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POLICY BRIEF

Climate Change, One Health & Schools

Schools as Climate-Health Ecosystems · Education as Preparedness · Disaster Microbiology

ONE-Bridge in Health Webinar Series · June 2026

Executive Summary

Schools are not outside the climate crisis — they are inside it. Every day, millions of children sit in overheated classrooms with inadequate ventilation, breathe air polluted by nearby traffic, play in schoolyards without shade, and drink from unreliable water supplies. These are not comfort issues. They are measurable health exposures, and they are not distributed equally. Children in low-income, under-resourced schools face compounding disadvantages: worse infrastructure, less green space, fewer protocols, and less institutional capacity to respond when conditions deteriorate.

At the same time, extreme weather events triggered by climate change are no longer rare. The Valencia flash flood of October 2024 — which killed over 220 people and destroyed entire urban districts — left a microbial legacy in soil and air that persisted for more than a year. Pathogens with clinical relevance, including multi-drug resistant strains, were still recoverable from the built environment during reconstruction. Disaster does not end when the water recedes.

Three conclusions demand policy action: schools must be treated as One Health environments requiring the same monitoring and protection standards applied to healthcare facilities; climate vulnerability in schools is socially produced and can be changed through targeted investment; and post-disaster microbial surveillance must become a standard protocol, not an afterthought.

3.6B People currently living in areas highly vulnerable to climate change (WHO)	**81%** Of school classrooms in recent studies that exceeded recommended CO2 thresholds	**220+** Deaths from the Valencia flash flood, October 2024 — with microbial hazards persisting 12+ months after	**50%** Of bacteria isolated from Valencia flood soils were of clinical relevance — including multi-drug resistant strains

1. Schools Are One Health Environments — And We Are Not Treating Them as Such

A school is not simply an educational institution. It is a biological, social, and physical environment where human health, building infrastructure, air quality, water access, green space, and community equity converge every day. When a heatwave hits, it enters a school as an overheated classroom. When traffic pollution levels rise, it enters as a respiratory burden on children sitting near busy roads. When a city floods, it enters school buildings as contaminated sediment and disrupted water systems. The climate crisis does not stop at the school gate.

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Yet schools are rarely governed as health environments. They lack heat protocols. They lack ventilation monitoring. They lack access to school health staff in most European countries. They lack green space in lower-income areas. And they lack — almost universally — any systematic mapping of the health risks their physical environment imposes on the children inside.

- Heat exposure in classrooms affects concentration, behaviour, fatigue, and attendance — before it becomes a clinical emergency. For children with chronic respiratory conditions, asthma, or disabilities, it can become a serious health risk much sooner.
- Poor ventilation and elevated CO2 are associated not only with respiratory risk but with measurably reduced cognitive performance and learning outcomes. This means that inadequate indoor air quality is simultaneously a health issue and an educational equity issue.
- School PM2.5 exposure is linked to lower test scores, disproportionately affecting children from lower socioeconomic backgrounds — air pollution reproduces educational inequality.
- Green space in schools reduces heat exposure, supports physical activity, improves well-being, and creates biodiversity learning opportunities. Its absence is not a cosmetic problem. Its absence is a measurable health deficit.

BOTTOM LINE	*Two schools can experience the same 40°C heatwave but have entirely different outcomes: one has shade, cooling, a heat protocol, a school nurse, and trained staff; the other has asphalt, overcrowded classrooms, no cooling, and no protocol. The hazard is the same. The protection is not. Climate vulnerability in schools is not inevitable — it is institutionally produced and institutionally correctable.*

2. Climate Vulnerability Is Socially Patterned — and Metrics Alone Cannot Capture It

Quantitative data can locate where climate exposure is concentrated — which classrooms are hotter, which schools have high CO2 levels, which neighbourhoods have higher PM2.5 readings. This is necessary. But it is not sufficient.

Children do not experience climate risk as a data point. They experience it as heat fatigue in the fourth period of the afternoon. As the smell of traffic entering through open windows in the only ventilation strategy available. As the anxiety of a wildfire visible from the playground. Qualitative data — interviews with children, teachers, and parents; classroom observations; participatory mapping — reveal how exposure becomes vulnerability, how teachers improvise protection in the absence of protocols, and whose discomfort gets normalised.

- Teacher improvisation in the face of missing protocols is widespread and structurally dangerous. When individual teachers compensate for absent institutional safeguards, we accept the absence of those safeguards as normal. We should not.
- Children learn not only from formal lessons but from the material conditions around them. A school without shade, ventilation, or emergency protocols communicates something: that discomfort is expected, that some children's safety is negotiable. This is the hidden curriculum of climate inequality.

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- Resilience must not mean that children, teachers, and families are expected to cope better. Resilience means schools are resourced to protect health, learning, and dignity — with infrastructure, protocols, staff, and partnerships.

BOTTOM LINE	*If some children attend overheated, polluted, under-resourced schools while others learn in green, well-ventilated environments with functioning protocols, climate inequality becomes part of everyday education. This is not an environmental problem. It is a social justice problem — and it is measurable, preventable, and policy-addressable.*

3. AI Tools Can Bridge Scientific Data and Classroom Learning — But Teachers Need Support

WHO's AirQ+ software — freely available, capable of estimating the health burden of PM2.5 exposure on defined populations — demonstrates how scientific data can be translated directly into educational material. When combined with AI-powered lesson-planning tools (such as MagicSchool AI), teachers can generate full lesson plans, student worksheets, rubrics, and multiple-choice assessments from a single policy scenario in under an hour, adapted to any grade level. This is not a replacement for teaching. It is infrastructure for teachers who lack time, specialist knowledge, or preparation support.

- AirQ+ allows students to calculate attributable deaths, attributable cases per 100,000 population, and the disease burden reduced by specific PM2.5 reduction policies — making the connection between environmental data, epidemiology, and policy decision-making concrete and computable.
- AI lesson-planning tools can adapt the same scenario to different age groups, generate differentiated worksheets, create rubric-based evaluation frameworks, and produce assessments — reducing the preparation burden that prevents many teachers from engaging with complex interdisciplinary topics.
- This approach is cross-curricular by design: it engages biology, chemistry, geography, mathematics, data literacy, and civic education simultaneously — exactly the kind of integrated learning that One Health requires.

BOTTOM LINE	*Climate and health education will remain theoretical unless teachers are given practical, low-barrier tools to bring real data into classrooms. AI-supported curriculum tools, combined with open-access public health software, make this possible today — at zero cost. What is missing is the systemic adoption, teacher training, and curriculum integration that would make this the norm rather than the exception.*

4. The Valencia Flood: What a Disaster Leaves Behind

The Dana flash flood that struck Valencia, Spain, in October 2024 was the most devastating natural disaster in 21st-century Europe to date. Over 220 people died. The meteorological conditions — an inland cold front interacting with an exceptionally warm Mediterranean Sea, following a prolonged drought — are consistent with climate model projections for intensifying extreme events in the Mediterranean region.

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What followed the acute disaster phase is less visible but no less important: the flood deposited contaminated sediment across entire urban districts. Twelve months later, during reconstruction and river-basin restoration, soil and air samples from multiple affected sites showed the following:

- Approximately 50% of bacteria identifiable from flood-affected soils were classified as clinically relevant — including Pseudomonas, Nocardia, Bacillus, and Kocuria species.
- Multi-drug resistant strains were identified, including Pseudomonas species resistant to multiple antibiotic classes, and Kocuria rosea with resistance profiles. These were isolated primarily from the most heavily affected areas.
- Specific strains — including Staphylococcus, Pseudomonas, and Kocuria species — persisted in the same geographic locations across both the 2024 and 2025 sampling campaigns, suggesting environmental persistence rather than transient contamination.
- Air sampling during the 2025 reconstruction phase confirmed that flood-derived microbial material was becoming airborne as sediments were disturbed — creating inhalation exposure pathways that did not exist when the flood water was present.
- Fungal diversity was high and variable across sites, with ongoing characterisation needed to determine clinical relevance.

BOTTOM LINE	*A flood is not over when the water recedes. The microbial hazard it creates in soil and built environments can persist for over a year and becomes an airborne exposure risk during reconstruction. Emergency preparedness frameworks must include systematic post-disaster environmental microbiological surveillance — beginning within weeks and continuing through reconstruction. This is not a specialised research activity. It should be standard public health protocol.*

5. Policy Recommendations

5.1 Schools as One Health Environments

1. **REC 1:** Mandate minimum climate-health standards for all school buildings in EU member states.

Every school should be required to meet basic standards for: maximum classroom temperature during instruction; CO2 and ventilation monitoring with defined thresholds; access to safe drinking water; shaded outdoor space; and a documented heat health protocol. These should be non-negotiable requirements, not voluntary guidance. Compliance should be monitored and reported through national school inspection systems.

2. **REC 2:** Establish school climate-health vulnerability mapping as a national policy tool.

Every EU member state should develop a structured framework for assessing school climate vulnerability across three dimensions: exposure (heat, air quality, flooding risk, CO2), sensitivity (children with chronic conditions, disability, poverty, migration), and adaptive capacity (protocols, infrastructure, staff, green space). This mapping should drive targeted infrastructure investment — prioritising the most vulnerable schools, not the most visible ones.

3. **REC 3:** Restore school health staff as a universal standard.

A school nurse or health professional is not a luxury. In a climate-changing world where heatwaves, air quality crises, and infectious disease risks are increasing, every school needs a

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designated health contact with clear protocols and the authority to act. The systematic removal of school health staff from many European countries — driven by austerity — must be reversed.

5.2 Climate Education and AI-Supported Teaching

4. **REC 4:** Integrate climate-health literacy into national curricula at all education levels.

Climate and health education should not be an optional add-on or a science-week activity. The links between air quality, particulate matter, disease burden, and policy decisions are computable, teachable, and directly relevant to civic life. Ministries of education should define minimum competency standards for climate-health literacy and embed them in cross-curricular frameworks covering biology, geography, mathematics, and civic education.

5. **REC 5:** Provide teacher training and institutional support for AI-assisted climate-health lesson development.

The combination of open-access public health tools (such as WHO AirQ+) and AI-powered curriculum platforms enables any teacher to create evidence-based, data-driven climate-health lessons. However, adoption requires training, time, and institutional endorsement. National teacher training programmes should include modules on AI-assisted lesson design for complex interdisciplinary topics. Schools should be given dedicated preparation time for this.

5.3 Climate Equity and the Social Determinants of School Health

6. **REC 6:** Treat unequal school climate conditions as a public health equity issue requiring active redistribution of resources.

The evidence is clear: children in lower-income schools face greater heat exposure, worse air quality, less green space, and fewer protective resources. This is not a natural consequence of climate change — it is a consequence of policy choices about how school infrastructure investment is allocated. Climate adaptation funding at EU and national level must be directed preferentially to the most under-resourced schools, not distributed uniformly or through competitive grant processes that favor better-resourced institutions.

7. **REC 7:** Include participatory methods — including student voice — in school climate-health planning.

Children are not passive recipients of climate education. They are primary inhabitants of school environments and holders of detailed knowledge about how those environments feel, fail, and affect their daily lives. Participatory approaches — student focus groups, classroom observations, school health diaries, photovoice methods — must be incorporated into school climate-health assessment. Decisions about school environments must include the people most affected by them.

5.4 Post-Disaster Microbial Surveillance

8. **REC 8:** Mandate post-disaster environmental microbiological surveillance as a standard public health protocol.

Following any major flood, wildfire, or storm event, national public health authorities should initiate systematic soil and air microbiological sampling within weeks of the event, continuing through the reconstruction phase. Sampling should cover bacterial diversity, clinical relevance classification, antimicrobial resistance profiling, and airborne microbial load. The Valencia flood data demonstrate that clinically relevant, multi-drug resistant organisms persist in the environment for over a year. This is a public health risk that current emergency frameworks do not address.

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9. **REC 9:** Include reconstruction workers and nearby residents in post-disaster health surveillance.

During the reconstruction phase, disturbed sediments generate airborne microbial and particulate exposure that did not exist during the acute flood phase. Workers involved in cleaning, reconstruction, and river-basin restoration, and residents living in proximity to active works, face inhalation exposures that should be monitored and mitigated. Respiratory protection guidance, health monitoring, and access to occupational health assessment should be standard components of disaster reconstruction planning.

1. **REC 10:** Build national capacity for rapid environmental metagenomics in disaster response.

The Valencia post-flood sampling demonstrated that culture-based methods alone cannot characterise the full microbial landscape — many organisms could not be identified by standard MALDI-TOF analysis. Nanopore sequencing and metagenomics are now operationally feasible in field conditions. Member states should develop national capacity for rapid environmental metagenomics as a disaster response tool, enabling strain-level identification, resistance gene characterisation, and persistence tracking across multiple sampling timepoints.

6. Conclusion

The climate crisis is already a school health crisis, a child health crisis, and a social equity crisis. It manifests in overheated classrooms, polluted playgrounds, absent protocols, and unequal protection. It manifests in post-flood soils where multi-drug resistant bacteria persist for a year after the cameras have moved on. It manifests in the invisible burden carried by teachers who improvise protection for children because no institutional framework requires them to be protected.

None of this is inevitable. Schools can be redesigned as protective environments. Teachers can be supported with tools that make evidence-based climate education accessible. Post-disaster surveillance can become routine. Climate vulnerability can be mapped, targeted, and reduced. What is required is the recognition that climate change enters children's lives through the concrete conditions of the spaces they inhabit every day — and that those conditions are a matter of public health policy, not individual adaptation.

FINAL MESSAGE	*Schools teach children about climate change. But schools are also where climate change teaches children — about whose safety is protected, whose discomfort is normalised, and whether institutions can be trusted to act. We have a choice about what that lesson is.*

Sources

Based exclusively on the ONE-Bridge in Health Webinar: 'Climate Change & One Health: Educational Scenarios and School-Based Actions' (June 2026). Scientific contributions from: Z. Anastopoulou (University of Patras, Lab of Public Health, Epidemiology and Quality of Life) — climate crisis, One Health framework, and education as a driver of change; A. Palaiologou (University of Patras) - WHO AirQ+ as an educational tool for PM2.5 health impact assessment, AI-supported lesson planning using MagicSchool AI; Sp. Papaioannou (Post-Doc Sociologist, University of Patras) — schools as One Health environments, social determinants of climate vulnerability, mixed-methods frameworks, qualitative methods, climate equity in school settings;

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Professor Sara Soto (ISGlobal Barcelona, Global Viral and Bacterial Infections Programme) — post-flood microbiology of the Valencia Dana disaster (2024), soil and air sampling campaigns 2024–2025, antimicrobial resistance in post-disaster environments. ONE-Bridge consortium: University of Patras, Technical University Dresden, CNRS France, ISGlobal Spain, EMVIO.

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