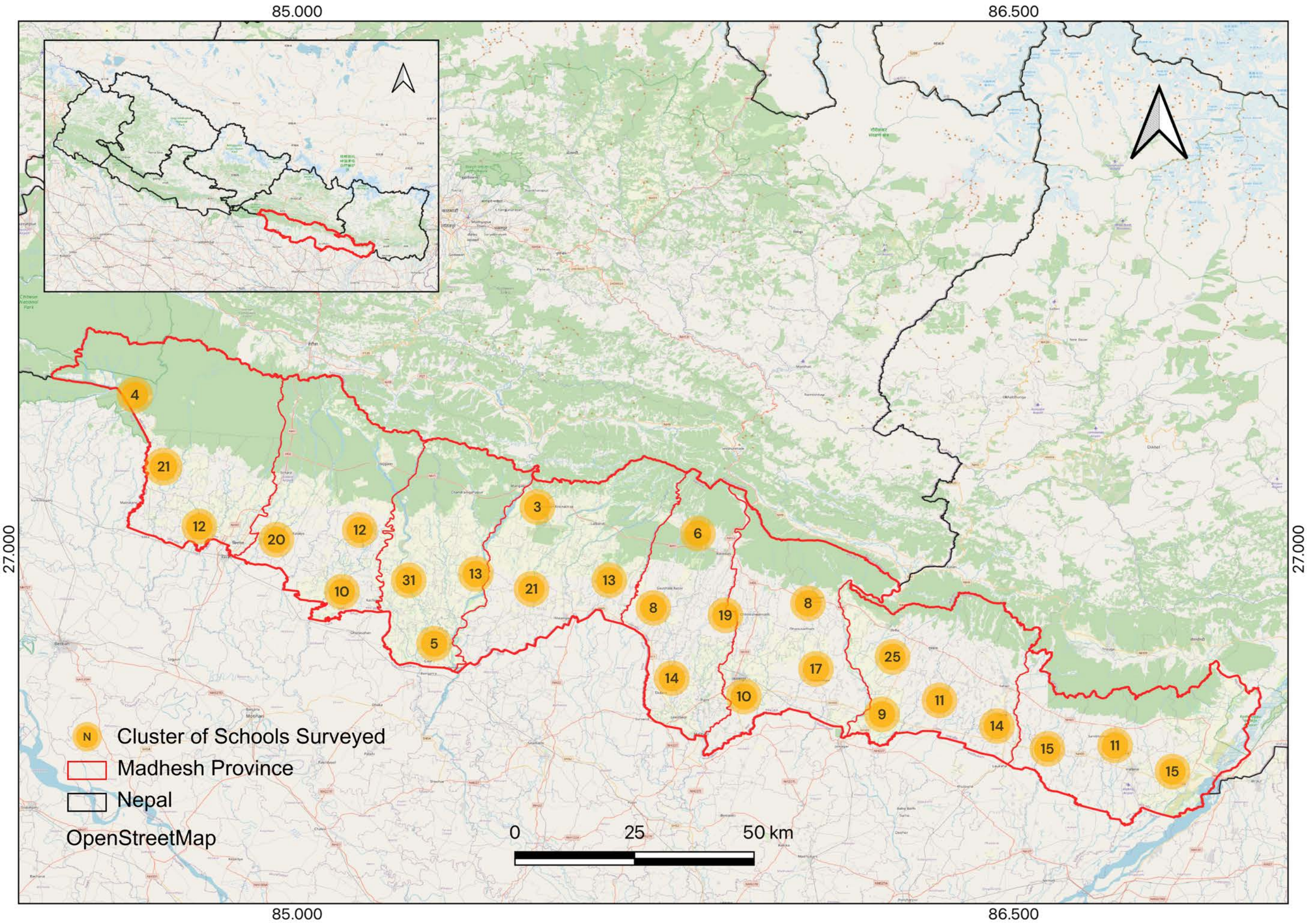

Figure 2: Spatial Clusters of Sampled Schools

Sampling

The study employed a random sampling approach to select public schools in Madhesh Province. The sampling frame was derived from the total number of public schools (3,466), obtained from the Ministry of Education and Culture (MoEC). Using a 95% confidence level and a 5% margin of error, the sample size was calculated, resulting in a selection of 347 schools for the study.

The Climate Vulnerability Assessment Report from the Ministry of Forests and Environment (MoFE) was then referenced to categorize districts based on their heat hazard rank. Bara, Parsa, Rautahat and Saptari fell under high heat hazard ranks, while Mahottari, Siraha, Dhanusa and Sarlahi were categorized as low heat hazard districts (MoFE, 2021).

A probabilistic sampling method was applied, resulting in 53.6% of sampled schools being located in high heat hazard districts and 46.4% in low hazard districts, yielding 161 and 186 schools, respectively. The sampled schools were distributed across 79 municipalities, with a minimum of 38 and a maximum of 53 schools per district.

Table 1: Total number of sampled schools across Madhesh Province

Sample Selection			
Name of Districts	# of Municipalities	# of Sample	% Distribution
Bara	10	41	11.82
Parsa	9	44	12.68
Mahottari	9	41	11.82
Dhanusa	10	38	10.95
Rautahat	10	43	12.39
Saptari	10	40	11.53
Sarlahi	11	47	13.54
Siraha	10	53	15.27
Total	79	347	100.0

Data Collection

Figure 3 illustrates the sequential steps used to gather primary and secondary data for the study. The research employed a mixed-methods approach, combining both quantitative and qualitative data collection techniques. Primary data were collected through semi-structured interviews and Focus Group Discussions (FGDs) just before the onset of summer in 2025, from February 7 to February 28.

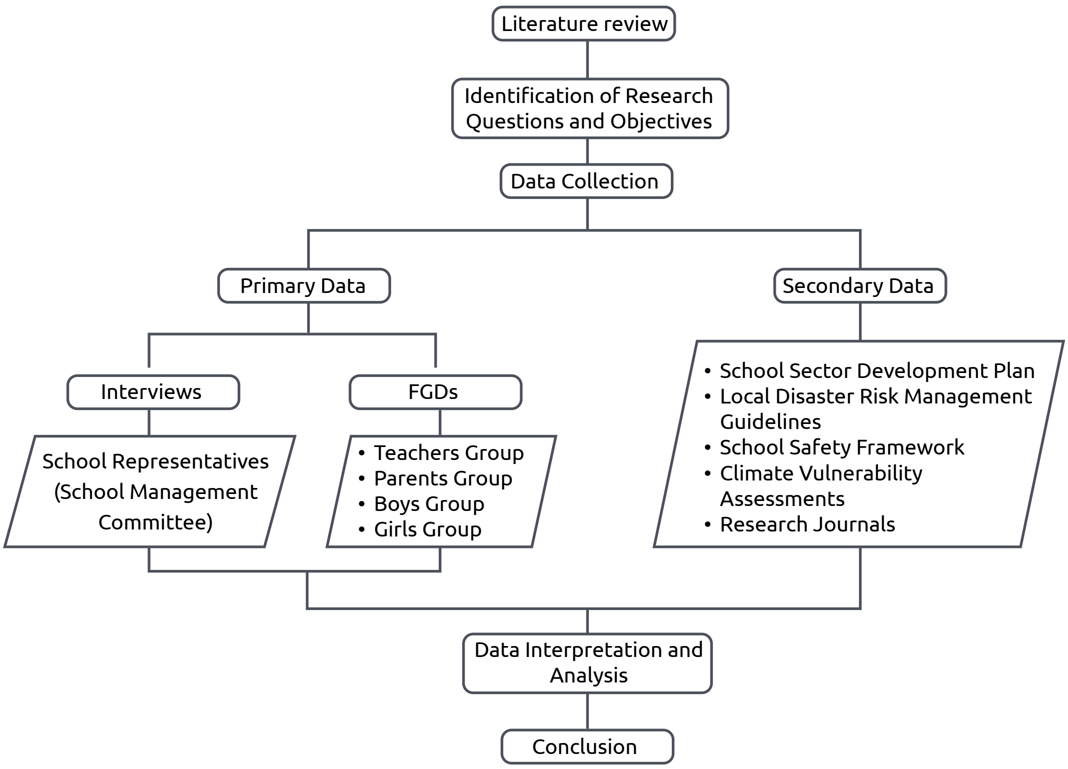

Figure 3: Research Design

Respondents were selected from the School Management Committee (SMC) of the sampled schools. Priority was given to individuals holding key positions with access to institutional information, based on their willingness to participate, and availability within the study's timeline. Informants were chosen based on their informational awareness, with the school principal as the primary point of contact, followed by the vice-principal, administrative officers, and executive members of the SMC. The semi-structured questionnaire was divided into five thematic areas to assess institutional capacity to address heatwave impacts, existing mitigation measures, and challenges in adapting to heat hazards. These areas included: physical infrastructure; education; environment and surroundings; health and well-being; and resources and adaptive capacity. The questionnaire also incorporated queries related to Gender Equality, Disability, and Social Inclusion (GEDSI) where relevant.

For FGDs, four stakeholder groups were identified: teachers, parents, boys, and girls. Teachers and students were selected due to their direct experience with schools' capacity to address heatwaves, while parents were included for their indirect connection through their children's education. Student groups were gender-disaggregated to identify any variations in experiences and impacts. To ensure reliable data and account for cognitive ability, only secondary school students participated in FGDs. A total of 32 FGDs were conducted across the province, with four FGDs per district, engaging all key stakeholder groups. Schools were randomly selected to reduce bias. These discussions aimed to validate data from semi-structured interviews and capture additional community-level perceptions of heat hazards and the schools' coping capacities. Forty social mobilizers from local municipalities (palikas) were recruited and trained for data collection. Ethical considerations, such as safeguarding principles, were emphasized to ensure the safety and well-being of children.

Data Analysis

Following quantitative data collection, categorical variables were coded for cleaning. One response from Rajgad municipality in Saptari district was an extreme outlier and was discarded to minimize error.

Qualitative data from semi-structured interviews and FGDs were analyzed descriptively based on a cross-sectional thematic design. These findings were validated through three community visits each in Rautahat and Sarlahi districts. Additionally, findings were cross-verified through a validation workshop with provincial authorities from the Office of the Chief Minister and the Council of Ministers, the PPC, education officers from five municipalities of Madhesh, and intergovernmental agencies, including the United Nations. Discussions covered district-level heat hazard rankings, the capacity of existing plans and policies to mitigate threats, and possible recommendations. This step ensured that findings aligned with official records and provided a comprehensive view of local governments' ability and willingness to implement proposed recommendations.

Limitations

1. The study used a sampling-based approach and did not include all schools and municipalities in Madhesh Province. As schools were the primary unit of analysis and public-school management is highly localized, the generalizability of findings across all municipalities is limited.
2. While the study incorporated perceptions from key stakeholders, such as students, parents, and teachers, representation from government officials was limited. Although a validation workshop gathered data from government bodies, the diplomatic approach may have constrained the comprehensiveness of insights into institutional perspectives and policy-level commitments.

RESULTS AND DISCUSSION

Demographic Distribution of Respondents

Respondents from semi-structured interviews were categorized into three age groups: 25 years and younger, 26 to 50 years, and 51 years and older. The majority (52.9%) fell within the 26–50-year range, followed by those aged 51 years and older. Only 4.9% were 25 years or younger. This intergenerational mix enhances the representativeness of the sample by reflecting a broad range of perspectives.

Out of 347 respondents, 89.7% were male and 10.3% were female. Male respondents predominantly held principal and administrative positions, while female respondents were more commonly vice-principals or held other roles within the SMC. This distribution is illustrated in Figure 4. This distribution suggests potential gender-based differences in decision-making authority and school management practices.

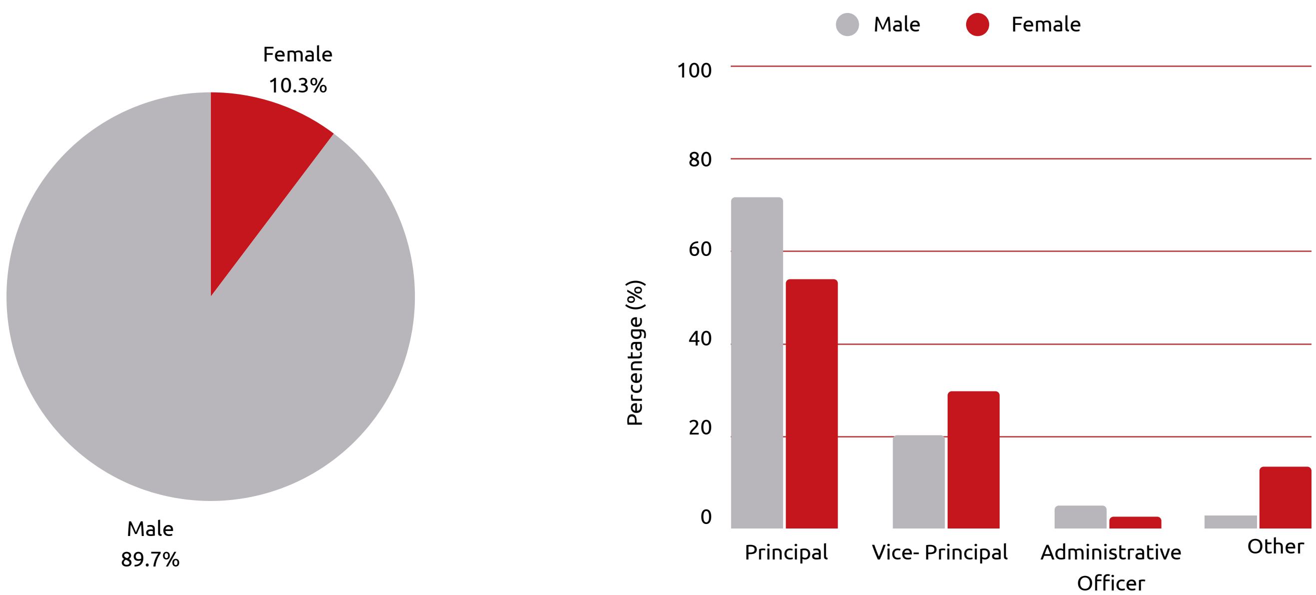

Figure 4: Gender-wise distribution of respondents in schools

Understanding of Heatwave

Definition and Experience

Respondents from interviews and FGDs demonstrated a generally well-rounded understanding of heatwaves, their effects, and their implications for children and school administration. However, the extent of knowledge varied significantly, indicating inadequate awareness in Madhesh Province, as noted by Dimal et al., 2018.

Of the respondents, 38.4% defined heatwaves as prolonged periods of hot days, while 20.5% and 15.6% described them as "very hot days" lasting six and three consecutive days, respectively. These perceptions align with definitions from the DHM and the United States Environmental Protection Agency (USEPA). The remaining respondents classified heatwaves as a single very hot day, the summer season, or days of extreme thirst. FGD responses were similar, describing heatwaves as extended periods of high temperatures without referencing technical definitions.

Respondents reported experiencing an average of 9.12 extremely hot days annually over the past five years, equivalent to approximately three heatwave spells per year.

Perceived Impacts

When asked about sectoral impacts, 90.2% of interview respondents agreed that education is one of the most affected sectors, followed by others, as shown in Figure 5. Respondents attributed this primarily to increased absenteeism and reduced classroom productivity caused by heat-related illnesses.

Some also linked heatwave impacts to geological and biological factors, for example, declining groundwater levels due to prolonged dry periods, which exacerbate drinking water scarcity, and children's heightened vulnerability to heat stress due to underdeveloped immune systems. However, such scientific explanations were largely absent among most respondents, particularly in the low heat hazard districts.

Boys' FGDs highlighted heatwave effects on agriculture and livestock, noting increased frequency and intensity of hot periods and rainfall. Both student groups attributed these adverse impacts to deforestation and industrialization in their localities. The consequences of extreme heat on mental health were acknowledged but not extensively explored, with most discussions focusing on physical health effects.

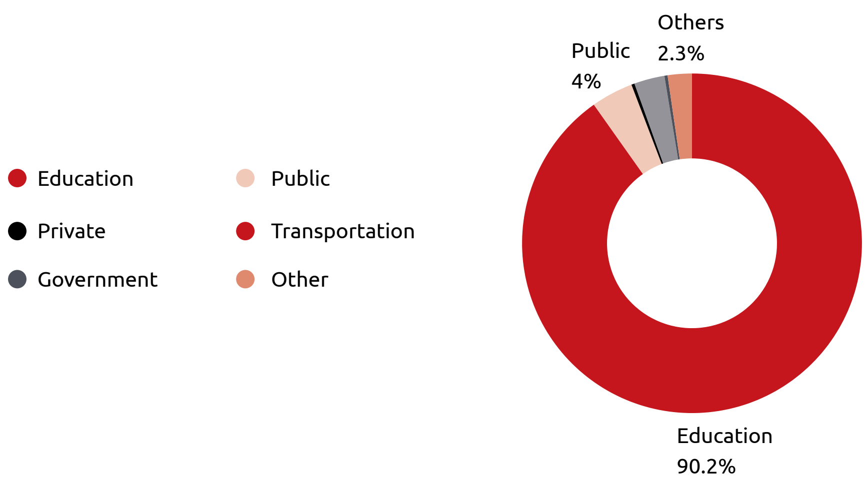

Figure 5: Perception of Sectoral Vulnerability

Proposed Preventive Measures

Respondents' suggestions for staying safe during hot periods offer insight into local understanding of activity-level measures to enhance resilience against extreme heat.

School representatives proposed improved access to cool drinking water, well-ventilated classrooms, structural upgrades, and the installation of cooling mechanisms, such as fans and air conditioners, to mitigate impacts on children and education. Some schools suggested conducting classes in open spaces with natural shade and providing umbrellas for students to facilitate safe travel. Stakeholders also emphasized regular showers, addressing air pollution through tree plantations, and installing backup electrical systems to counter associated threats.

A notable proposal from a school in Rajdevi municipality of Rautahat district suggested using solar power for cooling, which reflects a sustainable approach to balancing energy needs during heatwaves. Additionally, measures like raising awareness of heat's adverse impacts and providing first aid training to school staff for managing emergencies were emphasized in low heat hazard districts compared to high-risk areas.

These responses indicate that solutions to stay safe during hot periods have been considered at both individual and institutional levels. However, a gap in technical knowledge and financial resources hinders their practical implementation.

Physical Infrastructure

Seating Arrangements

According to reports, an average of 51 students share a classroom, ranging from a minimum of 2 to a maximum of 184 students per class. With an average of 4 students per bench — sometimes extending to 8 — parents and students have raised concerns about crowded seating arrangements and the need for sectoral segregation of classes. Guardians expressed apprehension about the quality of learning in such congested spaces. These concerns appear valid, as over half of the surveyed schools do not comply with 2002/03 educational guidelines' recommendation for classroom space, which is, at least 0.75 square meters per primary student and 1 square meter per secondary student.

Likewise, 24.4% of respondents reported that their classroom size was between 25-40 square meters, while 53.5% had classrooms smaller than 25 square meters. Only about 13% of schools had classrooms larger than 40 square meters, yet even these often accommodated above-average student numbers. These conditions do not comply with the minimum area requirements for bench seating specified in Nepal's National Building Code (2015) for educational institutions. This strains classroom comfort, amplifying both mental and physical stressors of students, particularly during extreme heat.

Similarly, the average teacher-to-student ratio was 1:50, ranging from a minimum of 1:13 to a maximum of 1:150. Comparing this data with the national average ratio (1:20.89), the number is more than double in Madhesh (MoEST, 2022). This disparity, a key indicator of education quality, reflects an unfavorable learning environment in Madhesh and underscores the urgent need for systemic reforms, particularly given the province's below-average literacy rates.

Composition of School Building

Of the respondents, 90.8% reported that their school buildings were constructed with brick and cement, followed by 3.5% respondents who said they were made of stone and cement. Only one school was made from bamboo and wood. These data suggest that most schools adhere to the school building design guidelines developed by the Asian Development Bank (ADB) and the Department of Education (DOE), which recommend stone or brick foundations. Structures made from natural materials and local products, such as wood and bamboo, may aid heat adaptation but are less effective against floods, a frequent hazard in Madhesh alongside heatwaves.

Additionally, 81.3% of schools reported at least one classroom with tin roofing, a measure implemented to reduce the casualties of earthquakes, as per the Ministry of Internal Affairs, Communication, and Law (MoIACL). However, as metal alloys have approximately 100 times greater thermal conductivity than conventional construction materials (Johra, 2021), these roofs significantly amplify the heat radiation within classrooms. FGDs with students and teachers substantiated this finding, noting that tin roofing makes fans ineffective, merely circulating hot air. This observation highlights an opportunity to rethink school infrastructure, integrating multi-hazard design principles (e.g., ventilation, material choices, and structural safety) in retrofitting or construction efforts.

Table 2: Structural Composition of School Roofing

Composition of School Roofing		
	Frequency	Percent
Tin	127	36.7
Concrete	64	18.5
Other	2	.6
Concrete and Tin	139	40.2
Tin and Open Building/No Roof	14	4.0
Total	**346**	**100.0**

The survey revealed that over 50% of school buildings used light- colored paints, approximately 30% used reflective coatings (white), while only the remaining minority of the schools had used heat-absorbing paint formulations. Most schools (83.8%) had single-story buildings, while less than 1% had four or more stories. Although this complies with the standard multi-story building guidelines, single-story buildings with tin roofing (approximately half of the schools) expose students to higher temperatures. Even in multi-story buildings with concrete roofs, the stack effect creates a thermal gradient (Dahlbolm & Jensen, 2014), where the highest temperatures occur in top-floor classrooms and progressively decrease in lower floors. These findings offer valuable insights for informing building design and retrofitting strategies.

Cooling Mechanisms

Regarding cooling mechanisms, 30.9% of the schools reported that they solely rely on windows and ventilation, with an average of five windows per classroom (ranging from one to twelve across different schools). In 67.9% of schools, fans were installed alongside ventilation, and only one school in Bara district had an Air Conditioner (AC). However, these facilities were unevenly distributed across classrooms. Approximately 20% of respondents also noted that fans were outdated and produced disruptive noise, hindering the learning process.

Only 23 out of 346 schools (6.6%) had backup power systems, which typically lasted 10 to 24 hours during outages. For the remaining schools reliant on electricity for cooling, power supply is a critical concern. With surging energy demand during summer—driven by both climatic conditions and increased economic activity (MyRepublica, 2024)—backup power systems are essential. Yet, 93.4% of public schools in Madhesh lack this support.

These findings highlight significant cooling infrastructure limitations in Madhesh's schools. The need for maintenance of existing cooling systems is evident. Despite multi-hazard design considerations in school building guidelines, heatwaves remain excluded, suggesting a need for revision to reflect the local context of the Terai region of Nepal as a whole.

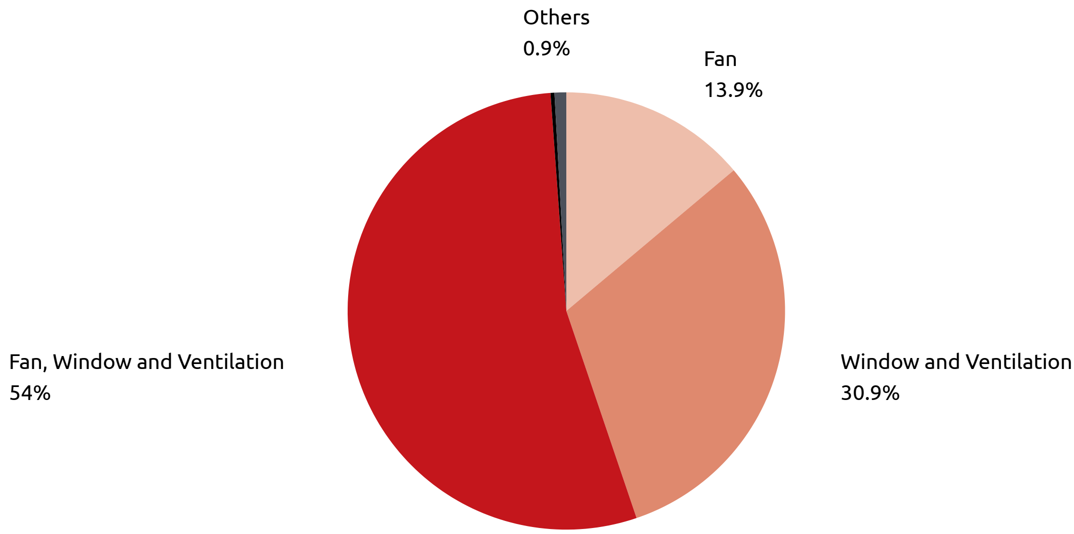

Figure 6: Type and Frequency of Cooling Mechanisms in Surveyed Schools

Drinking Water

Most schools (88.4%) depended on hand pumps for drinking water, while 9% of schools relied on tap water. Although 87.3% of respondents claimed that the drinking water source is available throughout the year, FGDs raised concerns about the number of drinking water stations within schools and students' access to cool water. Stakeholders emphasized the need for one drinking water station per classroom. While such demands may be disproportionate, external water sources offer potential relief. Of respondents, 52.8% (183) reported having an external source of drinking water, typically a hand pump, within 500 meters of the school. However, these alternatives fail to meet UNICEF's standards for safely managed drinking water services and their basic access. Concerns persist regarding water purity (78% of respondents expressed uncertainty) and it remains questionable whether it takes less than 30 minutes to access drinking water, either in a queue or a roundtrip to an external source.

Transportation

FGDs with guardians revealed that there is no shuttle service available, and that students travel to school either on foot or by bicycle without heat-protective gear or shaded green environments. With an average recorded travel distance of 4.6 km, this situation raises serious safety concerns. There is an opportunity to make a significant difference by introducing transportation services or increasing shaded pavilions along school routes, which could provide effective relief for both students and community members. Such measures can also address objectives under pillars 2 and 3 of the Comprehensive School Safety Framework by enhancing safety during school commutes.

Health and Well-being

Health issues due to heat stress were reported in every surveyed school in Madhesh Province. In 9.2% of schools, there were 20 or more annual cases of heat-related illness, while 8.1% of schools reported 10-20 cases. Nearly half of the schools surveyed documented fewer than five cases. Although 8.8% of respondents reported no health concerns over the past five years, 83.8% of these schools indicated implementing response measures previously.

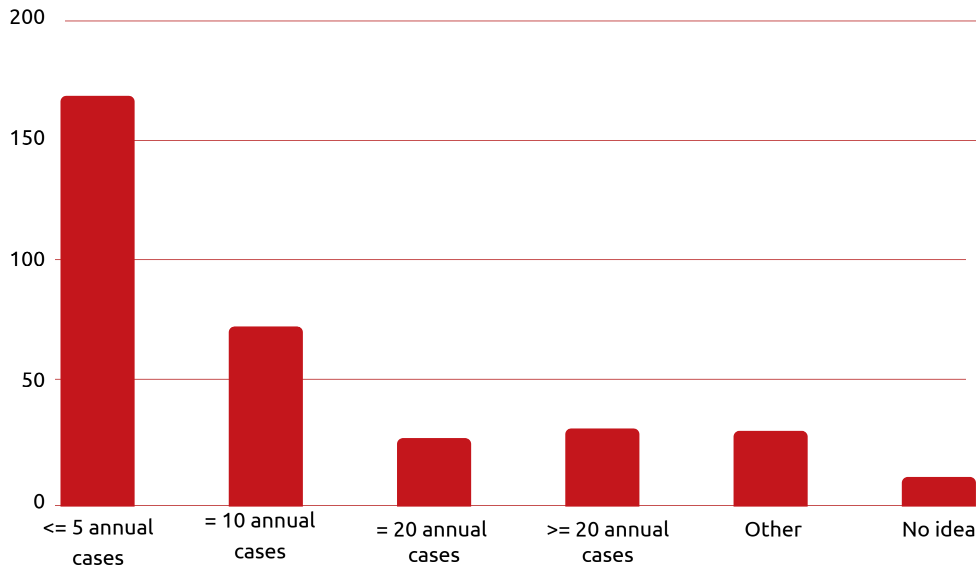

Figure 7: Reported number of health illnesses

Physical Health

According to interviews and FGDs respondents, heatstroke-induced exhaustion was the most frequently observed illness, followed by headaches, fever, dehydration, dizziness, conjunctivitis, and skin rashes. Stomach issues leading to diarrhea and vomiting were also prominent; Cholera was explicitly mentioned as their underlying cause. Although the exact mechanisms linking heatwaves and cholera are unclear, Wu et al., 2018 confirm that heatwaves promote the occurrence of cholera, influenced by rainfall and tree cover. Thus, extreme heat events likely exacerbate the risk of waterborne diseases, particularly in areas with inadequate sanitation and limited tree cover. In some schools, headaches and fever were the extent to which the primary physical effects of heatwaves were seen, while others reported all above listed stressors over the past five years. Prevalence of measles was noted in low heat hazard districts, alongside acute respiratory diseases, validated by FGDs. In the high heat hazard districts, teachers reported sore throats while teaching, and parents noted appetite loss among children, distinct from other effects. Nosebleeds among children were also common. Twice as many schools in low hazard districts reported no heat-related illnesses or stress over the past five years compared to high hazard districts.

All schools adopted similar approaches to manage these illnesses, primarily providing cool drinking water and rest spaces. In extreme cases, schools facilitated services from the nearest health post and informed students' guardians to prevent further distress. Many schools provided only first aid or granted leave for the affected student, accompanied by a friend or parent. In ward 5 of Simraungadh Municipality, Bara, one school consulted health teachers during heat extremes, an approach unique among surveyed schools.

Mental Health

Of respondents, 38.7% reported that students experienced mental health-related issues during extreme heat, primarily associated with physical symptoms like headaches and heatstroke rather than psychological distress. Only 17.1% of these schools recognized cognitive impairment due to exhaustion as a mental health issue, noting its impact on students' focus and academic performance. The remaining schools placed limited emphasis on psychological effects. Some representatives from low heat hazard districts highlighted that heat stress impairs teachers' ability to deliver effective lessons due to mental strain.

Given systemic barriers to discussing mental health in Nepal, having mental health guidelines in secondary schools in the Terai remain a progressive measure. Nevertheless, nine schools set an example, showing that it is something that requires mainstreaming. However, only one school in Haripur Municipality of Sarlahi district offered psychological counseling services to its students. The others provided general cooling relief facilities. Two of the nine schools, including the one in Sarlahi, noted that their guidelines needed revision. These data highlight the need for institutionalizing mental health support in public schools and indicate that Madhesh's schools do not fully align with the second pillar of the CSS Framework, which addresses the mental health and psychosocial needs of children.

Vulnerable Population Groups

FGDs with stakeholders revealed that children with epilepsy face greater challenges during extreme heat, supported by reports of higher hospitalization rates for epileptic seizures in hot temperatures (Zhang et al., 2023; McNicholas et al., 2024). Overall, 16.2% of schools indicated that students with pre-existing health conditions experience disproportionate impacts, emphasizing the need for tailored adaptation measures. Regarding gender-based differences, some interviewees suggested that girls face greater challenges than boys, although overall perspectives were mixed and inconsistent, as confirmed by FGDs.

Heat-induced Air Pollution

Approximately 87% of informants observed increased air pollution during prolonged high temperatures, and of these, 69% reported that such occurrences were frequent or consistent during heatwaves. Explanations varied: some attributed the pollution to dry air carrying dust, while others linked it to climate change. The general consensus, however, was that airflow during heatwaves brings dust indoors, a problem exacerbated by drying biofuels in summer, which contributes to pollutant circulation. Focus Group Discussions (FGDs) revealed that teachers were particularly concerned about pollutants and their health impacts, aligning with 76.3% of informants reporting health concerns. Notably, more responses in certain districts linked air pollution to insufficient vegetation. The limited scientific understanding of these issues among respondents calls for further attention.

Strategies for Health Risk Prevention

Schools are implementing three main coping strategies to improve health outcomes, each with limitations. Overall, existing preventive measures remain insufficient.

a. **Hydration Breaks**

When asked about hydration practices, 56.1% of respondents reported frequent water breaks scheduled during the summer season. However, 43.9% of schools had no hydration breaks beyond lunchtime. Of schools, 16.2% scheduled at least two hydration breaks, and 27.2% provided three to five breaks. 6.6% offered six to ten hydration breaks, supporting reports from student groups in adjacent regions noting teachers' leniency in offering breaks to stay cool.

Despite these provisions, the frequency of heat exhaustion reports and complaints about drinking water facilities suggest that hydration breaks are ineffective. A broader systemic approach, supported by constant monitoring and evaluation of relief resources, is needed across public schools in Madhesh.

b. In-house health posts/nursing stations

To respond to heat illnesses, only 4.3% of schools have established in-house health centers or nursing stations, despite the provincial "One School, One Nurse" policy. Over three-quarters of these schools reported inadequate clinical resources. Schools without nursing stations rely on external health centers during emergencies. While 72.6% of schools have a health facility within 1 km, 15.3% must travel at least 2 km, and 12.1% face even greater distances, causing critical delays given the lack of school transportation services. Although the average ambulance response time is 20 minutes, it can take as long as 2 hours, worsening the situation. These limitations are alarming, given substandard infrastructure, increasing heatwave trends, and the absence of basic first aid kits. During extreme health effects, severe outcomes cannot be ruled out in the current scenario. First aid kits and electrolytes, requested by most schools, could reduce heatstroke mortality by 80% (Bouchama & Knochel, 2002), yet remain scarce. These findings highlight the need for reforming existing health services and immediate action in these schools. Medical training and adequate resources are vital to saving children's lives.

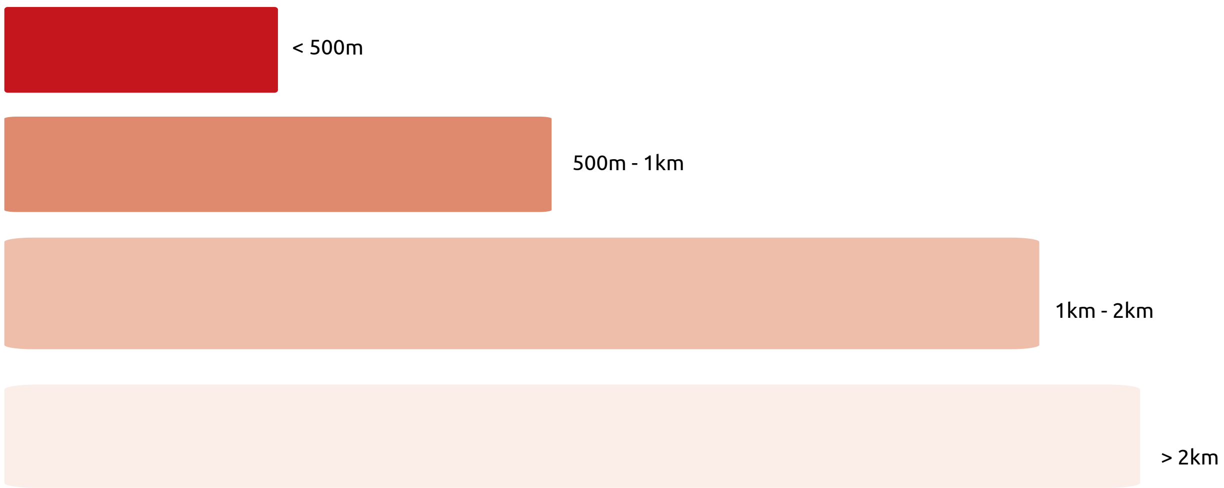

Figure 8: Proportion of schools with proximity to external health posts

c. Awareness of heatwaves

59.4% of public schools in Madhesh reported equipping students with skills to prepare for, recognize, and respond to heat-related illnesses. Additionally, 16 schools (4.6%) provided first aid training to staff or students. Common guidelines included wearing light-colored clothing, resting in shade, ensuring frequent water intake, avoiding outdoor activities, staying in ventilated spaces, consuming liquid-rich foods, and promoting tree plantation. However, several respondents emphasized the need for more comprehensive, context-specific revision of existing guidelines. Notably, parent groups reported no awareness of these guidelines, underscoring the importance of strengthening parental involvement in public education to ensure student well-being. With approximately 40% of schools lacking structured awareness programs on heat-induced health impacts, targeted interventions are urgently needed to improve preparedness and response.

Environment and Surroundings

Experiences

When asked about the frequency of heatwaves, 68.8% of respondents reported experiencing two or more heatwaves annually, 25.4% reported to have experienced one in a year, and the remaining reported having experienced at least one heatwave in the past five years. Findings from FGDs reinforced these observations, with stakeholders reporting an increasing frequency of hot periods over the years, a trend consistent with Sah and Chitrakar, 2023's research in Bara where a more frequent occurrence of heatwaves was observed. Some student groups explicitly linked this to climate change.

Water Bodies

Research highlights the cooling potential of water bodies through evaporative effects and microclimate regulation (Jandaghian & Colombo, 2024). However, only 16.5% of surveyed schools were located near water bodies, predominantly ponds (71%). Few respondents reported measurable cooling benefits, whereas two interviewees noted that ponds dry seasonally during summer, rendering them ineffective for heat relief.

Vegetation and Shade

Natural shade and vegetation are critical for reducing ambient temperatures (Manteghi et al., 2015). Yet, only 33.5% of schools had natural shade within their boundaries, with just 12.7% able to accommodate over 20% of their students. FGDs with stakeholders across all districts confirmed insufficient vegetation in and around school premises. Only 3.8% of schools reported lush vegetation outside their boundaries, while 35.8% reported having moderately vegetated areas. Approximately 40% of the schools had no trees nearby, and the remaining had sparse vegetation. Discussions revealed that even where natural shade exists, it is not adequate for relief.

Afforestation in and around school premises is a key action that could enhance stakeholder satisfaction in the long term. Prioritizing this measure, such as conducting classes under natural shade, could yield effective outcomes as temperatures rise. This would also effectively contribute to the goals and expected outputs of the CSS Framework, the School Education Sector Plan, Sendai Framework for DRR and the Sustainable Development Goals (SDGs).

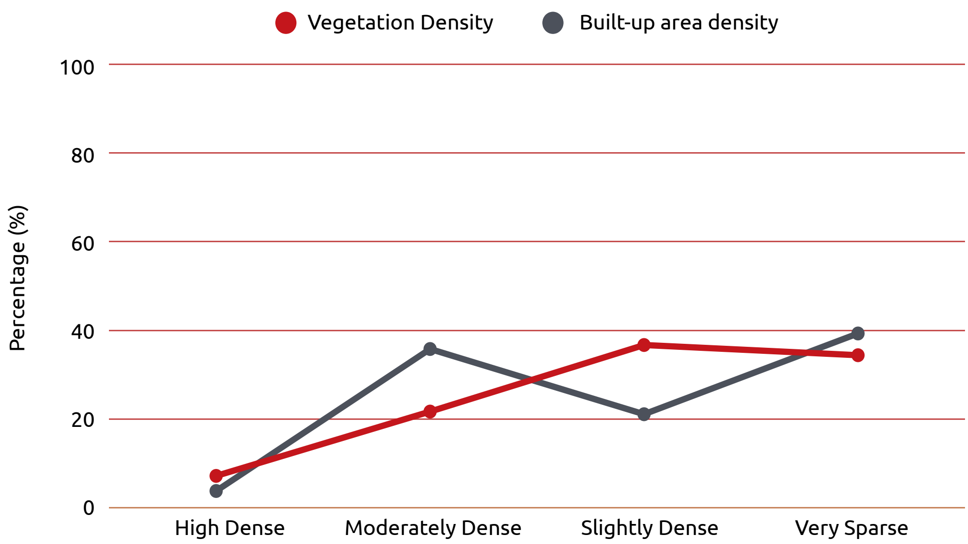

Figure 9: Density of vegetated and built-up area near school premises

School Uniform

An assessment of school clothing revealed that in 87% of schools, students and staff were mandated to wear government-assigned uniforms. Over 30% of these schools felt the uniforms were not weather-adaptive. In the remaining 13%, teachers and students were given the liberty to wear clothing of their choice, demonstrating better consideration of local weather conditions. Such small-scale adaptations help offset discomfort from extreme heat, but their absence in most schools reflects a barrier: public schools largely rely on local government leadership, limiting independent action.

Education

School Closure and Absenteeism

To evaluate the impact of extreme heat on education delivery, data on school closures and student absenteeism were collected. Findings indicate that schools close for an average of 10.87 days during extreme heat periods following heatwave alerts issued by the Department of Hydrology and Meteorology (DHM), with no consistent spatial pattern. Interestingly, some schools remain closed for over a month (up to 41 days), while others report no closures. Among schools that remain open, one-third have made provisions for morning classes as an adaptation measure to mitigate high temperatures.

Beyond closures, absenteeism is significant, with boys missing an average of 25.02 days and girls missing 28.71 days annually. Parents cite safety concerns due to extreme outdoor temperatures and prevalent illnesses as primary reasons for keeping children home.

These reasons complement discussions that reveal primary school children, particularly girls, miss school more frequently due to their heightened vulnerability. Gender disparities arise from systemic barriers that prioritize male education during crises. Several reports acknowledge this gender disparity that prevails, particularly in developing nations (GFDRR; Gul et al., 2024). FGDs and interviews confirm that girls are often required to forgo education to perform household chores, particularly during pre-monsoon periods when wheat sowing preparations intensify. The combination of extreme heat and rising moisture levels during pre-monsoon conditions exacerbates health vulnerabilities, disproportionately affecting girls.

Academic Performance

Even during regular school attendance in hot periods, dehydration and irritation among students are frequently reported. The congested classrooms, and foul smell resulting from excessive sweating have been identified as factors that limit students' concentration on their studies. Schools report that these conditions reduce teachers' willingness to teach under such extreme circumstances, and many acknowledge that their infrastructure poses a barrier to delivering quality education.

Under such circumstances, 61.3% of respondents noted that test scores declined to some extent. Although modeled and quantitative studies have demonstrated that high temperatures reduce the amount of content learned and cause a 2.28% dip in test scores, our findings are solely based on perceptions (WBG; Goodman et al., 2018). However, evidence of missing practical sessions and extracurricular activities in schools supports these claims in Madhesh.

As Madhesh faces additional disasters such as cold waves and flooding, school closures severely limit instructional time, raising serious concerns about literacy rates and the quality of education in the province.

Coping Mechanisms

To address missed educational opportunities, 62.8% of schools have adopted alternative methods to facilitate classes or tuition services. Among these, 97.6% implement morning classes during the first five months of the Nepali year. A few schools in Mahottari, Siraha, and Parsa districts have adopted unconventional measures, such as offering remedial classes or online teaching. According to discussions, some schools also reduce public holidays and vacations to compensate for missed classes.

Despite these efforts, the total number of teaching hours remains reduced compared to normal periods. Additionally, most schools struggle to meet the minimum required instructional days, and 37.2% have no strategies in place for missed classes.

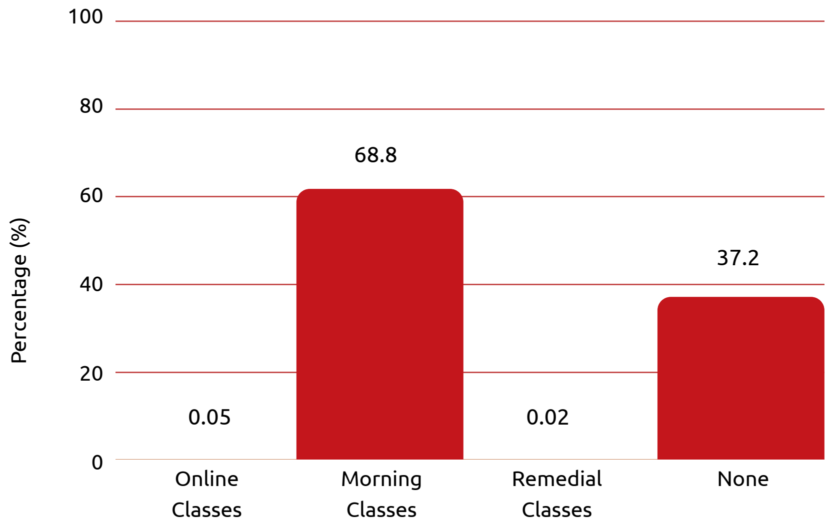

Figure 10: Proportion of schools with countermeasures for missed classes

When asked what prevents schools from adopting more robust plans to address missed education, most cited economic constraints and limited technical capacity. The financial ability of households to adopt online learning systems and the inability of primary school students to use these systems effectively were also highlighted. Limited school budgets, technical resources, and teaching staff were consistently reported as barriers across all districts. Schools generally rely on local government to initiate measures to mitigate educational and health risks, but most do not acknowledge their own limitations in implementing strategies. Some responses suggested continuing morning or evening classes, while others proposed conducting classes outdoors under natural shade.

Resources and Adaptive Capacity

Financial and Institutional Barriers

When asked about their financial capacity to invest in emergency response measures, 91% of respondents reported that they can cover less than 25% of the required costs. Only 3.5% of schools can fully fund responses to health emergencies, as illustrated in Figure 11.

Furthermore, 90.5% of the schools lack a school safety guideline. Only 8.7% have disaster management plans, of which half (4.3%) include no measures to address extreme heat. This highlights that heatwaves are not prioritized, unlike rapid-onset disasters with more visible impacts.

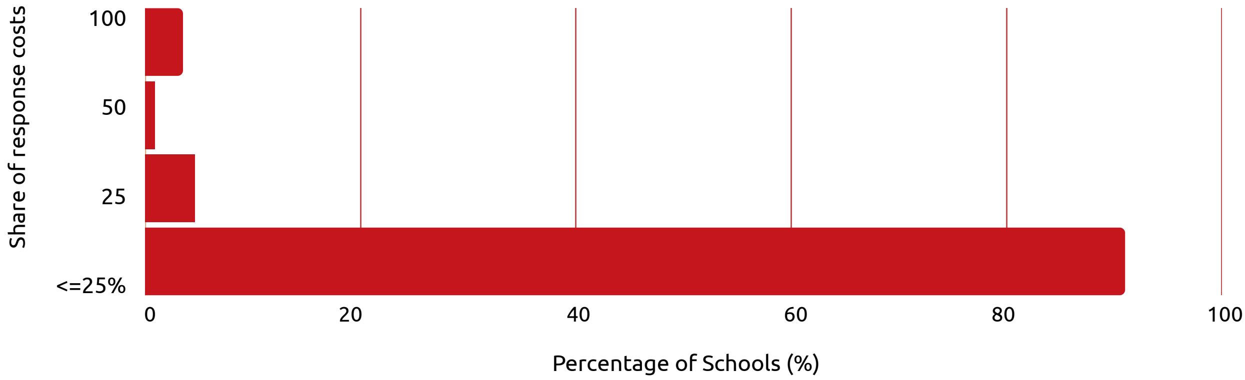

Figure 11: Proportion of schools that can finance a share of response costs

Challenges in implementing resilient plans stem primarily from schools' limited economic resources and lack of initiatives from local governments. Public schools, entirely dependent on government funding, report an inability to act independently. They also acknowledge a lack of knowledge about heat response strategies and the need for capacity-building programs to enhance their adaptive capacity. Limited parent-teacher interaction further impedes discussions on heat stress and user-centered adaptations. This suggests that prioritizing heat-specific adaptation practices in local-level planning and budgeting is critical for school resilience.

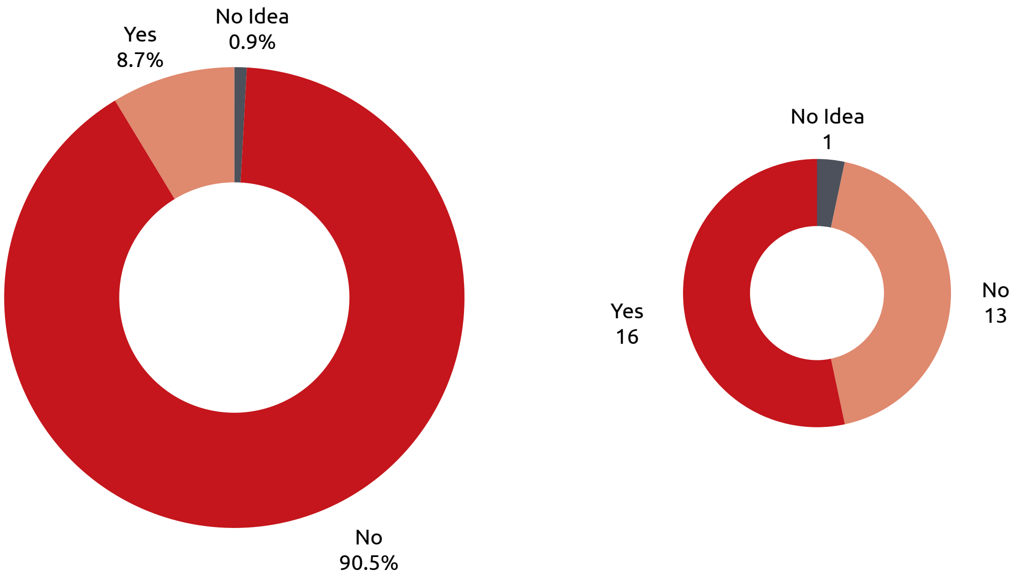

Figure 12: Proportion of Schools with a Disaster Management Plan (DMP), and number of schools that has heat-adaptation measures listed in the DMP

Gaps in Curriculum and Teacher Preparedness

Regarding heat adaptation at the individual level, the inclusion of heatwave content in the school curriculum was examined. 62.1% of school representatives reported having only an introductory course on heatwaves, while 35.3% did not mention having any such content at all. The remaining 2.6% thought the curriculum was robust and needed no revisions. These varying responses underscore the inconsistent understanding among respondents, indicating a strong need for capacity-building programs to enhance knowledge about heatwaves, their environmental and health impacts, and their effects on education delivery.

Among teachers, 95.7% have received no training to manage emergencies during extreme heat. Those who have undergone training noted that it was general first aid, not heat-specific. Additionally, public schools lack dedicated personnel to handle emergencies, though one SMC member reported appointing a health teacher as a point of contact. Focus group discussions with teachers confirmed these gaps, as none reported receiving any training. Despite these limitations, students observed that teachers make efforts to manage emergencies caused by extreme heat, including limiting physical activities, sharing safety tips, and maintaining a less rigid classroom environment to alleviate heat-related stress.

Demand for Action

Both schools and teachers express willingness to act to address challenges during hot periods. Over one-third of school respondents indicated a need for training and simulation exercises to manage extreme heat. Parents also expressed readiness to participate in such training if provided, expecting schools to facilitate these opportunities. Schools support this idea, but more than half of the institutions surveyed report receiving no assistance from external stakeholders. Most have made verbal or written requests to municipalities regarding their needs but report no response. Schools that have not sought external support often cited uncertainty about their needs or a reliance on local government initiative. Some identified a lack of discussion as a barrier, while others noted they had abandoned efforts after receiving no reply from the government. Only three schools reported receiving tangible aid, two of which were supported by local NGOs.

CONCLUSION

Extreme heat and prolonged hot periods significantly disrupt administrative functions and education delivery in public schools across Madhesh Province. These disruptions arise from inadequate school infrastructure, an unfavorable outdoor environment, limited financial resources, and technical constraints, which collectively contribute to adverse health effects for both students and teachers during extreme heat events. Consequently, school attendance declines, and the overall learning experience deteriorates. Children - particularly primary level students, girls, and those with chronic health conditions - are disproportionately affected, although teachers also experience significant impacts.

Key contributing factors include the absence of heat-inclusive disaster management plans, the structural composition of school buildings and roofing materials, limited vegetation density in the school premises, lack of in-house health centers or nursing stations with adequate clinical resources, insufficient trained staff to handle heat-related illness, and limited financial capacity of schools to implement heat-adaptive measures. Based on these data controls, the study identifies 58.3% public schools in Madhesh Province as highly vulnerable to the effects of heatwaves.

While some adaptive measures have been implemented to address health, academic, and operational challenges, these stopgap solutions remain inadequate to counter the escalating frequency and intensity of heatwaves, both now and in the projected future.

RECOMMENDATIONS

Provincial Level

1. **Research Initiatives for Data-Driven Planning:**
Heat resilient infrastructure – Conduct research comparing indoor temperatures in the presence of various construction designs, materials, building ages, and locations. Integrate these findings into thermal model simulations under current and future climate scenarios to identify optimal infrastructure designs and cost-effective retrofit priorities.

School schedule analysis - Evaluate learning outcomes, attendance rates, and teacher and student satisfaction to assess the feasibility of morning classes and inform better schedule adjustments.

2. **Enhancing Medical Access:**
Reinforce existing policies – Mainstream the "One School, One Nurse" program, with the Social Development Ministry leading the effort, building on the successful model established in Bagmati Province in 2018/2019.

Develop emergency porotocols – Establish frameworks for immediate emergency responses, including training school staff to manage heat-related emergencies effectively.

3. **Strengthening Risk Communication:**
Effectiveness – Local communities often struggle to interpret the temperature-based heat hazard categorizations issued by the DHM. The MoFE and MoIACL should support translating these categorizations into local languages and presenting them in user-friendly formats for the public.

Accessibility - Disseminate short, clear warning messages in local languages through widely used media platforms to improve early warning outreach. As noted during discussions, many people currently receive early warnings via government agencies' Facebook pages, making this an effective channel for targeted communication.

4. Provisions for Improving School Infrastructure:

Revise model school guidelines – Insert floor-area specifications based on building design codes to ensure classrooms are not congested and meet minimum bench-seating space requirements. Additionally, the term "disaster resilient infrastructure" should encompass multi-hazard considerations, including heatwaves, to enhance school adaptability to emerging threats.

Budget allocation for school infrastructure - Prioritize context-specific retrofitting of school infrastructure, such as upgrading water, sanitation, and hygiene (WASH) facilities and implementing multi-hazard resilient reconstruction, through conditional grants under federal guidelines and special grants via provincial proposal systems.

5. Policy Inclusion:

Mainstream heatwaves in sectoral policies - Update education sector plans, policies, and frameworks to include heatwave preparedness and response measures. Issue clear directives to integrate heatwave risks into local disaster management frameworks, such as the Local Disaster and Climate Resilience Framework (LDCRF), DRR Strategic Action Plan and the Disaster Preparedness and Resilience Plan, ensuring alignment with local contexts.

Mobilize data on heatwaves - Establish a centralized platform for heatwave-related data, as it is currently lacking. The MoIACL should ensure that data on heatwave-related losses, incidents, and research is easily accessible. The Bipad Portal can be leveraged to report critical data for informed planning, or a less technical platform can be developed to support timely decision-making for heatwave risks.

Municipal Level

1. Ensuring safe school commutes:

Short-term relief - Install shade structures made of local materials, such as bamboo or cloth canopies, at rest points or key sections of school routes. Distribute umbrellas or wide-brimmed hats to students in the most vulnerable schools.

Long-term strategy – Develop vegetated pedestrian pathways along community routes to enable safer school commutes. This intervention would also provide community-level relief. Municipalities should ensure saplings are monitored during their initial growth years through community ownership, complemented by buried mesh fencing and regular clearing of grasses and shrubs to prevent snake bites, a major concern in Madhesh.

2. Establishing shaded spaces:

Artificial shading – Provide temporary shade solutions, such as canvas canopies, to the most vulnerable schools for immediate cooling relief.

Natural shading – Direct municipality funds toward creating naturally shaded areas that offer thermal comfort for students and the broader community. Develop patches of parks near public schools and rest stops (chautaras) equipped with clean drinking water to serve as respite areas and learning hubs during extreme heat periods.

3. Awareness of heatwaves:

Training - Leverage support from development partners to organize knowledge-sharing and training sessions on heatwave threats and prevention strategies for public schools. Heath teachers, as implemented in some institutions in Madhesh, can serve as key points of contact for sustaining the learnings from such trainings.

Curriculum improvements - Revise the school curriculum to better integrate content on heatwave preparedness and response. Instruct schools to distribute reader-friendly heat action cards tailored to students' educational levels to ensure accessible, age-appropriate information.

School/Community Level

1. Sharing responsibilities with parents:

Risk prevention: Relay the municipality-led heatwave prevention training with parents and guardians and clearly explain the measures the school plans to take. Such an approach would enable multiplicative effects in training investments and also yield long-term social returns on investment.

Schedule Readjustments: Take a participatory approach in creating student-centric learning schedules. Morning classes, for example, raise concerns about students arriving without having eaten, so it's important to discuss such topics openly. To make up for reduced learning time in morning-only schedules, explore the possibility of offering remedial classes in the evenings.

2. Safety-first approach:

Develop a School Safety Plan: Introduce an effective disaster management strategy anchored in the CSS (Comprehensive School Safety) Framework to ensure safer learning environments, sustain educational continuity, and mitigate localized disaster risks. Tailor those guidelines to primary and secondary level students, considering their level of vulnerabilities. Development partners and NGOs can step in for technical support in this regard.

Keeping cool: Encourage students to wear light and white-colored clothing during hot periods, with more relaxed rules on school uniforms to better accommodate local temperatures. Additionally, arrange hydration breaks at least once every two learning sessions to ensure that children stay well-hydrated and are better prepared to cope with periods of extreme heat.

3. Upgrading school facilities:

Grey Infrastructures: Target interventions that commensurate with school's financial capacities based on spatial variability of surface temperature and outdoor thermal discomfort. As an immediate relief measure, prioritize expansion of drinking water stations. Follow this by retrofitting the school infrastructure – such as installing false ceilings, applying reflective white paint, or developing green roofs. Frequently quality assure the adopted measures for effectiveness and sustainability.

Green Infrastructures: Repurpose underutilized schoolyards as vegetated spaces. Introduce vertical greening systems on building facades to enhance urban greenery, improving microclimatic conditions through evapotranspiration and airflow regulation. Native plant species like Bauhinia vahlii (Bhorla) and Coccinia grandis (Ban Kakri) are recommended. Furthermore, promote plantation activities during special school occasions such as birthdays and anniversaries, accompanied by safety measures to mitigate potential risks of snake bites.

Development Partners

1. Policy sensitization:

Develop concise, accessible technical briefs on heat adaptation and mitigation measures for dissemination to the Provincial Planning Commission (PPC) and municipal bodies. This will support the integration of relevant actions into provincial and municipal development plans. Local-level sensitization on heatwaves is critical to raise awareness among governing bodies about the hazard's severity, particularly its disproportionate impact on vulnerable populations like children, who face heightened risks due to school infrastructural limitations.

2. Evidence generation:

Encourage think tanks, research agencies, and partner organizations to lead coordinated research efforts with the EDD and MoIACL to generate evidence for effective program and policy planning. Establish a provincial-level extreme heat standard for Madhesh to guide schools in implementing rapid adaptation measures. Define clear guidelines for data availability and dissemination. Once established, encourage the use of wet bulb temperature as a practical indicator for schools to identify critical heat thresholds, enabling efficient warning messaging with minimal resource requirements.

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