Smart at a glance

PAHO
Pan American Health Organization
World Health Organization
Americas Region

Smart Hospitals
SAFE • GREEN • MAINTAINED

Introduction

This overview was drafted during the Disaster Mitigation Advisory Group (DiMAG) meeting in Barbados, 4–5 November 2022, to advance the Smart Building Movement in the Caribbean and Beyond. The DiMAG is an international, not-for-profit body of multidisciplinary experts dedicated to advising Pan American Health Organization/World Health Organization (PAHO/WHO) Member States on reducing risks and vulnerabilities, particularly in the health sector. DiMAG draws on specialists in engineering, architecture, disaster management, emergency services, economics, and policy, bringing decades of combined experience in low- and middle-income countries where resource constraints and high exposure to natural hazards pose significant challenges.

The Smart Hospitals Initiative is a flagship PAHO/WHO project aimed at improving resilience, sustainability, and safety of health facilities in the Caribbean. Phase 3 of the initiative, titled "Building Smart (Safer, Greener, and Sustainable) Health Care Facilities in the Caribbean and Beyond," seeks to mainstream the adoption of Smart principles beyond hospitals to other critical infrastructure.

Table 1 shows the timeline of the Smart Health Care Facilities in the Caribbean project (also called the Smart Hospitals Initiative), implemented by PAHO and the United Kingdom Foreign, Commonwealth & Development Office (FCDO)/UKaid in the Caribbean region.

Table 1. Timeline of the Smart Health Care Facilities in the Caribbean project

Year	Key milestone
2012	The pilot phase is launched in two countries: Saint Kitts and Nevis and Saint Vincent and the Grenadines.
2013 (September)	The project's first retrofitted facility opens in the Caribbean: the Georgetown Hospital in Saint Vincent and the Grenadines.
2014	Continuation of Phase I (the pilot), developing toolkits, building standards, etc. A case study covers March 2012–March 2014.
2015 (June)	Official start of Phase II: the project expands to seven countries: Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, and Saint Vincent and the Grenadines.
2016–2020	Implementation of Phase II works: retrofitting 50+ healthcare facilities in the target countries.
2022 (27 January)	In Jamaica: the handover of nine upgraded Smart healthcare facilities.
2023	According to the final report, the overall project duration is 2015–2023. The Smart Hospital model is fully evaluated and the "gold standard" is established (A/70 target).
2024 (18 January)	In Jamaica: the final fully retrofitted site under the project – Santa Cruz Health Centre – is handed over.

Additional context

- The project uses the concept “Safe + Green + Maintained = Smart.”
- Phase I developed the toolkit (Hospital Safety Index, Green Checklist, Baseline Assessment Tool) and piloted it in two countries.
- Phase II is supported by FCDO/UKaid and aims at retrofitting ~55 health facilities across the 7 target countries.
- The Georgetown Hospital was the only hospital in Saint Vincent and the Grenadines to remain functional after a severe storm, thanks to its “smart” upgrades.

Lessons learned from the Caribbean experience

1. Resilient infrastructure protects lives and services

- Facilities retrofitted to Smart standards remained operational during hurricanes and floods, while nonretrofitted hospitals experienced extensive downtime.
- For example, in the British Virgin Islands and Dominica in 2017, retrofitted health centres sustained operations while others required full evacuation.
- Nonstructural measures, secure roofs, anchored equipment, and flood-proof storage were critical in preventing functional collapse.

Key insight: Resilience is both structural and operational; the building alone is not enough.

2. Business continuity systems are essential

- Operational continuity requires planning for utilities, logistics, and human resources.
- Examples of previous challenges:
    - Power outages due to grid failure and generator fuel supply issues.
    - Water contamination or tank damage disrupting medical and hygiene services.
    - Staff displacement and limited transport delaying critical services.

Lesson: Resilient facilities must include utility redundancy, staff contingency planning, and supply-chain resilience.

3. Multihazard and climate risks are increasing

- Hurricane intensity, rainfall, and storm surge are escalating, putting previously “safe” areas at risk.
- Volcanic eruptions (Saint Vincent, 2021) highlighted vulnerability to ash contamination in heating, ventilation, and air conditioning (HVAC), water, and electrical systems.
- Sea-level rise threatens coastal facilities previously considered low risk.

Lesson: Design must be future-proof and multihazard aware, considering projected climate changes, not only historical data.

4. Smart facilities function as community lifelines

- Beyond healthcare delivery, Smart hospitals and associated facilities serve as:
    - Emergency shelters and safe havens;
    - Distribution points for food, water, and medical supplies;
    - Communication hubs when infrastructure is compromised;
    - Centres for psychological support and recovery coordination.

Lesson: Smart facilities are critical nodes for community resilience, not just buildings for service delivery.

5. Energy solutions strengthen operational resilience

- Renewable energy and hybrid systems reduce reliance on diesel and the national grid.
- During hurricane disruptions, facilities maintained critical services such as:
    - Oxygen supply and refrigeration for medicines;
    - IT systems and patient records;
    - Communication with regional emergency operations.

Lesson: Renewable energy is a dual solution: improving both resilience and sustainability.

6. Governance and local capacity are key to sustainability

- Countries with strong government leadership, trained local engineers, and Smart coordinators achieved longer-lasting results.
- Regular maintenance, monitoring, and local ownership prevent deterioration and ensure continued operational effectiveness.

Lesson: Institutionalizing Smart ensures long-term impact and self-sufficiency.

7. Smart is scalable and cross-sectoral

- The British Virgin Islands applied the Smart approach beyond hospitals, to:
    - Schools – maintaining education continuity and providing emergency shelter;
    - Emergency shelters – ensuring safe, operational, multipurpose community spaces.
- Replication in multiple sectors demonstrated that Smart is flexible, adaptable, and scalable.

Lesson: Smart is a proven model for resilient infrastructure across sectors.

British Virgin Islands: A Smart success story

- **Hospitals**: Retrofitted to withstand extreme weather, with solar hybrid energy and functional continuity planning.
- **Schools**: Doubled as emergency shelters, demonstrating multipurpose design for education and disaster response.
- **Emergency shelters**: Protected communities during high-risk periods while maintaining services.

Key achievements:

✓ Proof of concept for cross-sector adaptation.

✓ Visible community trust in government-led resilience initiatives.

✓ Demonstrated cost-effectiveness by reducing post-disaster repair costs.

✓ Strengthened local capacity through training, maintenance, and governance systems.

Lesson: British Virgin Islands shows that Smart can be replicated in other countries and sectors with visible, measurable results.

Comprehensive Caribbean Smart concept timeline

Table 2 provides a more comprehensive view of the implementation of the Smart approach in the Caribbean.

Table 2. Caribbean Smart experience across health, education, and emergency shelters, 2012 to 2025

Year	Sector/location	Milestone/event
2012	Health –Saint Kitts and Nevis, Saint Vincent and the Grenadines	Pilot phase of the Smart Health Care Facilities in the Caribbean begins. Focus: "Safe + Green = Smart" for hospitals. (paho.org)
2013 (September)	Health – Saint Vincent and the Grenadines	First retrofitted hospital facility opens: Georgetown Hospital becomes the Caribbean's first Smart hospital. (searchlight.vc)
2014	Health	Phase I concludes; toolkit development (Hospital Safety Index, Green Checklist, Baseline Assessment Tool) and pilot evaluation complete. (paho.org)
June 2015	Health – Seven Caribbean countries	Phase II begins; retrofitting and Smart standards applied to ~55 health facilities across Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, and Saint Vincent and the Grenadines.

Year	Sector/location	Milestone/event
2016–2018	Health and adjacent facilities	Expansion of the Smart toolkit to senior homes and children's homes, introducing cross-sector interest in resilient and sustainable building standards. (paho.org)
2016 (March)	Education – British Virgin Islands	Two schools certified as "Smart Schools" (Seventh-day Adventist School and Little Lighthouse Child Development Centre), adapting the hospital-derived Smart model. (bvi.gov.vg)
2019 (September–October)	Emergency shelters – British Virgin Islands	BVI announces retrofitting of four community centres/emergency shelters using Smart standards (Safe + Green + Resilient), first application outside health sector; funded by the European Union, technical guidance from the Pan American Health Organization. (bvinews.com)
2022 (March)	Emergency shelters – British Virgin Islands	Four Smart-retrofitted shelters completed; British Virgin Islands becomes the first in the Americas to formally apply Smart standards to shelters. (paho.org)
2023 (February)	Emergency shelters – British Virgin Islands	Official handover of two Smart shelters: Valerie O. Thomas Community Centre and Gertrude and Christiana Warner Community Centre. (paho.org)
2020–2023	Education and other sectors – Caribbean	Smart concept adopted in additional schools, shelters, and community centres; growing regional policy acknowledgement of cross-sector Smart standards. (paho.org)
2023–2024	Education – Saint Lucia	20 "Smart Classrooms" launched in primary schools under resilience/digital transformation initiatives, reflecting broader adoption of the Smart approach. (sustainabledevelopment.govt.lc)
2024–2025	Education and community infrastructure – British Virgin Islands	Expansion of Smart Schools and community centres; Smart standards become part of long-term building resilience planning. (gov.vg)

Key observations

1. **Origin**: The Smart concept began in health care (hospitals), focused on safety, green energy/water efficiency, and operational resilience.
2. **Toolkit**: Hospital Safety Index, Green Checklist, Baseline Assessment Tool.
3. **Cross-sector adoption**: Expanded to senior homes, children's homes, schools (British Virgin Islands Smart Schools), and emergency shelters (British Virgin Islands).
4. **Shelter-specific impact**: Emergency shelters were retrofitted with structural reinforcement, energy/water efficiency, fire safety, and operational training. British Virgin Islands became a **regional pioneer** in applying Smart outside health.
5. **Education**: Adapted Smart for schools and classrooms (resilience, digital, and green infrastructure).

Next steps and priority focus areas

1. Institutionalize Smart standards

- Adopt Smart as recommended criteria for all new public buildings and retrofits.
- Integrate into:
    - National building codes;
    - Infrastructure procurement processes;
    - Health, education, and disaster management policies.
- Establish auditing, inspection, and compliance mechanisms to ensure standards are upheld.

Outcome: Resilience becomes a baseline expectation, not optional.

2. Embed Smart in post-disaster reconstruction

- Include Smart principles in damage assessments and rebuild plans.
- Avoid like-for-like reconstruction that reproduces vulnerabilities.
- Prioritize multihazard and climate-resilient designs in disaster recovery funding.

Outcome: Every recovery effort builds long-term resilience.

3. Expand Smart across lifeline public services

- Priority sectors include:
    - Schools and early education centres;
    - Emergency operations centres and shelters;
    - Water, energy, and telecommunications facilities;
    - Government offices providing essential social services.

Outcome: Communities benefit from a network of resilient facilities, improving continuity during crises.

4. Mobilize sustainable climate and resilience financing

- Position Smart as a flagship Caribbean climate adaptation initiative.
- Access multilateral and blended finance from:
    - Green Climate Fund;
    - Adaptation Fund;
    - Caribbean Development Bank, Inter-American Development Bank, World Bank.
- Provide evidence of cost savings, reduced losses, and operational benefits to support investment.

Outcome: Enable scaling from pilot projects to hundreds of facilities region-wide.

5. Build regional technical capacity

- Regional training and certification programmes for engineers, architects, and facility managers.
- Develop local supply chains for resilient building materials, renewable energy systems, and Smart equipment.
- Foster South–South knowledge exchange across Caribbean countries.

Outcome: Local expertise ensures rapid replication, maintenance, and sustainability.

6. Enhance digital tools and monitoring

- Implement digital platforms for:
    - Facility performance tracking;
    - Risk and hazard assessment;
    - Maintenance scheduling and monitoring.
- Collect data-driven evidence of Smart performance during disasters.

Outcome: Improved planning, accountability, and advocacy for scaling.

7. Promote Smart and tell the story

- Launch a Smart communications and advocacy campaign:
    - Highlight before/after transformations;
    - Showcase success stories from British Virgin Islands, Dominica, Grenada, Jamaica, Saint Vincent and the Grenadines, and others;
    - Document cross-sector replication and financial benefits.
- Share at regional, small island developing states, and global forums (Conference of the Parties [COP], United Nations, climate resilience conferences).

Outcome: Build global recognition, attract new partners, and inspire replication.

8. Engage insurance and reinsurance partners

- Develop insurance-based incentives to encourage Smart adoption:
    - Offer premium discounts or improved coverage terms for Smart-certified buildings;
    - Integrate Smart criteria into risk assessment and underwriting;
    - Reward facilities that demonstrate operational continuity during disasters.
- Advance joint financing models to support retrofits:
    - Co-financing arrangements between insurers, reinsurers, and governments;
    - Resilience upgrade loans linked to insurance policies;
    - Pay-as-you-save and energy-efficiency financing options.
- Strengthen data-driven evidence for reduced losses:
    - Use post-disaster performance data from Smart facilities to validate risk reduction;
    - Develop case studies demonstrating avoided damage and lower payout costs;
    - Improve actuarial models incorporating Smart resilience impacts.
- Align Smart standards with regional insurance market policies:
    - Collaborate with insurers to advocate for Smart-aligned building codes;
    - Explore a regional reinsurance facility rewarding climate-smart infrastructure;
    - Establish verification processes to ensure compliance and eligibility.

Outcome: Lower risk exposure for insurers, reduced long-term costs for governments and building owners, and a market-driven pathway to scale Smart across the Caribbean.

Strategic vision forward

Smart hospitals → Smart public buildings → Smart and safe communities → Climate-resilient nations

- Smart is proven, scalable, and cost-effective.
- The Caribbean is leading a global model for resilient infrastructure.
- Next decade focus: mainstream, scale, finance, and promote Smart across sectors and countries.

Core message:

“Every facility, rebuilt or new, is an opportunity to build safer, greener, smarter, and more resilient communities.”

Importance of maintenance and upkeep for Smart facilities

Sustaining the benefits of Smart investments requires proactive and continuous maintenance of infrastructure, equipment, and building systems. Experience across the Caribbean has shown that even the best-designed facilities can quickly lose resilience, efficiency, and functionality if

routine upkeep is not prioritized and funded. Maintenance is not a cost – it is a protective investment that preserves lives, safeguards previous capital expenditure, and ensures operational readiness during emergencies.

Smart retrofits introduce advanced systems such as renewable energy, rainwater harvesting, efficient HVAC, secure medical gas supply, anchoring of critical equipment, and digital monitoring solutions. These systems must be regularly inspected, tested, and serviced to guarantee reliable performance when hazards threaten power, water, or essential services.

A structured and well-resourced maintenance strategy supports:

- **Resilience and continuity** – Essential equipment and utilities remain functional during hurricanes, floods, and other hazards.
- **Cost efficiency** – Routine maintenance prevents expensive major repairs and extends asset life, reducing long-term infrastructure costs.
- **Safety and compliance** – Building integrity, fire detection, ventilation, and infection control measures stay within required standards.
- **Environmental sustainability** – Solar, water efficiency, and waste management systems operate at peak performance, reducing emissions and resource consumption.
- **Community trust and service reliability** – Facilities remain dependable health and support hubs when the community needs them most.

To institutionalize maintenance as a critical pillar of the Smart movement, countries are encouraged to implement:

- Dedicated facility management teams and Smart maintenance protocols.
- Budgeted maintenance plans linked to national health and infrastructure policies.
- Training programmes for engineers, technicians, and facility managers.
- Digital monitoring tools for detecting risk and scheduling preventive work.
- Accountability mechanisms and periodic performance audits.

Maintenance and upkeep translate resilience from a one-time construction activity into an ongoing operational commitment. Protecting Smart investments ensures that health facilities, and other critical public buildings, remain safe, green, and fully functional for the people who rely on them every day, especially when disaster strikes.

Conclusion

The PAHO Follow-Up Meeting on the Smart Hospitals Initiative reaffirms that the Caribbean is not only responding to climate and disaster risks but actively shaping a new global standard for resilient health infrastructure. Over more than a decade, the Smart initiative has demonstrated that combining safety, sustainability, and operational readiness saves lives, protects essential services, and strengthens national health systems during the most challenging events.

In the wake of Hurricane Melissa, which caused catastrophic flooding, infrastructure damage, power and water disruptions, and widespread health service interruptions across the region, including in countries such as Jamaica, Haiti, and Cuba, the relevance of the Smart approach becomes even

more urgent. For islands recovering from Melissa's impact, the Smart framework offers a clear path to rebuild not simply "what was" but build back *better*. Examples of how this applies:

- Retrofit or rebuild health facilities using Smart standards, ensuring structural reinforcement, anchoring of critical equipment, flood-resistant design, and backup energy systems, so that after a hurricane like Melissa, facilities remain operational rather than shutting down.
- Use the updated Smart Hospitals Toolkit to guide emergency recovery, integrating multihazard design (e.g., wind, flood, volcanic ash where relevant), utility redundancy, renewable energy and water systems, and operational continuity plans.
- Leverage the Smart model across other vital infrastructure in affected islands – schools, community shelters, government offices, water/telecom hubs – so that communities are not left without safe havens when the next storm hits.
- Mobilize climate-resilience funding specifically for Melissa-affected islands, positioning Smart-compliant rebuilding as a priority for recovery and adaptation funds, thereby reducing future losses and strengthening resilience.
- Strengthen local capacity immediately in the impacted islands: train engineers, facility managers, disaster planners in Smart standards, so that recovery is locally led and sustainable.
- Capture the stories from healthcare facilities or other buildings impacted by Melissa to highlight how Smart principles could have reduced loss, and use those narratives in advocacy to accelerate implementation across the region.

As the region faces intensifying climate threats, expanding the Smart approach across all critical public infrastructure is both a practical necessity and a strategic opportunity. Lessons learned from Phase I and II – particularly the successes in countries and territories like the British Virgin Islands, Dominica, Jamaica, and Saint Vincent and the Grenadines – show that resilient, green, and community-centred facilities are achievable and cost-effective, especially when guided by strong governance and local capacity.

The updated Smart Hospitals Toolkit; strengthened partnerships; and renewed commitment from governments, PAHO, and international funding partners provide a solid foundation for Phase III and beyond. By embedding Smart principles into national policies, post-disaster reconstruction (especially now for those islands hit by Melissa), and everyday facility management, the region moves closer to a future in which essential services remain functional and communities remain safe no matter the hazard.

The Caribbean has proved that Smart is not a concept; it is a movement. With continued leadership, investment, and knowledge-sharing, this model can be replicated across small island developing states worldwide, positioning the region at the forefront of climate-resilient development.

Together, Caribbean countries can ensure that every new or renovated facility becomes a catalyst for safer, greener, and more resilient Caribbean communities, today, and especially in the places hardest hit by Hurricane Melissa.