

# Preparedness of European Healthcare Facilities facing Climate Change Related Risks



**Italian Society of Architecture and Engineering for Healthcare - TSO**

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This document is a technical report from S.I.A.I.S. TSO, made upon request by IFHE-EU to its members, to obtain scientific contributions on selected issues, linked to its foundation documents. It aims to provide evidence-based support in the development of guidance and toolkits addressed to hospital management concerned with preparedness to climate change-related risks to hospitals and health facilities. The output expressed does not imply a position of S.I.A.I.S. TSO, which is also not responsible for the use that might be made of this documentation. The document is issued for limited, private circulation and internal use by members of IFHE-EU, S.I.A.I.S. TSO and its associated organisations. All images come from internet websites.

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## EXECUTIVE SUMMARY

This study examines the preparedness of European hospitals for risks associated with climate change. It acknowledges the increasing frequency and intensity of climate-related natural disasters (like floods, heatwaves, storms, even multiple events, such as fires developing from other climate events) and their devastating impact, which often exceed existing defence preparations, even in more aware, advanced countries.

The study highlights the fact that damage to Healthcare infrastructure often occurs precisely when these facilities are most needed.

### Key Issues & Scope:

- **Increased Risks:** Climate change poses both long-term health risks and immediate dangers from catastrophic events, threatening healthcare systems and infrastructures. Standard Hazard Vulnerability Analyses (HVA) and annually reviewed resilience plans are often outdated and inadequate.
- **Healthcare's Dual Role:** The healthcare sector is not only a victim of climate change but also a contributor, responsible for 4-5% of global carbon emissions. There's a need for the sector to reduce its carbon and ecological footprints.
- **Study Goals:** The research aims to:
  - Increase awareness among policymakers, healthcare providers, and climate crisis workers and the role of the healthcare sector.
  - Promote reductions in hospital carbon and ecological footprints through measures like circular economy practices and monitoring.
  - Encourage the supply chain and industry to adopt greener practices and renewable energy.
  - Reduce the vulnerability of healthcare infrastructure through enhanced preparedness, developing an evolution of HVA (Hazard Vulnerability Analyses) standard.

### Global & European Context:

- **International Efforts:** The study reviews progress in methods and tools for climate change adaptation and disaster risk reduction, referencing frameworks and initiatives by WHO, UNISDR, Canada, and the US [cite: 1, 81-110]. The WHO "Safe Hospitals Initiative" and the concept of climate-resilient health systems are noted.
- **EU Policies:** The European Green Deal's commitment to climate neutrality by 2050 explicitly includes the healthcare sector. Initiatives like Horizon Europe, EU4Health, the European Health Union, and HERA are part of the EU's response, although the specific focus on health facility resilience needs strengthening [cite: 2, 130-133, 138].

- **NHS Example:** The NHS in the UK is highlighted as the first healthcare system to commit to net-zero direct emissions by 2040, demonstrating leadership in assessing and reducing the sector's carbon footprint.

## Key Findings & Recommendations:

- **Europe's Vulnerability:** Europe is the fastest-warming continent, facing increased extreme heat, changing precipitation patterns, and severe flooding. Reports indicate a growing risk of damage to hospital infrastructure across Europe, particularly from flooding and coastal inundation.
- **Insufficient Assessment:** There's a lack of comprehensive analysis and assessment regarding the specific impacts of climate change on healthcare facility operations. Scientific literature and policy have historically given insufficient attention to the unique vulnerabilities and critical role of these infrastructures during climate-related disasters. Health professionals often feel unprepared or lack the time/resources to address these challenges adequately.
- **Advanced Preparedness Needed:** The study advocates for a different, more advanced approach to hospital preparedness, moving beyond traditional HVA. This involves:
  - An interdisciplinary team (engineers, facility managers, clinicians, operations experts) assessing vulnerabilities based on projected climate threats (heat, flooding, wind, seismic activity).
  - Quantifying potential disruptions and categorizing consequences (Major, Severe, Catastrophic).
  - Developing a comprehensive, prioritized plan to address vulnerabilities, considering costs and feasibility.
  - Implementing a long-term, constantly updated program to improve resilience, acknowledging that not all vulnerabilities may be addressed immediately. This approach helps in strategic planning, managing known risks, and evaluating facility obsolescence.

The research concludes by emphasizing the need for organizations like IFHE-EU and S.I.A.I.S. TSO to play a more significant role in raising awareness, developing metrics, and driving the necessary changes for enhanced hospital preparedness against climate change risks.

# 1. INTRODUCTION

## **1.1 Climate related natural disasters**

The proposal of the study of S.I.A.I.S. TSO for IFHE-EU encountered some redefinitions, which are an indicator of the needs for continuously considering new emerging important issues to be addressed with research and studies as a consequence of the rapid and intense changes that are going on in the globality of the planet and in its living conditions, including the Healthcare domain.

The pandemic, in its mutations, is basically still with us. The awareness of the need to be prepared for other similar events is present, at least among health professionals. In parallel, the natural disasters, that happen more frequently and with increasingly devastating impact, have brought about a better understanding of the multiple risks for the health care system and its major infrastructures, in connection to the overall problems generated by climate change.

In the first study for IFHE-EU, the goal of the S.I.A.I.S. TSO research was to address the challenge of the Health Systems in Europe in guaranteeing sustainable and resilient infrastructures.<sup>1</sup>

Climate change, in fact, with its environmental impact, is increasing long-term adverse risks to human health, requiring fresh attention on how care is delivered, but it also poses short-term risks of injuries and illness due to natural and frequently catastrophic events, often unanticipated, but even when their arrival is predicted, they tend to be more devastating than expected, surpassing the level of defence preparation, when it exists.

The overall result is that even in the most advanced countries, where norms and regulations are in place, and which healthcare authorities are required to adopt, the impacts are still dramatic, and the protecting actions prove insufficient to protect people, health infrastructures and environment. New threats to the communities and to the care infrastructures, come not only from the impact of one single event, but from a set of others associated and/or triggered by the main ones. Such situations are created, for example by floods, which frequently produce power outages, landslides, even fires, and other so-called natural calamities. Not to speak of hurricanes, tornados etc. that are complex phenomena in themselves, which become more dangerous, when combined with other destructive factors.

Furthermore, to underline the importance, that has “per sé”, the protection of the integrity of the Healthcare infrastructures, it should be considered that such damage would occur just when the fundamental Healthcare infrastructures, primarily the hospitals, would be required to perform at the highest level of their functionality.

Especially from 2021, many studies of prominent scholars and researchers have stressed the need of a deeper analysis of the risks facing hospitals. The “Hazard Vulnerability Analysis” that some hospitals started to perform every year for the past decade, in rare cases even longer, has been showing results that are no longer adequate. IFHE-EU has performed up to now its important role of participating, among others, to the activity “Engineering for a net zero future”, that produced a “Guide for Healthcare Estate<sup>2</sup>”. The study aims, among others, to support IFHE-EU in maintaining its relevant role and be a leader in the healthcare challenge against the climate change-related risks. It focuses, in fact, in delving deeper into the state of the art on these issues and contribute in defining

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<sup>1</sup> Daniela Pedrini, Simona Ganassi Agger “Sustainable and Climate Change Resilient Healthcare Facilities in Europe: The Challenge” S.I.A.I.S-Library - Technical Report n.1/2018

<sup>2</sup> IHEEM, IFHE, IFHE-EU, cef-NHS Countess of Chester Hospital-Hegma – “A Healthcare Engineering Roadmap for delivering net ZERO CARBON”



innovative vision, methods and tools for a better preparedness with regard to the risks related to climate change, what appears to be the biggest challenge of this period facing our planet.

The present study, more than 5 years after the first, aforementioned shows: i.) the need to update goals, strategy, methodology and tools to be up to the task of safeguarding and improving healthcare based infrastructures and of assuring the highest appropriateness of new healthcare facilities construction; ii) the necessity of recognising the importance of healthcare physical infrastructures for the prevention of injuries of hospitalised patients and of all staff of the hospitals to give care to the wounded, protect equipments, but, at the same time to be strategic bastions of support for the region and the social fabric against, as finally recognised, the primary enemy in the current geological era, defined as Anthropocene.

## **1.2 Concepts evolution and key definitions**

In recent times, the “planetary/global” approach has become prevalent, even in the domain of healthcare and its problems. A new discipline is beckoning “Planet health”.

In this regard, a December 2023 study published by the research institute XDI (Cross Dependency Initiative), focused on health infrastructures. The “2023 XDI Global Hospital Infrastructure Physical Climate Risk Report”, has global coverage with interesting data on the European Countries’ position with regard to risk exposure.

Earlier in the same year, the annual “The Lancet Countdown on Health and Climate Change” was stating: *“At the current 10-year mean, heating of 1.14°C above pre-industrial levels, climate change is increasingly impacting the health and survival of people worldwide”*.

As stressed in our research, comprehensive methodologies and tools designed to achieve the physical resilience of hospitals are still few. In fact, the state of play encountered in our present study shows changes disproportionate to the growth of climate-related health system problems.

To be more precise, studies on the dangers of climate change and its link to health were already well developed before the explosion of the Covid 19 pandemic.

The more recent studies have been focusing more on specific aspects related to “patients’ safety” in case of physically impacting events (e.g. storm and strong winds producing flooding of patients’ rooms). They certainly address important concerns, but in front of the multiplicity of events, what appears to be more and more needed is the complex of methodologies and tools guiding to comprehensive and systemic evaluations of possible/potential more vulnerable aspects of health care systems, such as hospitals, activating, more appropriate and effective actions of prevention.

The present situation has made this systemic approach extremely urgent.

The overall goal of this study is strengthening the awareness of the real problems, as already indicated in the study made by NHS and other health organisations, with IFHE-EU participation, published in 2021. To enhance and diffuse the comprehension of the hospital vulnerability, in this research, the **central focus is the preparedness of the hospital infrastructures for climate related risks, without, however losing sight of the previously identified basic goals.**

The first of them is the aim to “increase the awareness that the Healthcare sector is not only a victim, but it is a part of the problems, with its contribution to with its contribution to the causes of climate change and related negative aspects, such as air pollution”.

The preparedness through the analysis of the risk in order to increase the possibility of **mitigation of the negative impacts**, needs necessarily to include **the awareness that the Healthcare sector must reduce progressively its Carbon and its Ecological Footprints.**

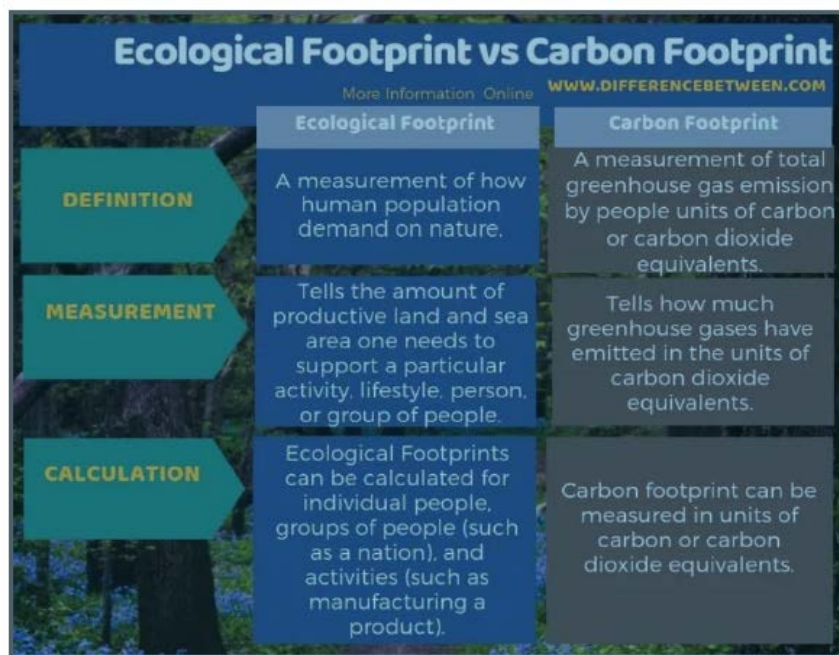
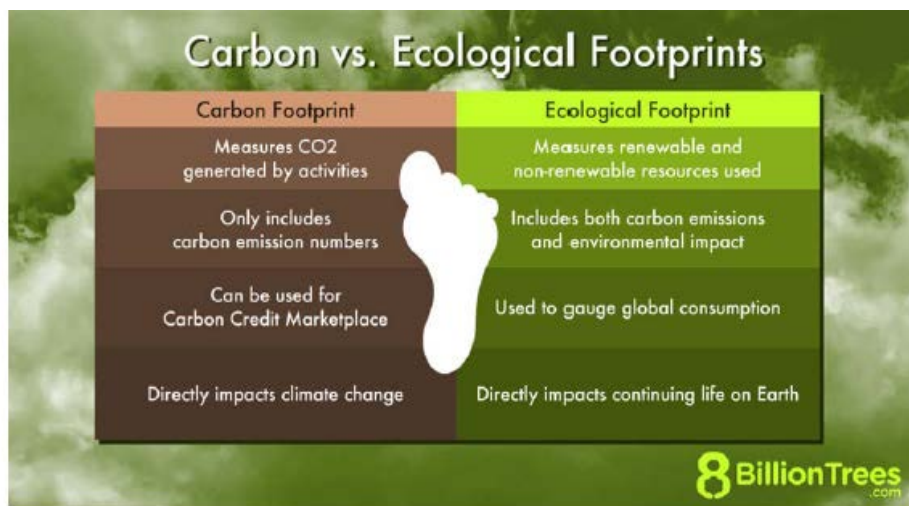
These are, in fact, two interrelated aspects, which work together for the indispensable result of achieving safer, more resilient and environmentally friendly Healthcare infrastructures.



Green hospitals or green Healthcare's infrastructures are concepts certainly implying to reduce and reach low levels of the two above indicated "footprints". In effect scientifically and in reality, there is a consistent difference between the two, that makes even more important having them proceed in high conjunction.

**"Carbon Footprint"** should correctly be defined as the complex of the GHGs, green House Gases", not only CO<sub>2</sub>, when **Ecological Footprint** measures how fast an hospital, or any other definable entity, consumes resources, that is what the hospital requires for operating, produced inside or imported (like energy or water) and generate waste and pollutants released into the air and water, compared to how fast nature can re-generate the resources consumed or absorb the waste, destroys the pollutant in a fixed period, in the area studied.

To be clearer we have borrowed two similar, but somewhat complementary, graphic presentations of the difference between the two footprints valid for any unit of evaluation, as it can be a single healthcare facility, as well as a larger health system, provided that the definition of the complex allows for metric values, i.e. each category is measurable.



The two figures come from <https://8billiontrees.com/carbon-offsets-credits/carbon-ecological-footprint-calculators/globally-green-environment/> (they are reported also in other web sites and youtube)

## 2. SCOPE OF THE STUDY

The introductory concepts have cleared the basic framework of the study and have established the scientific ground for better defining its large scope.

The more comprehensive goal is certainly to make the whole healthcare sector aware of the contribute that it has to give to the battle against climate change, which for hospitals means a strong, better to say stronger, commitment to “zero net hospitals”. A clearer appreciation of how the Health System is considered regarding its present situation and the need for improvement, comes from a recent official document of the European Union regarding this matter: “The healthcare sector is responsible for 4-5% of global total carbon emissions and generates significant demands for energy and materials, as well as production of dangerous waste streams that may cause air, soil and water pollution. At the same time, health and care provisions generally experiences less pressure to decarbonise and improve its circularity than other sectors of the economy. With the European Green Deal, the EU commits to reducing net greenhouse gas emission by at least 55% by 2030, and to reach zero net emissions by 2050<sup>3</sup>, and the **health and care systems are not exempt**. Research and innovation can support by ensuring a smooth transformation, while maintaining or improving quality of health and care services.”<sup>4</sup>

Such a statement appears certainly appropriate. In fact, it has to be recognised that, up to recently at least, healthcare authorities and organisations at all levels have shown insufficient attention to the connection between health and environmental problems climate change related and the needs for change, fortunately with some good exceptions, but up to now exceptions!

The scope of the study can therefore be summarised as follows:

### 2.1 Increase awareness

For the institutions already active, transforming it in consciousness of the large majority of policy makers, providers of healthcare, healthcare workers and, even more important, producing concrete actions to reduce the negative impact of the Healthcare systems, in a multidimensional way.

### 2.2 Reduce the hospital carbon footprints

Reduce the hospital carbon footprints (that is both carbon footprint and ecological footprint) generated by its own activities. This includes diffusing the knowledge and the application of circular economy, establish KPI and life cycles, control the outcomes through measurements, monitoring and reporting.

### 2.3 Stimulate the supply chain and industry to get green or greener

To increase renewable forms of energy and energy saving and to use renewable energy also for transportation in hospital's related activities. The knowledge is sufficiently acquired and diffused and experience that there are legal possibilities and instruments such as PCP and PPI, that can encourage and support the acquisition of environmentally friendly innovation both in products and in services. To this point, especially in consideration of all the climate related events, which have plagued several areas of the world, but having a particular eye in what keeps happening in Europe, the present

<sup>3</sup> Net zero is defined by several authorities and Entities. The UN, as an example, gives a simple definition and a larger analysis <https://www.un.org/en/climatechange/net-zero-coalition#:~:text=Put%20simply%2C%20net%20zero%20means,leaving%20zero%20in%20the%20atmosphere>.

<sup>4</sup> Horizon – Cluster 1 - Health – General Introduction

S.I.A.I.S. TSO study considers fundamental to expand the attention with “preparedness”, already mentioned specifically, to another fundamental aspect.

## **2.4 Reduce the vulnerability of healthcare infrastructures**

The climate related, frequently catastrophic, events are continuously changing and would require the control and update of methods and tools to explore and to approach in different ways the goals of “Mitigation” “Adaptation” “Resilience” and “Sustainability”, the most used words that were used in the past decade or more. Their common necessary bases is the analysis of the potential risks. The typical Hazard Vulnerability Analysis – HVA appear not to be sufficient any more, as the dramatic events have showed to us. This study therefore will extend its scope to examine the evolution that HVA should have for a more advanced preparedness of EU health facilities for climate change related risks. The whole research will touch the point of the poor attention given to the hospital care facilities (referred frequently with the acronym HCFs) and how IFHE – EU action should become more effective in changing this bilateral “negligence”. The large area of “metrics” is essential in improving preparedness, it is an area highly underdeveloped, as it was highlighted in the first S.I.A.I.S. Study (see footnote n.1), but this is also the area in which the members of these organisations have a large, not to say unique knowledge and experience, therefore they can give the highest operational as well as scientific contribution.

## **3. WORLDWIDE PROGRESS IN THE DEVELOPMENT OF METHODS AND TOOLS FOR CLIMATE CHANGE ADAPTATION AND DISASTER RISK REDUCTION**

### **3.1 General overview**

The first study S.I.A.I.S. TSO for IFHE-EU was concluded in 2018 and made public in 2019, and the researchers considered that it was opportune to give a continuity between the two studies.

The comparison is highlighting aspects of some interest that we will synthetically expose with some comments:

- Important studies were devoted around the first decade of the new millennium (2003-2008), that was marked by relevant disasters from floods to earthquakes and heatwaves.
- In particular, for it was important, the “2008-09 Disaster Reduction Campaign” started by the United Nations with the World Health Organisation, the World Bank and the ISDR (International Strategy for Disaster Reduction).
- In the framework of this campaign WHO produced a large documentation of specific interest for the organisations involved<sup>5</sup> since the direct objective of the documents were the hospitals. The first study was reporting part of this.
- WHO and PAHO the Pan American Health Organisation, produced the second edition of the Hospital Safety Index Guide for Evaluators of which it is worth to underline this passage:  
*“Many hospitals are built without taking the occurrence of hazards into account. In addition, when maintenance is neglected, systems that are critical for the functioning of the hospital deteriorate over time. However, the vulnerability of health facilities can be reversed through sustained political and financial support, as has been shown in a variety of projects in many countries. In*

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<sup>5</sup> <https://www.unisdr.org/2009/campaign/pdf/wdrc-2008-2009-information-kit.pdf>;  
<https://www.who.int/activities/making-health-facilities-safe-in-emergencies-and-disasters>

*designing new safe hospitals or taking measures to improve the safety of existing hospitals, there are four objectives: I) enable hospitals to continue to function and provide appropriate and sustained levels of Healthcare during and following emergencies and disasters; II) protect health workers, patients and families; III) protect the physical integrity of hospital buildings, equipment and critical hospital systems; and IV) make hospitals safe and resilient to future risks, including climate change. The aim of Safe Hospitals programs is to ensure that health facilities will not only remain standing in case of emergencies and disasters, but that they will function effectively and without interruption. Emergencies and disasters require an increase in treatment capacity, and the hospital must be ready for optimal use of its existing resources. The hospital must also ensure that trained personnel are available to provide high quality, compassionate and equitable treatment for casualties and survivors of emergencies, disasters and other crises.”<sup>6</sup>*

Another document that proves the relevance of this period has been the **Sendai Framework for Disaster Risk Reduction – 2015-2030**, still a point of reference<sup>7</sup>. In the activity of this period the risks of disasters were approached in a general way and the physical impacts of events were considered with the same approach that epidemics, one of the most relevant of which was the Ebola epidemics. It is mentioned here, as historic point of reference, the Kyoto protocol, the first international agreement that stated precise engagements of industrialised countries to reduce emissions of Green House Gases (GHGs), responsible of the warming up of the planet. It needs to be underlined that it was adopted in Kyoto, Japan the 11<sup>th</sup> December of 1997, it came into force the 16<sup>th</sup> February of 2005.

The time passed between its formulation and its coming into force, can possibly also give a reason why the relationship between climate change and disasters was slow to emerge, as well as the effects of climate change on human and environmental health and formulation of the principle “One Health”. All this studies production was crucial, however for the success of the COP 21 of Paris, that still constitute, despite of “waves of negationists”, the most important event to promote understanding and coordinated action for the limitation of global warming and fight climate change.

The “Paris Agreement”<sup>8</sup> was and remains a **legally binding international treaty on climate change**. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016.

Back to our main subject of Healthcare facilities and climate change.

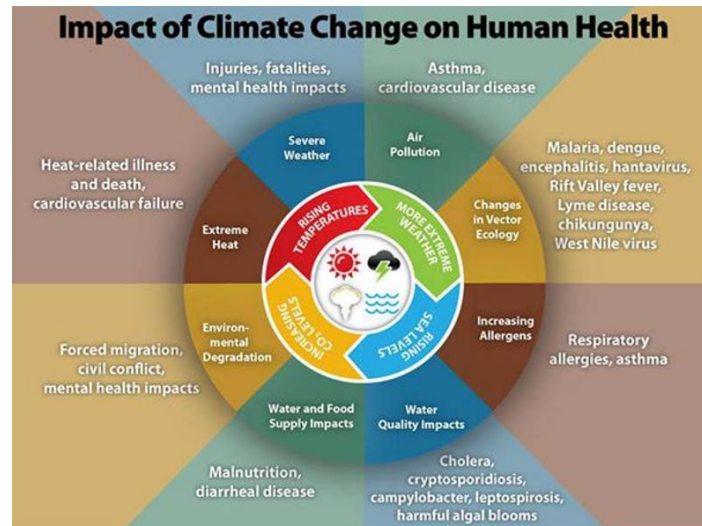
In the study S.I.A.I.S. TSO for IFHE-EU 2018/2019, it was in detail reported the “state of the art” of the scientific and official production of methodologies, guides, tools on the issues related to the reduction of the anthropologic causes of climate change and, in parallel, the effects of the latter on human health and environment conditions. The report highlighted the importance of understanding of the effects of climate change on human health in a large variety of aspects and stressed the progress in arrive to the necessary complete vision, well visualited by the following chart on November 2016.

<sup>6</sup>[https://iris.paho.org/bitstream/handle/10665.2/51448/9789275120293\\_eng.pdf?sequence=1&isAllowed=y](https://iris.paho.org/bitstream/handle/10665.2/51448/9789275120293_eng.pdf?sequence=1&isAllowed=y);

<sup>7</sup>[https://www.preventionweb.net/files/43291\\_sendaiframeworkfordren.pdf](https://www.preventionweb.net/files/43291_sendaiframeworkfordren.pdf);

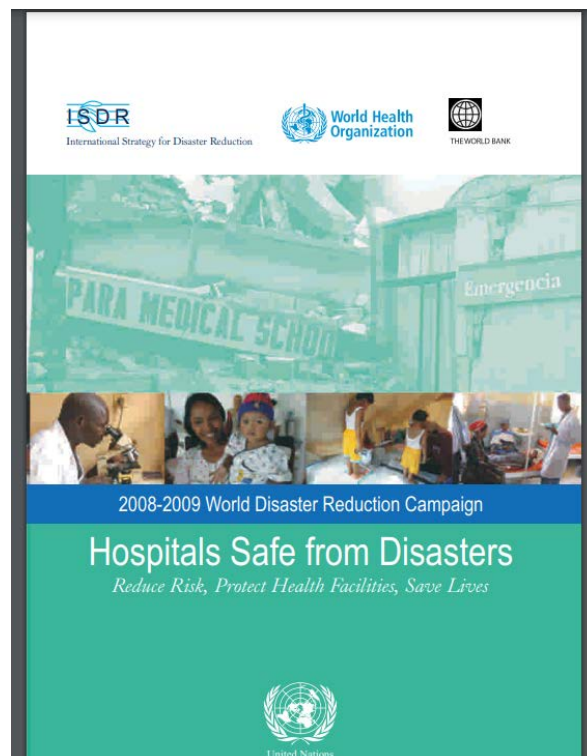
<sup>8</sup><https://unfccc.int/process-and-meetings/the-paris-agreement>;





Source: USA [Centers for Disease Control and Prevention](http://www.cdc.gov)  
 Page/s that contain this image: [Health](#) Last modified: 16 November 2016

“In the framework of the “2008-09 Disaster Reduction Campaign”, the United Nations with WHO, the World Bank and the International Strategy for Disaster Reduction (ISDR), launched a campaign called “**Hospitals Safe from Disasters**”<sup>9</sup> stimulated by disasters directly impacting on hospitals, like the ones produced by Katrina Hurricane in 2005 with the devastation of a major hospital in New Orleans (Louisiana-US).



Fontpage of the publication  
 Hospitals Safe from Disasters 2008-2009 World Disaster Reduction Campaign [www.unisdr.org/wdrc-2008-2009](http://www.unisdr.org/wdrc-2008-2009)  
[www.who.int/hac/techguidance/safehospitals](http://www.who.int/hac/techguidance/safehospitals)

<sup>9</sup> <http://www.unisdr.org/2009/campaign/pdf/wdrc-2008-2009-information-kit.pdf>

It is worth to recall the attention also to the key message from Message from Mr Sálvano Briceño Director, International Strategy for Disaster Reduction:

*A safety net for everyone, at all times*

*“When disasters strike, aid agencies, communities, the media, and governments focus immediately on the victims. But if our focus on victims is to have real meaning, we must prioritize a deeper understanding and support of medical care. Those who are injured need urgent medical attention, but those who escape injury have not escaped the long-term need for medical care and public health after the disaster is forgotten. When health services and hospitals fail due to disaster, people die and suffer needlessly both during the disaster and long into the future. Health sector damage can cause devastating secondary disasters. For example, the December 2004 Indian Ocean tsunami disaster affected entire national Healthcare systems and millions of beneficiaries, particularly the poor, at an untold cost. It damaged 61% of health facilities in northern Aceh province, and killed approximately 7% of its health workers and 30% of its midwives. As a consequence, Aceh’s primary care, maternal health and neonatal care was sent into a crisis, and public health system recovery has required intensive investment. From a human perspective, all disasters are a health issue, and damage to health systems affects every part of society and nations as a whole. As such, everyone should be made aware of the importance of the issue and be committed to helping ensure that hospitals and health facilities are resistant to natural hazards. Awareness and commitment are the major ingredients: awareness and commitment from both policy/decision makers and the public at large. The difference in expense between building a safe and an unsafe hospital can be negligible. But that tiny investment can be the difference between life and death, or between a community’s impoverishment and its sustainable development. Because of this, the secretariat of the International Strategy for Disaster Reduction (UN/ISDR) and the World Health Organization (WHO), with some support from the World Bank, are dedicating the 2008-2009 World Disaster Reduction Campaign to ‘Hospitals Safe from Disasters.’ As in the education sector, as in the education sector, UNICEF’s role in the health sector will also be very important in this Campaign. The Campaign’s objectives are to effect change that helps to: (1) protect the lives of patients and health workers by ensuring the structural resilience of health facilities; (2) make sure health facilities and health services are able to function in the aftermath of emergencies and disasters - when they are most needed; (3) improve the risk reduction capacity of health workers and institutions, including emergency management. As disaster risk reduction is everyone’s business, and unsafe hospitals are potentially damaging to everyone, I would like to call on all members of our global community – decision makers, decision implementers and the public at large – to join the Campaign.”*

The Director message was supported by an equally strong declaration:

*“Message from Dr Ala Alwan Assistant Director General, Health Action in Crises World Health Organization”*

*Don’t let hospitals become a casualty of disasters*

*As news of a disaster or emergency reaches the global community, our thoughts turn immediately to the human consequences; and at the forefront are concerns for the health and wellbeing of the disaster-stricken population. For decades, the World Health Organization has worked to save lives and reduce suffering in times of crises. One way in which this is accomplished is by strengthening the capacity and resilience of health facilities, health systems and countries to mitigate and manage disasters. For this reason, I am pleased that WHO is partnering with the secretariat of the International Strategy for Disaster Reduction (UN/ISDR) on the 2008-2009 World Disaster Reduction Campaign on Hospitals Safe from Disasters. The message of this Campaign is clear: **when hospitals, health facilities or health systems fail in disaster and emergency situations, whether for***



***structural or functional reasons, the result is the same: they are not available to treat the victims at precisely the moment they are most needed.”***

It seems appropriate to report at length these messages, because, after just about 15 years, they still represent one of the clearest and most relevant recognition of the importance of the healthcare systems physical infrastructures, to be even more appreciated, because not too frequent.

The study has, in fact covered the last period and the part that follows will try to highlight the achievements and also the still missing parts for a real understanding of the role/the place that should be given to health infrastructures in the context of the protection of health from the impact of climate change. Let's see the progress made, what still needs to be done and how, especially organisations like IFHE-EU and S.I.A.I.S. TSO could perform a great role achieving the adequate preparedness.

Connecting again with the first study, the attention goes to the countries, authorities and organisations that had shown to have the major awareness of the importance to be prepared in protecting the health systems to the impact of climate change.

### **3.2. WHO and UNISDR - United Nations Office for Disaster Risk Reduction**

In the first study of S.I.A.I.S. TSO it was reported and stressed the relevant role of the World Health Organisation – WHO. It has to be recognised, in fact, that it was basically the first among the high public international Authority, addressing the issues related to the need of hospitals safety for many years in the framework of the programme “Safe hospitals Initiative”.

The “Comprehensive SAFE HOSPITAL FRAMEWORK” in the context of the work for a safer and healthier society stresses that it is necessary to “*take into account the critical role that different types of health facilities play in ensuring a safer health system*”<sup>10</sup>. The major contribution is the “Hospital Safety Index – Guide for Evaluators” published originally in 2008 by WHO and PAHO, the Pan American Health Organisation. It has been reported about it above. It was followed by a second important contribution, published in 2015, which goals and objectives were clearly expressed as: “*to provide guidance for health systems and public health programming to increase their capacity for protecting health in an unstable and changing climate*”.

In this work, as reported, there was the important introduction of the **concept of resilience**, that it is worth to recall:

*“In the simplest terms, resilience refers to the holistic ability and agility of a system to change and flex – according to circumstances – and continue to function under stress, while undergoing change. Resilience is much more than just the absence of vulnerability; it is about whole system capacity. With regard to health, resilience relates to the capacity of the system itself to cope with and manage health risks in a way that the essential functions, identity and structure of health systems are maintained. While health adaptation seeks to moderate harm or exploit beneficial opportunities, the preservation of a certain level of quality and sustainable performance of the system itself is not ensured. The incorporation of a climate-resilient approach to health systems contributes to assuring the performance of the system, and therefore, the sustainability and maximization of value for money of health investments.*

*However, it is important to remember that maintaining system resilience may not always be possible. The magnitude of climate-induced changes or shocks may be so significant that it is outside human abilities to maintain its essential functions, and thus the system may collapse or fail.”*<sup>11</sup>

<sup>10</sup> [http://www.who.int/hac/techguidance/comprehensive\\_safe\\_hospital\\_framework.pdf](http://www.who.int/hac/techguidance/comprehensive_safe_hospital_framework.pdf)

<sup>11</sup> <https://www.who.int/publications/i/item/operational-framework-for-building-climate-resilient-health-systems>;

WHO in the same year 2015 published the most important study in what concerns the matters of our priority interest. In the framework of “Safe Hospitals Initiative” WHO published “Hospital Safety Index - guide for evaluators.”

### Operational framework for building climate resilient health systems

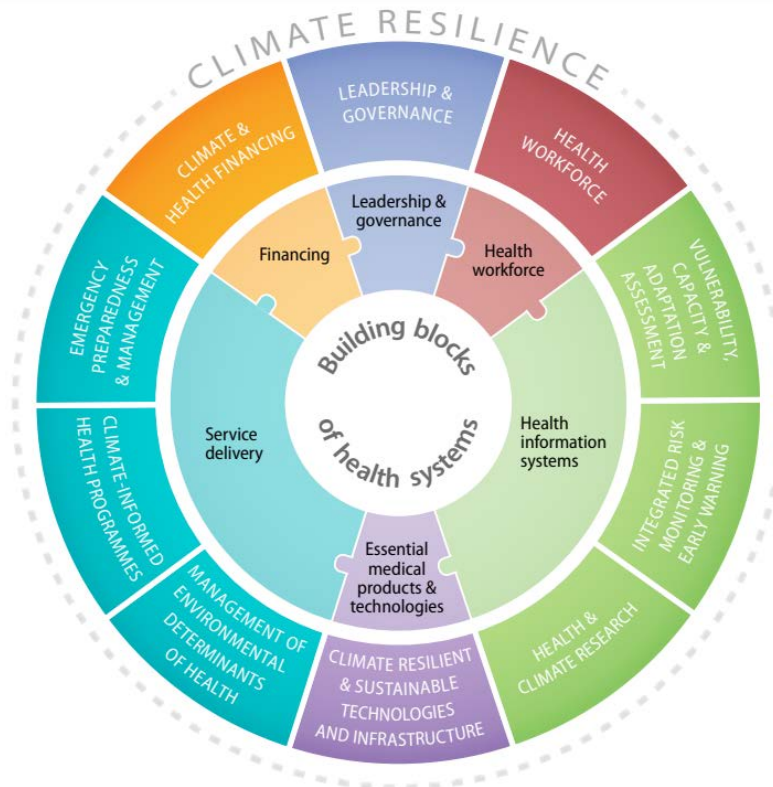


Figure 3 - page18: Ten components comprising the WHO operational framework for building climate resilient health systems, and the main connections to the building blocks of Health Systems

### 3.3 The Canadian Coalition for Green Health Care

Starting about 20 years ago as “Canadian Coalition on Climate Change and Development (C4D)” aimed to be an alliance of international development and environmental organizations, consultants, and think-tanks working together to share knowledge and take concerted action to address climate change, one part of which was devoted to work especially in the domain of healthcare.

Building on the experience of some of its Provinces, like the “Health Care Facility Climate Change Resiliency Checklist” produced in 2013 by the Province of Nova Scotia<sup>12</sup> the Coalition has produced “The Health Care Facility Climate Change Resiliency Toolkit”<sup>13</sup> offering collaboration to the Healthcare infrastructures to assess their level of Resilience. At this regard it is interesting to underline the framework of collaboration with participating hospitals, based also in online communication. It has been put in place a project called “The Green Hospital Scorecard (GHS)”, that it is indicated as “the only comprehensive **health care environmental performance benchmarking tool** in Canada measuring energy conservation, water conservation, waste management and recycling, corporate commitment and pollution prevention. Participating hospitals report on their environmental and sustainability initiatives through a questionnaire and receive a Green Hospital

<sup>12</sup> <https://greenhealthcare.ca/wp-content/uploads/2020/07/1-CCGHC-HealthcareFacilityResiliencyChecklist.pdf>;

<sup>13</sup> <https://greenhealthcare.ca/climatechange/climate-change-resiliency-toolkit/>;

*Scorecard summarizing their year-over-year environmental performance relative to their peers.”<sup>14</sup>*

The Canadian Coalition has the collaboration of several universities.

The Canadian Government has created a programme: “The Climate Change and Health Capacity Building Program”, that supports the objectives of Canada's [National Adaptation Strategy](#) and the [Government of Canada Adaptation Action Plan \(GOCAAP\)](#). *“The expanded Climate Change and Health Capacity Building Program aims to advance knowledge, capacity and innovation in adapting to the health risks associated with climate change. The program is divided into 2 streams:*

- *Stream 1 HealthADAPT: Building climate-resilient and low-carbon health systems,*
- *Stream 2 HeatADAPT: Protecting the health of people in Canada from extreme heat”*
- Among the priorities of Stream 1 one subject is:
  - Health sector guidance, training and network building:
    - This priority focusses on creating and delivering training and education programs for the health sector. These programs will support planning and deployment of professional and human resource capacity for building climate resilient and low carbon health systems.

The Institute for Public Administration of Canada – IPAC provides support for healthcare facility design and resources.<sup>15</sup>

### **3.4. The US advancement**

In the previous research it was underlined that relevant documents concerning climate change were made by public Institutions more exposed to atmospheric events. In fact, the first general toolkit was produced by the National Oceanic Atmospheric Administration, the “U.S. Climate Resilient Toolkit”. It was general, not specifically oriented to health facilities, but has a general methodological value, that we had summed this way: “Individual, businesses and communities all face challenges related to our changing climate. The steps to Resilience can help you to identify your vulnerabilities and select actions to address them.”

Compared to the previous more general focus, the US government has issued studies directly related to health and health care organisation. Among them, the most relevant is the specific U.S. Climate Resilient Toolkit, that follows this approach:<sup>16</sup>

*“Health care organizations play a key role in community resilience. Climate change, by increasing the intensity and frequency of some extreme weather events, is creating complex hazards that challenge accepted baseline assumptions for infrastructure capabilities, redundancies, and disaster preparedness and response — and this means a need for new building design thresholds.*

*Essential health services must remain available to communities and individuals during and immediately following extreme weather events, even during extended utility outages and transportation infrastructure disturbances. Resilient health care organizations must anticipate extreme weather risks and transcend limitations of regional public policy, local development vulnerabilities, and community infrastructure challenges as they site, construct, and retrofit health care facilities. To assist with building resilience, the Department of Health and Human Services (HHS) has developed the Sustainable and Climate Resilient Health Care Facilities Toolkit. Developed through a public-private partnership with the health care industry, the Toolkit consists of an [overview guide document](#) and a suite of online tools and resources that highlight emerging best practices for developing sustainable and climate-resilient health care facilities. The guide provides*

<sup>14</sup> <https://greenhealthcare.ca/ghs/>

<sup>15</sup> <https://ipac-canada.org/healthcare-facility-design-resources>

<sup>16</sup> <https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector>

*a compilation of information on threats to health care facilities posed by extreme weather events and ways in which organizations around the country are responding to those threats.”*

There are interesting points in this approach, among others the mention of the creation of a public-private partnership with the healthcare industry.

Framework for Resilient Healthcare Settings is illustrated as follows:

|   |   |
|---|---|
| 1 | <p><a href="#"><u>Climate Risks and Community Vulnerability Assessment</u></a></p> <p><i>Maintain up-to-date data on climate hazards and community climate and health vulnerabilities, and use hazard vulnerability analyses to inform health services and infrastructure planning today and for the future. Understand the role of the hospital, long term care and ambulatory settings within the community during and after identified extreme weather events, and use this knowledge to inform resilience strategies.</i></p>   |
| 2 | <p><a href="#"><u>Land Use, Building Design, and Regulatory Context</u></a></p> <p><i>Understand and catalogue the land use, building design and regulatory context within which current healthcare facilities are situated. Are site improvements and existing building structures adequate to withstand extreme weather events now and in the future? What were the design assumptions for roads, stormwater quantities, building envelopes and structures, roof drainage systems? Consider the larger local and community land use vulnerabilities that may impact healthcare facilities in the face of extreme weather—aging or inadequately sized infrastructure or removal of natural buffers.</i></p>  |
| 3 | <p><a href="#"><u>Infrastructure Protection and Resilience Planning</u></a></p> <p><i>Construct critical healthcare facilities with sustainable communications, energy, water and waste infrastructure in appropriate locations to a standard of climate resilience to withstand events over the anticipated life of the structure. Infrastructure resilience measures reduced disruption, incapacitation or loss of use of critical healthcare facilities. For less critical facilities: design for safe closure prior to an event with the ability to resume services within 48 to 96 hours following a major event.</i></p>  |
| 4 | <p><a href="#"><u>Essential Clinical Care Service Delivery Planning</u></a></p> <p><i>Ensure that essential clinical care services remain operational during and immediately following extreme weather events. Often, hospitals must both shelter inpatients in place as well as handle patient care surges related to the weather event. Emergency departments, urgent care centres, laboratory and imaging services must remain operational. Nursing homes and residential care facilities house medically fragile, vulnerable populations. Research facilities house irreplaceable samples and data. In addition, healthcare settings may serve important non-traditional disaster response roles in their communities: sources for clean water, food, and shelter for a larger affected population.</i></p> |
| 5 | <p><a href="#"><u>Environmental Protection and Ecosystem Adaptations</u></a></p> <p><i>Protect and support ecosystems and natural buffers to mitigate extreme weather hazards that may threaten your building or campus. Green infrastructure practices, heat island mitigation</i></p>   |

|   |
|---|
| <p><i>and enhanced stormwater management are key contributory strategies. Understand that ecosystems, wildlife corridors, and natural hydrology patterns extend beyond individual property boundaries; engage the broader community in applying best design practices for adapting to extreme weather risks in order to mitigate future damages to property and people.</i></p> |
|---|

#### Checklists for Sustainable and Climate-Resilient Facilities

This Toolkit contains a set of introductory checklists for each of the five elements of climate resilience. These checklists can assist healthcare organizations in assessing climate-related infrastructure and care-delivery vulnerabilities at both a system and facility level. These checklists are available both as a single document here (see links below) or individually at the end of each element section.

Who should participate in completing the checklists? Resilience requires a multi-disciplinary approach. At a minimum, representatives from Facilities, Security, Engineering, Sustainability, Environmental Services, Nursing (Clinical Care), Supply Chain, and Emergency Planning might all participate in the exercise. In addition to internal staff review, community partners and government relations may need to be included to provide broader community and regional context during the exercise.”

The Department of Health and Human Services - HHS with the document “Sustainable and Climate Resilient Health Care Facility Initiative”<sup>17</sup> provides a relevant synthesis, making reference also to other international contributes, as the previously mentioned Canadian one.

### **3.5 In the European area: the NHS contribution**

In may 2022 the UK Government published a document “**Climate and health: applying All Our Health Guidance**” that was important in its comprehensive attention to the correlation between life and climate and furthermore to the impact of climate change on human and environment health. The Healthcare sector and hospitals in their functions, however, were pointed out as producing negative effects of climate change and considered as part of the problem, suggesting to ways and methods to reduce their footprint. It is, therefore, not surprising that it was underlined that “within the health and care sector, the NHS in England became, the first Healthcare system in the world to commit to reduce the carbon emissions it can directly influence (for example, the amount of electricity used by hospitals) to net zero by 2040.”<sup>18</sup> Naturally this is important and valuable and goes in the direction of a deep study, published in The Lancet in February 2021 “Health care’ response to Climate change: a carbon footprint assessment of the NHS in England.”<sup>19</sup> The authors were among the first in analysing and graphically representing the green house emissions by sectors, that become well know and bases for important considerations and further re-interpretation’s analysis.

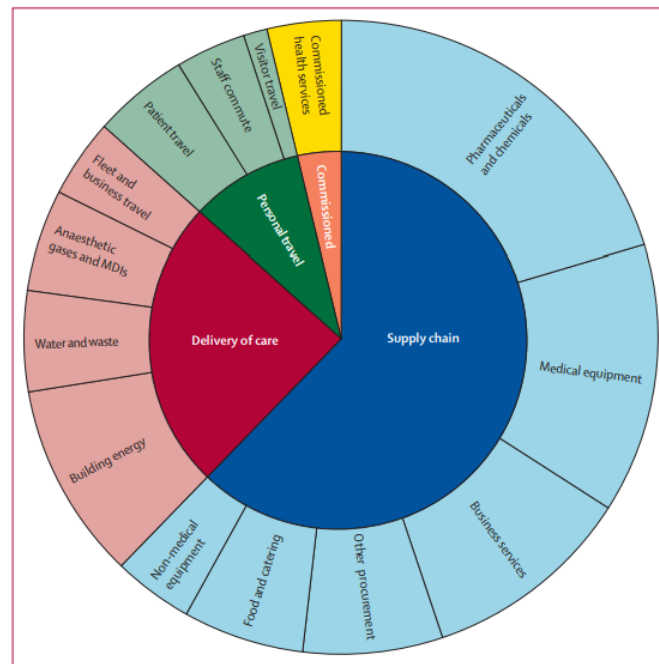
<sup>17</sup><https://toolkit.climate.gov/sites/default/files/SCRHCFI%20Resource%20Sheet%20Composite%20082615.pdf>

<sup>18</sup><https://www.gov.uk/government/publications/climate-change-applying-all-our-health/climate-and-health-applying-all-our-health#:~:text=Within%20the%20health%20and%20care,to%20net%20zero%20by%202040.>

<sup>19</sup>[https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196\(20\)30271-0.pdf](https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196(20)30271-0.pdf)

By: Imogen Tennison, Sonia Roschnik et al: “Health care’s response to Climate Change: a carbon footprint assessment of the NHS in England”





**Figure 4: Contribution of different sectors to the greenhouse gas emissions of the NHS England, 2019**  
Data available in appendix 1 (p 39). MDI=metered dose inhaler. NHS=National Health Service.

The above is the figure as reported from the mentioned article.

Regarding the contribution of NHS to mitigate the climate change's impact on the health systems, this article confirms the great relevance of the contribution not only of NHS, but also of regions like Scotland, the first in advancing tools for energy saving for hospitals and also for promoting renewable energy for health facilities and just one year ago banning desflurane, sevoflurane and similar highly dangerous anaesthetic gases.

Also, some Trusts showed great understanding for the impact of climate change on health and produced remarkable plans of action. One is the **Newcastle upon Tyne Hospitals NHS Foundation Trust**. *"The Climate Emergency is recognised as the single greatest threat to global health. In June 2019, Newcastle Hospitals became the first Healthcare organisation in the world to declare a Climate Emergency. This is our recognition that a climate emergency is a health emergency and a commitment to becoming a net-zero carbon organisation by 2040"*. The website presents also the biennial publication called "SHINE" that reports the work done for sustainability. Two aspects of the approach are especially remarkable: the joint effort for carbon neutrality by 2040 has been approached *"By joining forces with Newcastle City Council and Newcastle University we have created a civic partnership resulting in Newcastle upon Tyne being the first city in the UK to have all three anchor institutions declare a climate emergency and commit to achieving carbon neutrality by 2040."*<sup>20</sup> Regarding specifically the health institutions the systemic approach included also the built structures, improving the existing ones and realising two new building with such environmental quality to be *"both on track to achieve BREEAM<sup>21</sup> 'outstanding' and Net Zero"*.

<sup>20</sup><https://northeastnorthcumbria.nhs.uk/our-work/wider-impact/sustainable-healthcare/the-newcastle-upon-tyne-hospitals-nhs-foundation-trust/>

<sup>21</sup><https://breeam.com/> Since 1990, BREEAM's third-party certified standards have helped improve asset performance at every stage, from design through construction, through use and refurbishment.



## 4. EUROPEAN GREEN DEAL AND HEALTH POLICES TO FIGHT CLIMATE CHANGE

### 4.1. The Green Deal for EU sustainability and climate neutral

*“In November 2019, the EU Parliament declared a climate emergency asking the European Commission to adapt all its proposals in line with a 1.5°C target for limiting global warming and ensure that greenhouse gas emissions are significantly reduced. In response, the Commission unveiled the [European Green Deal](#), a roadmap for Europe becoming a climate-neutral continent by 2050.”<sup>22</sup>*

Published: 07-08-2018 and last updated 27-06-2024 it will be re-proposed to the newly elected Parliament for discussion and final approval with possible additions or changes.

The main areas to address were indicate in:

- [Mitigating global warming: a matter of 2°C increase](#)
- [The European Green Deal: achieving zero net emissions by 2050](#)
- [Cutting greenhouse gas emissions with EU climate policies](#)
- [Boosting renewable energies and energy efficiency](#)
- [Creating a sustainable and circular economy by 2050](#)
- [Fighting climate change with biodiversity preservation and nature restoration](#)

For the EU to reach the 2030 target, the EU approved a package of new and revised in 2023 legislation known as [Fit for 55](#), comprising 13 interlinked revised laws and six laws on climate and energy.

### 4.2 The scientific development in the Agenda 2021-2027: Horizon Europe

It is important for the activities involving the members of IFHE-EU as well of S.I.A.I.S. TSO to keep in the panorama of this study the programme Horizon Europe of the EU Agenda 2021-2027 in the middle of its implementation.

Horizon Europe, as it is largely known, is the European Union's largest and more ambitious, research and innovation programme. It will run until 2027 with rolling ‘calls for proposals. It is the successor to Horizon 2020 and it has received a budget of over € 95 billion. The success rate of the EU applications is stated as being twice the usual market percentage. Its main features are:

- strengthening science and technology in the European Union through increased investments in highly skilled people and cutting-edge research,
- promoting the EU’s industrial competitiveness and its innovation performance,
- achieving the EU’s strategic priorities, such as the Paris Climate Agreement, and addressing global challenges that affect the quality of our daily lives.

Horizon Europe programme has three pillars:

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Millions of buildings around the world are registered to BREEAM’s holistic approach to achieve environmental and social governance (ESG), health, and net zero goals.

<sup>22</sup><https://www.europarl.europa.eu/topics/en/article/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu#:~:text=Parliament%20adopted%20the%20EU%20Climate,global%20fight%20against%20climate%20change.>

### **Pillar 1 - Excellent Science**

- Supports frontier research projects that researchers themselves define and direct through the European Research Council (ERC). In addition, this pillar funds fellowships and exchanges for researchers through Marie Skłodowska-Curie Actions (MSCA) and invests in research infrastructures.

### **Pillar 2 - Global Challenges and European Industrial Competitiveness**

- It directly supports research related to societal challenges. The European Commission has formulated these into six clusters:
  - Health,
  - Culture, Creativity and Inclusive Society,
  - Civil Security for Society,
  - Digital, Industry and Space,
  - Climate, Energy and Mobility,
  - Food, Bio-economy, Natural Resources, Agriculture and Environment.

### **Pillar 3 - Innovative Europe**

- It aims, through the European Innovation Council (EIC), to make Europe a leader in market-creating innovation.

The three “pillars” are defined in operational terms, in “clusters” dealing with specific areas and policies.

The Horizon Europe ‘Health’ Cluster requires research and innovation that were important in supporting recovery of people and communities from Covid-19. In addition, the Health cluster aims to develop resilience and preparedness in EU national health systems ahead of any future public health emergencies.

The last European Commission in charge expressed strong commitment for building a “European Health Union”, for stimulating greater synergy in future public health responses across the EU answer to the ongoing pandemic. The new Commission, that has come out from the elections of June 2024 has stated its support for the continuation of this policy approach.

From Horizon Europe’s strategic plan 2021-2024, these two Key Strategic Orientations (KSOs) are addressed in the ‘Health’ cluster: (KSO-D) creating a more resilient, inclusive and democratic European society, and (KSO-A) promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains.

‘Health’ contributes to four impact areas of the strategic plan:

- Good health and high-quality accessible care;
- A resilient EU prepared for emerging threats;
- High quality digital services for all;
- A competitive and secure data-economy.”<sup>23</sup>

The calls for projects of the Cluster Health were intending to have a specific impact in “six destinations” two of them with high possibility to be more of specific interest for S.I.A.I.S. TSO / IFHE-EU members including call focused on physical aspects of health and healthcare:

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<sup>23</sup><https://www.catalyze-group.com/fund/horizon-europe/cluster-1-health/>

- Destination 1: Staying healthy in a rapidly changing society

Focused, particularly on healthier environments, improved evidence-based health policies, and more effective solutions for health promotion and disease prevention.

- Destination 2: living and working in a health-promoting environment, related to better environmental, occupational, social and economic determinants of health.

In addition to Horizon, the other relevant programme of the European Council, that recognises the “role” of health is related to the “Recovery and Resilience Plans” financed through the Recovery and Resilience Facility (RRF), a temporary instrument, centrepiece of Next Generation EU. The fundamental goal of this EU's plan is to emerge stronger and more resilient from the current crisis. The RRF sets the rules for each Country that has being granted RRFs funds, that each intervention has to respond to the principle of producing “no harm to health”. The National Plans, called NRRP, National Recovery and Resilience Plan (NRRP) is part of the Next Generation EU (NGEU) programme, the EUR 750 billion package agreed by the European Union in response to the pandemic crisis. How those plans have been shaped it cannot be analysed in this report. First global information to eventually pursue the matter can be found in a specific website of the EU Commission that gives a synthetic picture nation by nation, from which it doesn't emerge, however, the role given to the system health in each EU nation.<sup>24</sup>

### **4.3 Development of EU policies from the pandemic's lessons to the increasing pressure of change and Health**

Covid-19 has produced a set of basic changes in EU policies concerning health, some direct, stimulating more attention and stressing the need for more funding for the healthcare sector, others indirect, addressing the health sectors in a larger context, in terms of economic and social aspects, as well as in its whole dimension. As overall initiative that was launched as a new road in the policies of the Union was the aim to reach what was labelled “European Health Union”.<sup>25</sup>

Before entering in the analysis of one of the most important of its tools, concerning the matter of this study, the authority called HERA, it is important to mention one of the relevant and direct action for the Healthcare sector focused to intervene as a response to the Covid-19 pandemic: the EU4Health Programme, that was adopted to address the crisis preparedness in the EU.

#### **• EU4Health Programme**

The pandemic highlighted the fragility of national health systems. The EU4Health programme was aimed to bring a contribution to the long-term health challenges by building stronger, more resilient and more accessible health systems.<sup>26</sup>

*“EU4Health is the EU's response to COVID-19's impact on medical and Healthcare staff, patients and health systems in Europe. The new programme will go beyond crisis response to pave the way for a stronger, healthier and more resilient Health Union. EU4Health is the largest health programme ever and will invest over €5 billion over seven years (2021-2027) to improve health in the Union.*

*The programme aims to*

- *improve and foster health in the Union,*
- *protect people in the Union from serious cross-border threats to health,*
- *improve medicinal products, medical devices and crisis-relevant products,*

<sup>24</sup> [https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages\\_en](https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages_en);

<sup>25</sup> [https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union\\_en](https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union_en);

<sup>26</sup> [https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/eu4health\\_en](https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/eu4health_en);

- *strengthen health systems”.*

Health is an investment and, with a total of €5.3 billion budget during the 2021-27 period, has been an unparalleled EU financial support in the health area. It was intended, in fact, by the EU Commission to be a clear message that public health is a priority for the EU and it is one of the main instruments to pave the way “to better meet the needs of people in Europe”.<sup>27</sup> Compared to the approach of the previous EU Healthcare programmes, this new view showed a positive change, which is complemented by another important steps highlighted in the Horizon Europe programme of the EU agenda 2021-2027, as reported in the previous paragraph with the “Cluster 1 Health”.

### • **The European Health Union**

The coronavirus pandemic gave additional stress to the importance of coordination in the health domain among European countries. The cross-border EU’s health threats and the parallel the law preparedness and management of different health care systems, induced the EU Commission in November 2020 to present a series of proposals aimed to centralise at EU levels relevant operations of directions and control, strengthening and improving operative capacity of some Agencies *“The European Centre for Disease Control and Prevention and the European Medicines Agency have been at the forefront of the EU’s work to address COVID-19 since the outbreak of the pandemic. However, COVID-19 has shown that both agencies need to be reinforced and equipped with stronger mandates to better protect EU citizens and address cross border health threats.”*

The European Commission started the building of the idea of a strong European Health Union, in which all EU countries prepare and respond together to health crises, medical supplies are available, affordable and innovative, and countries work together to improve prevention, treatment and aftercare for diseases such as cancer.

The European Health Union was conceived as an indispensable way of:

- better protecting the health of our citizens,
- equipping the EU and its Member States to better prevent and address future pandemics,
- improving the resilience of Europe’s health systems.

In parallel, with the shaping of the “European Health Union” EHU<sup>28</sup> the other relevant step for dealing with a more efficient Healthcare delivery was taken in 2021 with the creation by the European Commission of the “Health Emergency Preparedness and Response Authority” (HERA) dedicated to design a new strategy for health and sustainable development.

Before entering into the examination of this important new Agency it needs to be underlined that WHO had launched the “committed to improving the information that underpins health policies in the European Region. It has been fostering international cooperation to support the exchange of expertise, build capacity and harmonize processes in data collection and reporting.”<sup>29</sup> It is also contributing to change the “isolation” in which each member states of the European Union had the tendency of operating in the health domain. This has been further valorised by the document of the Pan-European Commission on Health and Sustainable Development issued by WHO Regional Office for Europe.

<sup>27</sup><https://eu4health.eu/an-inclusive-eu4health-programme-to-better-meet-the-needs-of-people-in-europe/>

<sup>28</sup>[https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-life/european-health-union\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-life/european-health-union_en)

[https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_6363](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6363)

<sup>29</sup>[https://www.who.int/europe/groups/european-health-information-initiative-\(ehii\)#:~:text=The%20European%20Health%20Information%20Initiative,in%20data%20collection%20and%20reporting](https://www.who.int/europe/groups/european-health-information-initiative-(ehii)#:~:text=The%20European%20Health%20Information%20Initiative,in%20data%20collection%20and%20reporting)

- **HERA**

Health Emergency Preparedness and Response Authority has to be considered as the most relevant new Agency created to implement the goals of common protection of health of EHU, and it was designed focusing on the main goal of building a cohesive preparedness of the specialised institutions to face emergencies, by passing the boundaries of specialties and of legal and geographic subdivisions. As such, its mission was to work in connection with the other major Institutions and Agencies, and their satellite organisations. This was the main request of interaction.

An article published on The Lancet is useful to understand the importance and the challenge of this role. The opening sentence synthetises it *“The proposed focus is broad, and HERA will be expected to operate among a multiplicity of agents already responsible for preparedness planning and response in Europe...”*.

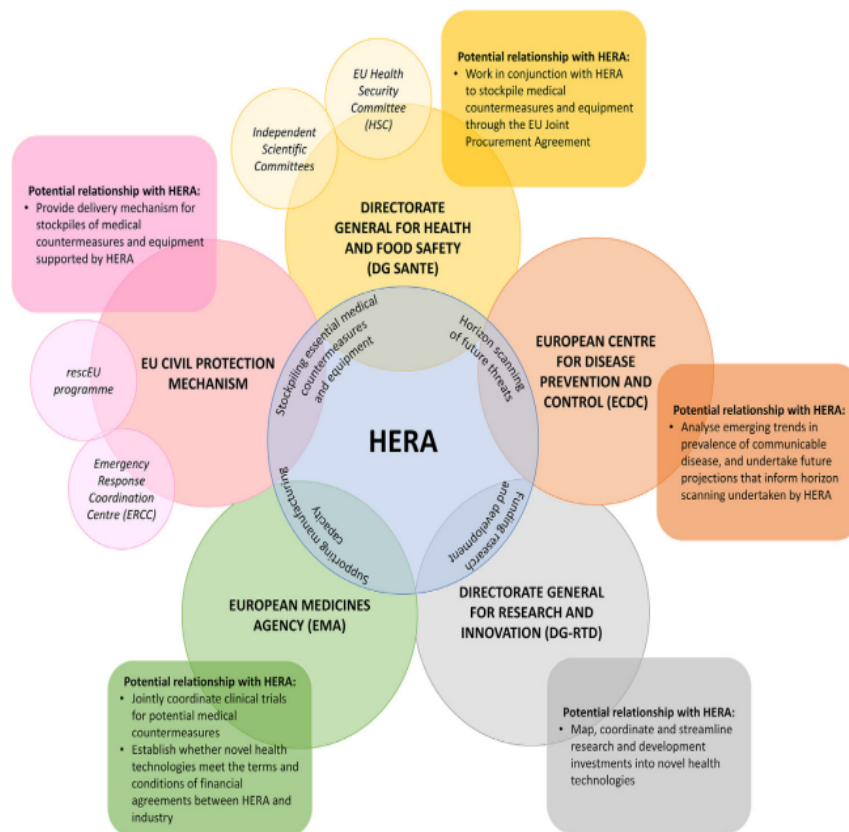
| Agency/Institution   | Current roles and responsibilities   |
|--|--|
| Directorate-General for Health and Food Safety (DG-SANTE)    | <ul style="list-style-type: none"><li>• Provides a forum for coordination and sharing of best practices through the EU Health Security Committee (HSC) and independent scientific committees</li><li>• Procures medical countermeasures and equipment through EU Joint Procurement Agreement</li></ul> |
| The Directorate-General for Research and Innovation (DG-RTD) | <ul style="list-style-type: none"><li>• Allocates and coordinates EU investments in research and development for medical countermeasures and diagnostics</li></ul>   |
| European Centre for Disease Prevention and Control (ECDC)    | <ul style="list-style-type: none"><li>• Provides surveillance of communicable diseases</li><li>• Issues scientific advice on communicable disease epidemiology, prevention and control</li><li>• Provides public health training</li></ul>   |
| European Medicines Agency (EMA)                              | <ul style="list-style-type: none"><li>• Assesses the safety and effectiveness of novel health technologies</li></ul>   |

In other terms HERA was entering in the field where were operating institutions already existing and with a well-defined legal frame and definition of tasks. The article underlines, in fact, that *“There is the DG-SANTE, department of the European Committee responsible for EU policy on health and Food Safety, and hosts the Health Security Committee (HSC), and independent scientific committees, that provide forums to coordinate and share best practice between member states and non-member observer states for preparedness and response activities. Then there is (DGRTD) responsible for allocating and coordinating EU research and development investments for medical countermeasures, and diagnostics through programmes such as Horizon ... (ECDC) is the agency responsible for communicable disease surveillance, provision of scientific advice on communicable disease epidemiology, prevention and control, and training of public health professionals....finally (EMA) responsible for assessing available evidence on the safety and effectiveness of novel health technologies including vaccines, and medicines...”*<sup>30</sup>

This figure that gives evidence of the web of relations of the latest born HERA.

<sup>30</sup> <https://www.thelancet.com/action/showPdf?pii=S2666-7762%2821%2900180-0> Authors of the article: Michael Anderson, Rebecca Forman, Elias Mossialos





**Fig. 1. The role of HERA in coordinating European responses to major threats to health.** HERA: Health Emergency Preparedness and Response Authority. Four proposed functions of HERA are outlined in the blue circle. The potential relationship between pre-existing EU agencies and institutions are outlined within squares with rounded edges.

*From the article of The Lancet - note 31*

A document from EHU<sup>31</sup> has a reference with the major programmes and policies developed by the European Union and in parallel by the WHO it gives evidence to the changes in the comprehension of the role of health, certainly mostly two to the impact of the Covid-19 not only, but also to the growing awareness of the connection between the anthropic changes in the environment related climate change and the upsurges of pandemic and epidemic health problems for human being. From the focus on European Health Union, advocating cohesion in every fields concerning health and the creation of a new strong agency HERA, with the characteristic seen above, some aspects emerge as fundamental for having success: **the need to collaboration among fragmented and specialised pieces regarding health and a unified systemic approach**, encompassing also the preparedness to the extreme assaults of possible, near or far, new pandemics and especially equally dangerous threats, that we are already facing with the catastrophic events climate related. This is basically a positive aspect of the evolution in understanding the role of the Healthcare. It needs however to be stressed that in what has been examined the importance of health facilities and of their role is still largely missing and the following part of the report is, in fact, focused to the necessity and the ways of making fully understood the importance and role of health facilities in the “emergency preparedness to fight Climate Change related disasters”.

<sup>31</sup>[https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-life/european-health-union\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-life/european-health-union_en)



## 5. THE CLIMATE-RELATED NATURAL HAZARDS IN EUROPE

### 5.1 The most relevant disasters in Europe due to the hits produced by Climate Change

There is now enough evidence that the Climate Change is an induced effect of human actions and behaviour, in spite of the resistance, against all scientific evidence, of the negationists.

It is equally undeniable that the phenomenon is affecting the entire Planet.

Up to recently it was reported that 2023 was the warmest year on record, but the last diffused data show that the year 2024 has been warmer, breaking that record. In this general situation, it is necessary to underline that the picture is even worse for Europe, because it is the fastest warming continent in all planet. The Mediterranean Sea, of vital importance for all its southern countries, has warmed more than the ones of Oceans, which rising temperatures are of great concern.

Extreme heat events for long periods, once relatively rare, are becoming more frequent, while precipitation patterns are changing. Downpours and other precipitation extremes are increasing in severity, recent catastrophic floods have plagued different areas of Europe.

On the other geographic part, Southern Europe has, and is, suffering considerable declines in overall rainfall and more severe droughts. If and when there are precipitations, they take the form of devastating storms.

These events, combined with environmental and social disasters, pose major challenges throughout Europe. Specifically, they compromise food and water security, energy security and financial stability, the health of the general population and of outdoor workers.

All this, naturally, affects social cohesion and stability. At the same time, climate change is impacting terrestrial, freshwater and marine ecosystems.

As there is irrefutable evidence now, event's impacts related to climate change are difficult to predict and to evaluate, first of all because they can have different possibilities to create damages according to the weakness or strength of the social fabric, can exacerbate existing other problems and produce the explosion of latent crises. They can lead to system-wide challenges affecting whole societies, with vulnerable social groups being particularly affected. Examples include mega-droughts leading to water and food insecurity, disruptions of critical infrastructure, and threats to financial markets and stability. They have come to be known as "physical cascade risks". There are also the examples of floods producing power failures, which trigger big fires or generate landslides.

When applying the scales of severity used in the European climate risk assessment, several climate risks have already reached critical levels. If decisive action is not taken now, most climate risks identified could reach critical or catastrophic levels by the end of this century, studies stress. Hundreds of thousands of people would die from heatwaves, and economic losses from coastal floods alone could exceed EUR 1 trillion per year, according to the European Environment Agency -EEA<sup>32</sup>.

Below is posted a synthetic report from EEA.

It is relevant coming from an official source.

*Extreme weather events pose an increased risk to nature, buildings, infrastructure, and human health. These events, expected to increase in frequency and intensity because of climate change, are already causing substantial damage and loss. We must adapt and prepare for life in a changing climate.*

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<sup>32</sup>EEA Report 1/2024 European Climate Risk Assessment Report (PDF) Published 11<sup>th</sup> Mar 2024, <https://www.eea.europa.eu/en/analysis/publications/european-climate-risk-assessment>

*The summer of 2023 was the [hottest on record](#) globally. Over 460.000 hectares of forest have been destroyed by wildfires this year. Latest data for April and May 2024 also shows that we might be breaking new records this year too.*

*Over the past decades, Europe has been experiencing frequent and severe weather and climate-related natural hazards like **droughts, forest fires, heatwaves, storms and heavy rain**. Climate change will make these events even more intense and more frequent.*

*Extreme temperatures do not only impact the health of **vulnerable groups** but also cause sleep disturbance for everyone. **Rivers and lakes** are drying up, impacting all life dependent on them. **Soils** are also getting drier, increasing fire risks and reducing agricultural productivity.*

*Other parts of Europe are experiencing **intense downpours**, sometimes flooding buildings and damaging property and infrastructure within a matter of minutes. **Coastal zones** will be at risk of more frequent **storm surges**, also resulting in flooded buildings or agricultural lands. **Wind speeds** are reaching levels never seen Europe before, causing accidents and serious damages to property.*

*Other parts are seeing severe **cold spells**.*

Another source of information is Adapt with its report **2023 XDI Global Hospital Infrastructure Physical Climate Risk Report** “This report, by XDI, reveals the risk of damage from 6 different climate change hazards (including flooding, wind and fire) to over 200,000 hospitals, including more than 23,000 in Europe, from 1990 until the end of the century. The results are based on an analysis combining climate hazard projections with typical hospital-specific information and spatial context data to calculate risk probabilities.”<sup>33</sup>

## **5.2 The recent response of Europe**

The above-mentioned report states:

*“... without a rapid phase out of fossil fuels (RCP 8.5) and hospital adaptation measures, by 2100 Europe could have up to four times more or over 1,000 hospitals at high risk of total or partial shutdown from extreme weather events, which means for some countries that up to 29% of all hospitals are at risk. Rapid emission cuts could lessen the impact to a doubling of the damage risk. Analysis suggests that global warming has already resulted in a 27% increase in risk of damage to hospital infrastructure in Europe since 1990. Coastal inundation and flooding are the main driving hazards; however, modelling suggests that extreme wind also increases damage in a number of countries.*

*By 2100, Italy, France and Germany will have the highest number of hospitals at high risk of total or partial shutdown, ranging between 137 and 82 hospitals, i.e. for some of these countries almost twice the number of hospitals at risk today. Other countries, such as Denmark, Albania, Belgium and Ireland could experience an exponential (500-1000%) increase in damage risk to hospital infrastructure. Analysis suggests that Greece has experienced the greatest increase in risk of damage to hospital infrastructure from climate change in Europe to date, with an 83% increase in risk of damage since 1990”.*

<sup>33</sup>[https://climate-adapt.eea.europa.eu/en/metadata/publications/2023-xdi-global-hospital-infrastructure-physical-climate-risk-report?set\\_language=en](https://climate-adapt.eea.europa.eu/en/metadata/publications/2023-xdi-global-hospital-infrastructure-physical-climate-risk-report?set_language=en)

The EU Parliament resolution by 19 September 2024 starting with its title “The devastating floods in Central and Eastern Europe, the loss of lives and the EU’s preparedness to act on such disasters exacerbated by climate change”<sup>34</sup>

The first reference is to: “heavy rain and strong winds have impacted central and eastern Europe, in particular Austria, Czechia, Germany, Hungary, Poland, Romania and Slovakia, causing floods that have resulted in human casualties and large-scale damage; whereas a significant part of their territories has been affected, in particular less developed regions with weaker infrastructure and agricultural regions.” The addition in more or less the same period in the Northern countries were registered two waves of floods, in particular in Italy the Romagna part of the Emilia-Romagna Region, plagued also the year before with the same types of events in the same areas.

When this report will be delivered to IFHE-EU, it will be clearly seen that the 19<sup>th</sup> September 2024 doesn’t include the last disaster in the area of Valencia in Spain and the large number of human casualties.

## 6. CLIMATE CHANGE AND HEALTHCARE FACILITIES

### **6.1 The missing comprehensive analysis and assessment of the impact of Climate Change on Healthcare Facilities**

From the preceding part it emerges a certain consciousness of the vulnerability of the healthcare structures, however there is less clarity on how to address the risks related to the Climate Change. A question that arises is how the healthcare facilities are considered, when considering climate and the effects on the environment. This is certainly an important issue when speaking of preparedness. Scholars of climate start from a simple definition: “*Climate represents the weather trends and patterns that are experienced in a location over a long period of time, such as months to years. There are four “global climate drivers” that influence weather patterns that occur over months and seasons. Depending on the season, a certain climate driver may get a bigger influence than other drivers. That driver would then have a bigger influence also on the weather that occurs during that season.*”<sup>35</sup>

The extreme increase of greenhouse gases GHGs have affected the “global climate drivers” impacting in different ways the successive strata of the atmosphere with these main catastrophic effects:

- 1) increase of mean temperature of the atmosphere, impacting especially on the troposphere, and of the oceans,
- 2) raise of [ocean levels and acidification](#) of their waters with related impact on their ecosystems,
- 3) production of more frequent and more devastating, extreme events in all the Planet, including in Europe (e.g., floods, storms, wildfires, landslides, drought).

According to data from scientific sources, between 1995 and 2015, 90% of disasters were caused by weather-related events, leading to more than 600,000 deaths and 4.1 billion people injured or in need of medical assistance.<sup>36</sup> As already stressed, finally Climate Change has been recognised as the biggest threat of the present century for human health.

The progressive understanding should have also led to the recognition of the strategic relevance of Healthcare Facilities, from hospitals to territorial health facilities, for the care of the population.

<sup>34</sup>[https://www.europarl.europa.eu/doceo/document/TA-10-2024-0014\\_EN.pdf](https://www.europarl.europa.eu/doceo/document/TA-10-2024-0014_EN.pdf);

<sup>35</sup>The four climate drivers are: 1. The Sun; 2. El Niño Southern Oscillation (ENSO); 3. Madden Julian Oscillation (MJO); 4. Southern Annular Mode (SAM). Depending on the season, a certain climate driver may get a bigger influence than other drivers. That driver would then have a bigger influence on the weather that occurs during that season;

<sup>36</sup>Data from documents of the “World Meteorological Organisation”, documents of “UNDRR the United Nation Office for Disaster Risk Reduction” among others;

In the previous study of S.I.A.I.S. TSO for IFHE-EU it was underlined that the understanding and attention regarding the necessity of having strong healthcare facilities and related public infrastructures, resisting also in the cases of disasters, were certainly not sufficient.

In the study it was given as example the fact that the Covenant of Mayors had not indicate the healthcare facilities among the strategic infrastructures needing special protection in case of emergencies. This was stressed in an in dept study of the Joint Research Centre (JRC), called EU Science Hub.

As reported in other occasions, there are studies focused on social impact of specific events, like heat waves or crop destruction and consequent food shortages. Some have considered the impact of climate change in terms of what can happen to patients in an hospital hit by such disasters.

The Covid-19 epidemic brought an indirect confirmation of the insufficient evaluation of the importance of the buildings and plants of the hospitals in the case of that emergency and gave evidence also to the connected consequences of insufficient appreciation given also to the role of the technical figures operating in healthcare facilities.

To make evident, let's say more objectively, the lack of understanding of the importance of healthcare facilities in presence of the increasing disasters produced by the impact of climate change related events, it is certainly significant to report the results of a recent study, made in 2022 and published in 2023 by Elsevier in the Environmental Research Journal.<sup>37</sup>

A group of scholars from different French and Belgian Universities and research Institutions produced made a research of relevance for S.I.A.I.S. TSO and IFHE-EU having as objective "to highlight the components of the healthcare facilities affected by climate change".

Their starting considerations are worth of being reported in some extent:

*"There has been substantial research on the links between Climate Change and health (Watts et al., 2015; World Meteorological Organization, 2019; Watts et al., 2019), and as of late, more studies are being conducted on the impacts of Climate Change on Health Care Facilities. Health Care Facilities play a central role in health systems through health-specific infrastructure and specialized medical equipment in buildings and thanks to trained and qualified staff taking care of patients with increasingly complex pathologies and growing challenges such as antibiotic resistance (Laxminarayan et al. 2013). Emergency departments attached to Healthcare Facilities are tasked with reaching vulnerable populations as quickly as possible, in the event of need for urgent care. They are on the front line of responses to natural disasters or climate change-related events (World Health Organization and Regional Office for the Western Pacific, 2010). As a result, they can reduce health impacts from Climate Change not only by treating illnesses and injuries and caring for patients during and after disasters, but also by reducing the impact of climate itself, through mitigation actions (Loosemore et al., 2011).*

*In 2005, in recognition of the importance of "making hospitals safe from disasters", it was stipulated by the UNISDR (United Nations International Strategy for Disasters Reduction) that all new hospitals should be built "with a level of resilience that strengthens their capacity to remain functional in the event of a disaster and to implement mitigation measures to strengthen existing health facilities, particularly those providing primary health care" (UNISDR, 2008).*

*However, emergencies and crises continue to render Health Care Facilities unable to function, and a significant number of health facilities are still being built in areas highly prone to disasters (World Health Organization et al., 2013a). A number of climate-related phenomena pose significant threats to Health Care Facilities operations. While HC Health Care Facilities are most of the time at full*

<sup>37</sup><https://www.sciencedirect.com/science/article/pii/S0013935122020369>

**"Climate change and health care facilities: A risk analysis framework through a mapping review"** authors: Jérémy Guihenneuc, Sarah Ayraud-Thevenot, Sonia Roschnik, Antoine Dupuis, Virginie Migeot



capacity and regularly overcrowded, the system will be further tested as population health is adversely affected by increased climate-related disease. Health Care Facilities are highly dependent on community services that are vulnerable to power supply (Kile et al., 2005; Rand et al., 2005), or supply chain disruptions (Appelbaum, 1999). And through the Covid-19 health crisis, we have observed the fragility of the current system in different countries (Khullar et al., 2020; White and Lo, 2020; Supady et al., 2021; Rosenbaum, 2020; Herreros et al., 2020). Health institutions and health systems have not responded well to these diversified challenges. In the future, with increasing frequency and severity and probably with long-lasting impacts, climate-related health issues will not necessarily just follow one another (e.g. heatwaves, droughts, storms), and will in all likelihood become additive (IPCC. Global Warming of 1.5°C Matthews, 2018; Golechha and Panigrahy, 2020). And since each additional degree of warming will be proportionally more destructive, some countries are now making Climate Change a national security priority (The White House, 2021).

While some publications have studied the impact of Climate Change on health, we have focused on Health Care Facilities and the ways in which Climate Change will impact health care delivery, and some of the impacts already experienced have not been analysed. There has been no comprehensive assessment of the impact of Climate Change on Health Care Facilities operations and the potential dysfunctions that could occur. That much said, Climate Change and Healthcare Facilities is increasingly under discussion. Recently, international institutions such as the WHO, the Canadian Coalition for Green Healthcare, and Health Care Without Harm have been working on the topic and have published reports (World Health Organization, 2020; Health Care Without Harm, 2017).

In 2020, the WHO proposed a framework through which Health Care Facilities might implement appropriate interventions (World Health Organization, 2020). By the same token, different organizations have proposed tools to assess climate vulnerabilities and implement related interventions (The Health Care Facility and Climate, 2022; U.S. Climate Resilience Toolkit, 2021; World Health Organization, 2021a). In view of assessing the climate risks in each Health Care Facility and subsequently adapting their infrastructure and processes, the objective of our study was to highlight the components of Health Care Facilities that are affected by Climate Change through a mapping review of the literature.

This situation is represented in this figure:

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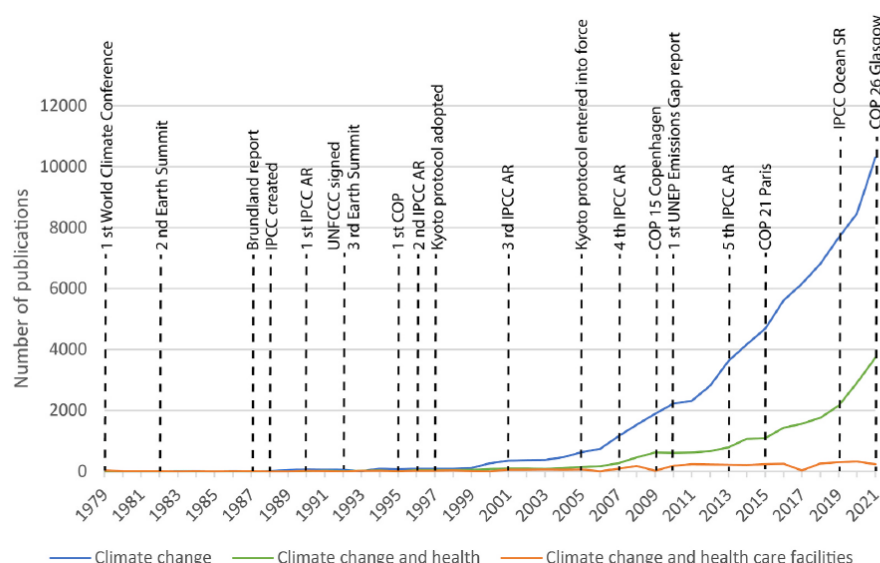


Fig. 1. Publications on 'climate change', 'climate change and health', and 'climate change and health care facilities' by year indexed in PubMed database between January 1, 1979 and December 31, 2021.

IPCC: Intergovernmental panel on climate change, UNFCCC: United Nations Framework Convention on Climate Change, COP: Conference of Parties, AR: Assessment report, UNEP: United Nations Environment Programme, SR: Special report.

The study proceeds illustrating the material and the methods used. Obviously, it is not here the place to report and comment on how the production of this report was pursued. The link at the bottom of the page can allow interested people to enter in this matter.

The part dedicated to “Discussion” highlights that *“Climate Change is a latecomer to the field of health and only in the 2000s become a topic in the scientific debate”* confirmed by many databases. This research recognises that WHO, along with other organisations has at least reduced the gap producing guidance for systematic risk analysis, assessment and monitoring first in 2015 and the in 2022, as it was recognised in the preceding study of S.I.A.I.S. TSO for IFHE-EU also the present study has stressed.

In spite of the increase on health-related Climate Change interest, *“In its 2021 report, the Lancet Countdown also showed, in another database, Embase, the recent but significant increase on health-related Climate Change (Romanello et al., 2021). Moreover, as in our study, this report concluded that in terms of absolute number of articles, the topic of health-related Climate Change included far fewer publications than Climate Change alone (Romanello et al., 2021).”*

This could be explained by the fact that:

- i) Climate Change has been perceived rather weakly by health professionals, or not strongly enough for them to take up the issue,*
- ii) despite a stated willingness of health professionals, there are still many obstacles preventing commitment and action, particularly the lack of time,*
- iii) health professionals do not feel sufficiently prepared for the challenges of Climate Change, and*
- iv) some health education institutions do not address the issue of Climate Change in the teaching of health students (Kotcher et al.).*

It has been given more evidence to this conclusion, because it is an indicator, in effect, of the situation existing inside of the domain of experts of technical disciplines concerned with the correct performance and safety of *Health Care Facilities*. This could be considered one of the most important so called “take away” from this study for the members of S.I.A.I.S. TSO and IFHE-EU.

In effect, the Climate Change should be more intensively perceived by the whole category of health professional. On the other hand, it is not only the specific category of expert that IFHE-EU and S.I.A.I.S. TSO associations represent that needs to pay and receive more attention. This need is universally highly represented by the concept “ONE HEALTH” considering that the Climate Change is the main challenge for the Planet, as stated by the major world institution, such as UNDRR (United Nations Disasters Risk Reduction). Also, for the European Continent, as showed by the most dramatic recent events, there are clear examples of the need to increase the knowledge and awareness of Climate Change by all the “players” in the health domain, from politicians and decision-makers, to health professionals, health students, technicians, providers for Healthcare. It is necessary to acquire more consciousness of the necessity of a double set of actions. The health domain needs to reduce its Carbon as well as Environmental Footprint, as we have already stressed previously, but also to work for obtaining a better understanding with regard to the importance of the Health Care Facilities in mitigating the impact of Climate Change.

We have reported in details the findings of specific research about the insufficient consideration in the scientific research regarding Climate Change of its impact on Healthcare Facilities.



It would certainly be important to explore in dept, with an “ad hoc study” the whole policies of the European Union with regard to the Healthcare.

The penetration of the “ONE HEALTH” approach, as defined for example by WHO<sup>38</sup>, that follows the previous approach highly discussed in the period 2014-2018 “HEALTH in ALL POLICIES”<sup>39</sup>, for the moment seems to have diluted the substance of health care in quotations, rather than in actions and activities to protect health from the greatest current enemy, climate change, with even greater distancing effects from understanding the relationship between Health Care Facilities and Climate Change. As said, specific research should be done at this regard. An example can come from the large report published at the beginning of 2024 by “European Climate Risk Assessment”<sup>40</sup>.

In the part on Health the most important policy priorities are given as:

- (2) increasing the capacity and preparedness of the health sector;**
- (3) increasing the resilience of critical health infrastructure;**
- (4) designing adaptation measures to limit disparities in levels of vulnerability.**

At least point 3 recognises the need for improvement of resilience of health infrastructures, without further specification.

In the chapter dedicated to “Major disruptions of critical infrastructures” Health and Education are in the “social category” of minor relevance, lower than energy, transport and industrial infrastructures. Other examples have been already highlighted in previous chapters.

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<sup>38</sup>[https://www.who.int/health-topics/one-health#tab=tab\\_1](https://www.who.int/health-topics/one-health#tab=tab_1) One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems.

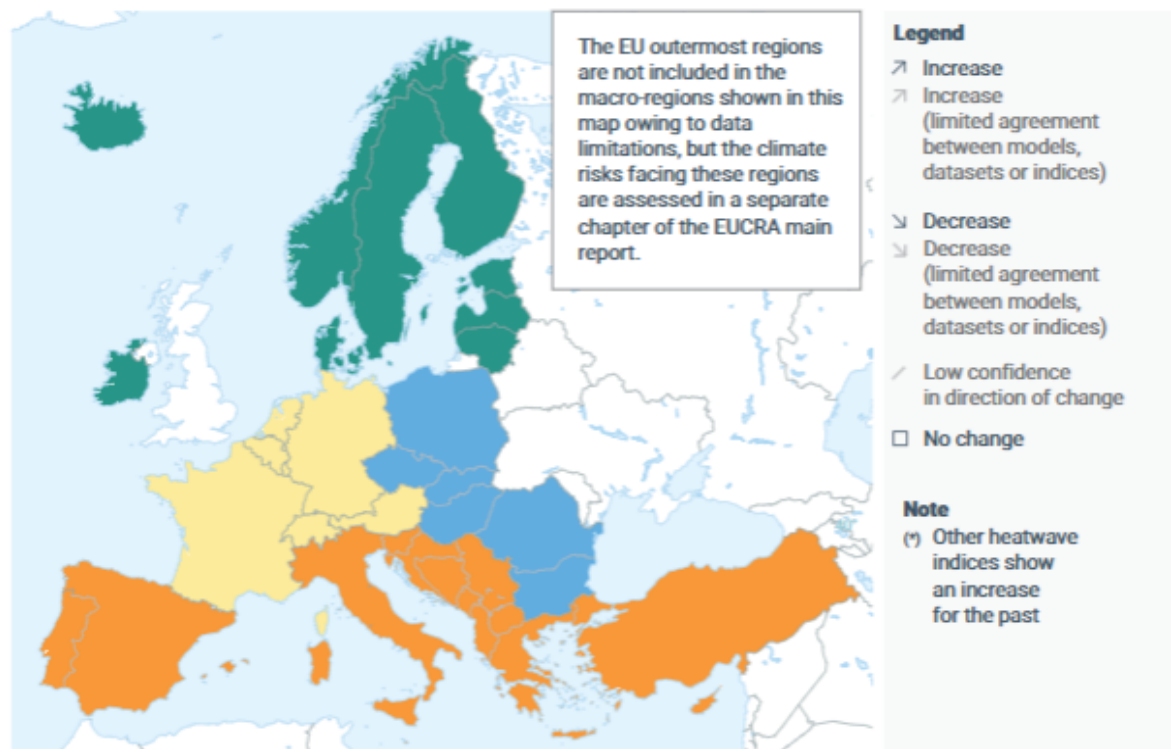
It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.

<sup>39</sup><https://www.who.int/activities/promoting-health-in-all-policies-and-intersectoral-action-capacities> HiAP (Health in All Politics) is about integrated governance which promotes health and equity objectives and at the same time achieves mutual benefits for partnering sectors.

<sup>40</sup> [https://www.google.com/search?q=european+climate+risk+assessment+eea+report+01%2F2024&rlz=1C1UKOV\\_itlT984IT984&oq=&gs\\_lcrp=EgZjaHJvbWUqCQgEECMYJxjqAjlJCAAQIxnGOoCMgkIARAJGCcY6gIyCQgCECMYJxjqAjlJCAMQIxnGOoCMgkIBBAJGCcY6gIyCQgFECMYJxjqAjlPCAYQLhgnGMcBGOoCGNEDMgkIBxAgGCcY6gLSAQ03NDE1ODYzMTlqMG03qAIIsAIB&sourceid=chrome&ie=UTF-8](https://www.google.com/search?q=european+climate+risk+assessment+eea+report+01%2F2024&rlz=1C1UKOV_itlT984IT984&oq=&gs_lcrp=EgZjaHJvbWUqCQgEECMYJxjqAjlJCAAQIxnGOoCMgkIARAJGCcY6gIyCQgCECMYJxjqAjlJCAMQIxnGOoCMgkIBBAJGCcY6gIyCQgFECMYJxjqAjlPCAYQLhgnGMcBGOoCGNEDMgkIBxAgGCcY6gLSAQ03NDE1ODYzMTlqMG03qAIIsAIB&sourceid=chrome&ie=UTF-8)

**Figure ES.1 Observed and projected trends in key climatic risk drivers in different European regions**

| Land regions        | Northern Europe |        |      | Western Europe |        |      | Central-eastern Europe |        |      | Southern Europe |        |      | European regional seas  |      |        |
|---------------------|-----------------|--------|------|----------------|--------|------|------------------------|--------|------|-----------------|--------|------|-------------------------|------|--------|
|                     | Past            | Future |      | Past           | Future |      | Past                   | Future |      | Past            | Future |      |                         | Past | Future |
|                     |                 | Low    | High |                | Low    | High |                        | Low    | High |                 | Low    | High |                         |      |        |
| Mean temperature    | ↗               | ↗      | ↗    | ↗              | ↗      | ↗    | ↗                      | ↗      | ↗    | ↗               | ↗      | ↗    | Sea surface temperature | ↗    | ↗      |
| Heatwave days       | ☐(*)            | ↗      | ↗    | ↗              | ↗      | ↗    | ↗                      | ↗      | ↗    | ↗               | ↗      | ↗    |                         |      |        |
| Total precipitation | ↗               | ↗      | ↗    | ↗              | ↘      | ↘    | ↗                      | ↗      | ↘    | ↘               | ↘      | ↘    | Sea level               | ↗    | ↗      |
| Heavy precipitation | ↗               | ↗      | ↗    | ↗              | ↗      | ↗    | ↗                      | ↗      | ↗    | ↗               | ↗      | ↗    |                         |      |        |
| Drought             | ↗               | ↘      | ↘    | ↗              | ↘      | ↘    | ↗                      | ↘      | ↘    | ↗               | ↗      | ↗    |                         |      |        |



**Notes:** Underlying climate variables are: heatwaves (days with maximum temperatures above 35°C), heavy precipitation (maximum 1-day precipitation), and drought (using a standardised precipitation evapotranspiration index over 6 months (SPEI-6, Hargreaves' method)). Time periods and scenarios are past (1952-2021); future until the end of the century (2081-2100 relative to 1995-2014); low scenario (SSP1-2.6); and high scenario (SSP3-7.0).

**Source:** Copernicus Climate Change Service (C3S).

## 6.2 Establishing the starting point for promoting change

The conclusions of the previous chapter speak for themselves.

A better understanding of importance of Health Care Facilities in response to possible disastrous events climate change related, could first of all stimulate the engagement of health professionals in the sectors several times mentioned:

- 1. reduce the contribution** of this sector in the GHGs production;
- 2. in parallel develop the implementation of the measures** related to the need of functionality and efficiency that the health sector is called to give for to the protection of people and society in case of disastrous events climate change related.

What need to be built as basic foundation, in appropriate engineering terms, is the understanding that preparedness has becoming more than normal preparedness, but “emergency” preparedness of hospitals for serving that essential role. The reasons (why) have been touched several times, the actions (how) will be examined as well as the timing and strategy (when) and carried on by (whom) in the chapter that follows.

This research at its starting point examined and stressed the difference between **carbon footprint** and **ecological footprint** in general and specifically for the Healthcare systems.

Here it is given space to reflection on the variety of terms used especially after the COP 21, known as the Paris Conference, held in Paris in December 2015, which was a milestone for the treaty signed by 196 parties, for action in the planetary fight against climate change<sup>41</sup>.

The terms most frequently used become **Adaptation** and **Mitigation**, which, thinking about, indicate actions. In fact, a definition by the European commission is: “*Adapting to climate change means taking action to adjust to its present and future impacts*”. **Adaptation** *refers to a wide range of measures to reduce vulnerability to climate change impacts, from planting crop varieties that are more resistant to drought to enhancing climate information and early warning systems to building stronger defences against floods.*”<sup>42</sup>

**Mitigation**, generally correlated with Adaptation, is defined as “*reducing climate change – that involves reducing the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing sources of these gases (for example, the burning of fossil fuels for electricity, heat, or transport) or enhancing the “sinks” that accumulate and store these gases (such as the oceans, forests, and soil).*”<sup>43</sup>

Other words that have become always present in the current vocabulary are **Resilience** and **Sustainability**. Also, in this case, it is important to go at the sources of the words, their original meaning and the sense that it has been given to these two words, used especially to indicate a STATUS, that is the objective to achieve with the actions. The Organisation for Economic Cooperation and Development – OECD- gives the following definition: “*Health systems Resilience is the capacity of health systems to proactively foresee, absorb, recover from, and adapt to shocks such as pandemics, climate change, geopolitical conflicts, and cyberthreats. As countries recover from Covid-19, bolstering the overall capacity of health systems is more critical than ever. Health system resilience must be prioritised as one of the key objectives for high-performing health systems.*”<sup>44</sup>

When digging into the work done under the “umbrella” OECD regarding the resilience of Healthcare systems, there is a study, very recently published, that looks quite appealing by the title “Strengthening Health Systems – A practical Handbook for Resilience Testing”. Going through the very interesting pages, however, one can only confirm the conclusions reached by the long study reported before: Healthcare Facilities don’t enter in the evaluation as part of a Health System’ resilience. The attention is addressed to problems related to the most aggressive and problematic health problems of our historic period epidemics, air pollution etc., but the assumption that Healthcare

<sup>41</sup><https://unfccc.int/process-and-meetings/the-paris-agreement> The Paris Agreement is a **legally binding international treaty on Climate Change**. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016.

<sup>42</sup>[https://climate.ec.europa.eu/eu-action/adaptation-climate-change\\_en](https://climate.ec.europa.eu/eu-action/adaptation-climate-change_en)

<sup>43</sup>[https://science.nasa.gov/climate-change/adaptation-mitigation/The\\_goal\\_of\\_mitigation](https://science.nasa.gov/climate-change/adaptation-mitigation/The_goal_of_mitigation) is to avoid significant **human interference with Earth's climate**, “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner” (from the [2014 report on Mitigation of Climate Change](#) from the United Nations Intergovernmental Panel on Climate Change, page 4)

<sup>44</sup><https://www.oecd.org/en/topics/health-system-resilience.html>

Facilities are part of the need for strengthening resilience of Health Systems is not taken into consideration.

The meaning attributed to **Sustainability** related to healthcare facilities is mostly addressed to their improvement regarding the carbon footprint and, in the most advanced of the cases, such as the highly regarded American Hospitals Association - AHA, states “*Hospitals can reduce carbon emissions significantly with simple changes, such as reducing surgical waste, reducing toxic chemicals and installing life-saving renewable energy sources*”<sup>45</sup> and offers to its members a guide to each sustainability of their estates applying these simple parameters.

Advancing in this research it is emerged the recognition for the vital importance of Healthcare Facilities, especially in moments in which Climate related disasters happened, completely destroying full hospitals. They were however considered as terrible fact, but “events” of which measure the amplitude of the damage and the social and human destruction, from which to derive some lessons.

One of them has been the opportunity to move certain hospital’s equipments from basements to higher levels. In effect, as the above-mentioned English study had pointed out Healthcare Facilities – referred with the acronym HCFs, are not considered enough in the domain of scientific research and in parallel in policy making for the health domain. This could also be considered one of the reasons for the frequent insufficient recognition also of the technical health professional in charge of the complex aspects of maintenance, resilience improvement and preparedness or better emergency preparedness, as it will be explained. Facing events, that are more and more frequent and devastating, sometimes with consequences at social and urban level, as, an example, it was the case in February 2023 in Boston<sup>46</sup> should produce actions focused on:

1. Increase attention has to be given to the physical structures, the healthcare facilities and the technical experts in their safety and management;
2. Understand that the usual tools valid for the past goals related to Adaptation and Mitigation are no more sufficient and that there is an urgent demand a new understanding and new approach.

Now it is indispensable to address the notion, as stressed by the title of this research, of **Preparedness**, together with the concrete needs of different vision, concepts and supporting action, frequently presenting themselves as **emergency action**. This will be the matter of discussion, that it is intended to stimulate with the present study S.I.A.I.S. TSO and IFHE-EU among their members and, through them, to the world of health professionals of all disciplines, specialties and roles.

## 7. A DIFFERENT APPROACH TO PREPAREDNESS

### 7.1 Why is it needed?

Up to recent times we could define Preparedness as the result of the actions developed in the framework of Mitigation and Adaptation.

The weak point of preparedness could come from the lack of understanding of the needs for some actions. Laws in several European countries have for example made mandatory the preparation for local governments, and also for the hospitals, of plans for adaptation to Climate Change, to be periodically, generally yearly, reviewed. As there has been the occasion to underline before, the focus and the advancement of such tools, which were regarding in many cases specific events (e.g. heat

<sup>45</sup><https://www.aha.org/sustainability>

<sup>46</sup>In early February, the Boston area experienced historically low temperatures, causing four local emergency rooms to close due to flooding from burst pipes. A February 19 article in The Boston Globe reported on the closures and explored a larger question: as [climate change](#) continues, and extreme weather events become more common, how will [hospitals](#) and [health systems](#) cope?

waves, or floods) and they were specifically addressed and tailored on the impact of events that had hit seriously the area of interest. That is a sort of actions taken as consequence of the events.

It needs also to be underlined that, as data show, a number of institutions had not even fulfilled such request. In other cases, a plan was elaborated, but the institutions in charge of implementing it didn't have sufficient financial means, or prepared manpower, for executing and managing as necessary.

Even in the cases in which "normal" procedures were followed, when the exceptional events hit, the situation after the impact showed that there was in reality insufficient preparation. The conclusion that can be drawn is clear and unavoidable. The present climate hits on large areas and their infrastructures, don't follow pattern pre-detectable in long, or even medium-times, nor do they have repetitive patterns.

There are continuous examples, like the recent flood in several parts of Europe, the unimageable wildfires in Canada, as well as the one in California, made possible by the drought conditions and the high winds fuelling wildfires of unprecedented amplitude. Preparedness for such events, generating unexpected emergency situation, highlights even more the need that the related impact on health it involves the whole health system. Existing conditions like asthma and heart problems, previously under control in the area, worsen and require hospitalisation.

Psychological stability of individuals or groups, also becomes problematic, needing hospital care.

The escalation and unpredictable strength of the weather-related disasters **unequivocally impose** reconsidering the level and the quality of preparedness of healthcare facilities, taking into consideration also the territorial infrastructures (road, bridges etc.) connecting them to the areas that each facility should serve.

A new preparedness, that for further clarity should be appropriately considered an **emergency preparedness**.

Focused on the need to respond to the shifting risks facing the Healthcare Facilities and to overcome the "normal" measures resulting from current 'normal' preparedness methods and basic criteria to date being redundancy.

An interesting article published in 2021 was making an important point:

*"These types of events are harmful to patient care, harrowing for staff, and, ultimately, very expensive for the facilities involved. The unprecedented weather patterns created by Climate Change require a new approach to emergency preparedness for Healthcare systems, as risks previously thought impossible are likely to become reality in coming years."*<sup>47</sup>

## **7.2 The path for Preparedness of Hospitals; an advanced approach to Hazard Vulnerability Analysis - HVA for the Healthcare Facilities**

It is useful to repeat that the focus of a hospital-based preparedness covers the necessity for protecting the persons already hospitalised, the hospitalisation of people getting worse in their chronic illnesses, and the absolute need for the preservation of the infrastructure's functionality for the increased demand of care of the people directly hit by the disastrous events.

It is evident that the path to preparedness of the hospitals, should have two fronts: the forecasting of the type and the intensity of the estimated risks on one hand and on the other the capacity of the single Healthcare facility to stand them, its resilience.

Several public institutions have tackled the matter of "risks", of all types of risks. One of the most relevant for the European Union EEA (European Environment Agency) in January 2024 is the

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<sup>47</sup><http://rimed.org/rimedicaljournal/2021/11/2021-11-55-climate-baugh.pdf> "Beyond the Hazard Vulnerability Analysis: Preparing Health Systems for Climate Change " Authors: J.Baugh,K. Kemen, J. Messservy, P.Biddinger



publication with EUCRA (EUropean Climate Risk Assessment) of the first report on the European situation. The report offers a guide for risk analysis and assessment, which has the limit, for what concerns the area of this study, to focus and present “Thematic Factsheets”, meaning general analysis of the risks of the different systems, (e.g. Terrestrial and Freshwater, Marine and Coastal Ecosystem, Food production and food security etc...) and consider health within the all-encompassing human health.<sup>48</sup>

The attention for healthcare facilities, doesn't reach the level of analytical evaluation required for preparing Health systems for climate change, confirming the finding exposed in the previous chapter. Looking for examples of studies entering in the examination of the hospitals as physical structures and of their plants, it was pointed out that the study giving the major contribution remains the “Hospital Safety Index – Guide for Evaluators” published originally in 2008 by WHO and PAHO, the Pan American Health Organisation, followed by a second important contribution of 2015, “*to provide guidance for health systems and public health programming to increase their capacity for protecting health in an unstable and changing climate*”. In the preceding study of S.I.A.I.S. TSO for IFHE-EU it was underlined the important contributions of this work made over the years, but also its limits. It is clear that the mild reference of climate as “unstable and changing” indicted a more optimistic evaluation than the one we are now obliged to consider.

The present research has examined also the methodologies of other works focused on the decarbonisation of the health sector. At this regard two studies were examined:

- the one already mentioned, that involved both IFHE international and IFHE-EU “*A Healthcare Engineering Roadmap for Delivering net Zero Carbon*” (previous reference footnote n.2);
- the NHS – England publication “*Net Zero Building Standards – a user guide*”<sup>49</sup>

They provided useful methodological approach, the first especially had the advantage of an analysis focused on the multiple engineering aspects, necessary to measuring the potential carbon reduction in each of them. This analysis was useful in guiding the analysis of the vulnerability of single elements, in designing a new approach to preparedness, as it will be seen.

Back to the path for a more advanced preparedness, the authors of the article previously mentioned (footnote n. 42) point out how standard Hazard Vulnerability Analysis - HVA, up to the present, is based on historic data for the assessment of risks and consequently support preparedness, in other terms, the events that happened in the past are the guide for the evaluation. This type of analyses is likely to become inadequate. The cases and the reports on the recent events recalled all along this research, in fact, show that climate related events are more severe, more frequent, can have cascade threats, making them much more difficult, if not impossible, to predict. The most recent and highly disastrous events, show that this is a reality, more than a likelihood, therefore it should be stressed that traditional Hazard Vulnerability Analysis (HVAs) are no longer sufficient and adequate. It is known, as an example, that the recent floods around Europe, took by surprise also the most prepared of the hospitals, producing the destruction of essential services such as electricity, water pipes, sewage collection system etc. Outside Europe, the above-mentioned article reports an example highly illuminating: “*Hospitals in New York had, in fact, built flood barriers as part of their preparedness plans for extreme precipitation prior to 2012; yet, the flood depths produced by Hurricane Sandy were higher than those planned for and unfortunately overwhelmed these physical barriers, necessitating the evacuation of multiple facilities and resulting in extensive damage. Similarly, multiple hospitals in Louisiana very recently required evacuation due to damage from high winds and precipitation during Hurricane Ida, a particularly challenging task amidst the power grid*

<sup>48</sup><https://www.eea.europa.eu/en/analysis/publications/european-climate-risk-assessment>;

<sup>49</sup><https://www.england.nhs.uk/wp-content/uploads/2023/02/B1697-Net-Zero-Building-Standards-User-Guide.pdf>;

*failures resulting from the storms' power overwhelming the measures put in place by the traditional preparedness".*

The main aspects emerging from these examples are: the amplitude of the impact overwhelms the measures of preparedness put in place according to the traditional results of HVA, furthermore one category of disasters (strong winds, floods, etc.) impact, due to its increased power, is more like to produce other destructive events. The cascade effect already mentioned.

The conclusion, therefore, is that not only there is the need to be aware that the planetary situation requests common and powerful effort to mitigate the main factors producing Climate Change, but that, until hopefully mitigation measures don't become effective, the entire planet will be facing not only more frequent climate related disasters, but variable events, and also combination of events. *"The unprecedented weather patterns created by Climate Change require a new approach to emergency preparedness for Healthcare systems, as risks previously thought impossible are likely to become reality in coming years."*

The risk analysis that was working within the framework of historical patterns, had generally suggested as safety measure: "redundancy".<sup>50</sup> For example a solution proposed frequently was to position in different areas not one, but a double set of power generators, to increase the possibility of having emergency energy in case of power failure. This has proven to be an expensive and unsafe choice.

The authors of the article above mentioned, propose a new approach, worth to examine, describing a specific work done by their team to achieve a different type of prevention for this setting: *"Our large integrated health system is located in New England in the United States, and includes facilities in urban, suburban, rural, and island locations. There are 10 individual hospitals in our system along with many other associated facilities, including rehabilitation centres, administrative buildings, and research complexes. Some of the hospitals are high volume quaternary care academic centres, while others are relatively small community hospitals with limited numbers of service lines. In total, our process included resilience analyses for over 30 individual buildings across the system."*<sup>51</sup>

The climate projections are the first step of the work and represents the first innovation of this approach. The climate patterns are not based on historical data, but on Climate Change projections over short-term and long term. It is a part that in Europe could take advantage from the data of Copernicus, a component of the European Union's space programme.<sup>52</sup> It is also important to consider and examine possible data and studies produced in the same area by other authorities, city governments or private entities, that have eventually made studies on projected changes in weather patterns over time. In addition, search for those kind of studies for Healthcare Facilities in similar conditions and which suffered from events that could be similar.

In the example proposed *"Our first step involved an assessment of Climate Change projections for each of our locations over short-term and longer-term time horizons (for the years 2030 and 2070, respectively). To do this, we engaged a consultant group with Climate Change expertise and leveraged recent city and state level reports on projected changes in weather patterns over time."*

<sup>50</sup>**Risk can be reduced by having redundant assets.** Redundancy involves the use of duplicate assets in critical areas in order to provide a backup in the event of failure, as well as to allow for operational flexibility during day-to-day operations.

**Redundancy in supply chain** refers to the practice of having backup options or alternatives in place to ensure the continuity of supply chain operations.

<sup>51</sup>Joshua BAUGH, Katie Kemen, John Messervy, Paul Biddinger "Beyond the Hazard Vulnerability Analysis: preparing health Systems for Climate Change"

<sup>52</sup><https://www.copernicus.eu/en>

*For our locations, we focused on three climate-related threats: 1) Extreme heat (higher temperatures and prolonged duration), 2) flooding (due to powerful storm surge and/or high precipitation), and 3) high winds (likely in the setting of severe storms).*

Frequently it is important, as in many areas of Italy, for example, to consider to include a seismic assessment, even if it is not considered climate related.

In addition to extreme heat, in Europe many areas have suffered flooding of different type and in certain areas extremely high winds.

To assess flood risks, the suggested way is the creation of probabilistic and consequence-based flood maps. *“Probabilistic maps were useful in assessing risk tolerance; for example, we might tolerate flooding that extended into a parking lot but not a building or we might tolerate a 5% annual chance of flooding in a garage but not a 1% annual chance of flooding in a clinical building. Consequence-based flood maps modelled worst-case scenario storms, which provided insight into the maximum level of protection our health system might need, or if that wasn’t feasible, what kind of emergency preparedness plans we needed.” (note 42).*

To prove how helpful is to try to have access and use also studies made by other authorities of the area, the authors underline that *“This modeling was possible through use of the Boston-Harbor Flood Risk Model, commissioned by the Massachusetts Department of Transportation.”*

For the other detected risks of the area, there are public authorities which can provide studies and predictions. ESA, the European Space Agency, can supply data, concerning winds. Studies predictions from different scientific sources suggest to consider an increase of 5% of the wind speed for each 1 degree of temperature in sea surface temperature, .... *“Applying this principle to climatology and storm surge models, high level estimates of potential wind speed increases through 2070 were prepared. These projections were compared with the wind speed design criteria specified by the Massachusetts Building Code for the location and use at the time of construction”.*

If seismic risks are included information can be given by the specialised public agencies.

Gathering this information, *“Ultimately, we produced a series of scenarios categorized by likelihood and projected consequence, which could subsequently be applied to each facility”.*

### **7. 3 The role of the health technical professionals in the Hazard Vulnerability Analysis - HVAs**

- **Create the wide-ranging vulnerabilities list**

The first phase is concluded. The work that has been taken as guide enters in the vulnerability analysis, which is the “core” of the enhanced vision of a new Preparedness, better to be defined now a necessary sort of Emergency Preparedness.

In the last miles, which start in this phase, it emerges the importance of the expertise and knowledge of the technical professional working in health facilities.

The working team has to be interdisciplinary, with the participation of engineers, architects, technicians with the required specialties, with knowledge of the structure of the building, experts among other in the power, water, ventilation systems, waste dealing, essential operational elements for the functionality of the hospital, together with facility managers, clinical leaders, the experts in operational functions, such as how and where to move patients.

In the meetings of this working groups projections will be submitted for various level of possible events, which were selected as potential hits for the area of the specific facility studied. As an

example, it can be considered that the risks could come from levels of heat or from flooding, eventually with high speed winds, in some cases also with seismic tremors. The interdisciplinary discussions among experts are aimed to quantify potential disruptions to each function due to the previously determined several projections of climate threats. The New England work indicates the conclusions: *“Ultimately, a **comprehensive list of vulnerabilities** ... generated, organized by likelihood of an event and the potential consequences of that event based on our models. Consequences from a vulnerability were organized into three categories: Major, Severe, and Catastrophic”*.

- **The comprehensive plan to address vulnerabilities and its strategy of implementation**

The first task of the technical experts of the facility will be completed with the development of the plan defining what would be needed to reduce or **eliminate each vulnerability**.

The development of the plan will be discussed step by step but only with the management, and also with representatives of the hospital staff and of the supply chain.

According to the conditions of the hospital structure and sub-systems, compared also with the three degrees of threats, different types of solutions shall be proposed. Some could involve reorganisation of the locations of equipment for example, other structural changes. Concrete experiences in the area of physical management of hospitals could confirm that the total estimated costs would be high, especially **because of the high number of vulnerabilities**.

The plan with a general description and the cost of each vulnerability at this point has to be addressed. The most likely probability is that the total expenditure would result to be too expensive for taking charge of all the necessary interventions at once.

The scientific and technical knowledge, coupled with the familiarity with the previous situation of the specific infrastructure, shall allow the technical experts, the managers, the medical and clinical staff, with the contribution of other specialists, if and when necessary, to make the **strategic prioritisation of the interventions**.

**This plan and its strategy of execution will have the goal to improve Preparedness, especially Emergency Preparedness, classified as potential in the short-term**, that is, to provide the selection of expected major points of weakness, based on the likelihood of the first hits and their degree.

In the meantime, the programme shall trace the proceeding in the improvement overtime of the resilience, with the consideration of the need to cope with the possible increase of the threats, as it is visible in the present patterns.

For the managers and decision makers of the Hospital concerning a Preparedness, that takes realistically into account the mutation of the risks related to Climate Change, this designed methodology should have at least three important features, which could constitute a useful “takeaway”:

- a. It gives a clear knowledge for them that their hospital complex **has not to be considered covered in all its vulnerabilities**, because of the decision to delay some of the works, therefore put in place specific measures of control in those points, knowing that they remain points of vulnerability.
- b. It allows to know the total costs of addressing the whole vulnerability of the Healthcare facility, therefore it gives a “scientific” help in evaluating when such a facility would be obsolete to the point of needing to be substituted with a new hospital, for it is not protectable against Climate Change risks, even with high investments.
- c. It produces necessarily a long-term programme, to be submitted to constant revision and updating which give the possibility of having the bases for a “seamless” passage from one administration to the other, with the possibility in the periodic revisions to evaluate the effective necessity and

impact on what was previously done (ex post evaluation, very important, and always so difficult to do).

## 8. CONCLUSIONS

The major goals of the research committed to S.I.A.I.S. TSO were declined according to the perceived need of the IFHE-EU members, also as expressed in a survey administered in 2023.

**1. Stimulate a more aggressive and impacting role of the Healthcare sector in the fight against Climate Change**, starting with reducing and progressively eliminating its contribution to create the problem, that is reduce its Carbon and Ecological footprints and applying the knowledge deriving from previous works produced in cooperation with other institutions and associations “A Healthcare Engineering Roadmap for Delivering Net Zero Carbon” published in 2021 and the previous study of S.I.A.I.S. TSO for IFHE-EU “Sustainable and Climate Change Resilient Healthcare Facilities in Europe: the Challenge” that was indicating a path for Resilience of the Hospitals against Climate Change diffused in 2018 and receiving a prize in the category of “Climate Fight leadership” in 2019 by Health Care Without Harm”.

**2. Act for a better understanding** of the importance of Healthcare Facilities after the experience of the pandemic generated by Covid-19, in parallel increase the know-how of all the operators working in Healthcare, concerning the present situation of the Healthcare new forms of protection related to Climate Change, also stimulating a better comprehension of this matters inside the Universities especially with medical, technical and social approach.

**3. Have a larger and updated vision of the European “actors”**, both institutions and associations, including the knowledge of the programmes and specific activities, that could be important for an expanded and solid presence of IFHE in Europe for the realisation of an effective European Health Union.

The research activity has reached its conclusion with another set of take away or at least issues for discussion, concerning **the proposed different way of approach to Preparedness**, that the most recent and dramatic events related to Climate Change, should better have the profile of **Emergency Preparedness**. At this regard the fundamental aspects that should be taken into consideration as necessary and innovative can be seen in:

- Different approach in evaluating possible risks related to Climate Change not based on historical trends, but projections in short and long terms. Collection of data coming from different Public Agencies, Scientific Institutions, Local Authorities of the area or areas with similar characteristics,
- Involvement of a variety of specialists’ indispensable for the vulnerability assessment, that should be covering every sector, and operational actions. Together with the evaluation of the potential gravity of the damage (Major / Severe / Catastrophic),
- List of vulnerabilities with the possible damages according to the threat, with in parallel indication of possible solution,
- Evaluation of the costs of taking care of each vulnerability,
- Plan correlating single vulnerability to the weight of its consequences and the likelihood of happening. In consideration of the high cost of intervening for all at once, determinant will be to make a
- Strategic plan for deciding the progression in time of the interventions to make.



As a follow up of this proposed vision of **Preparedness**, it would it should be given due consideration and become a stimulating objective for IFHE-EU, to envisage activating their members in producing “**case studies**”. The examples constitute a relevant help in highlighting the importance of protecting Healthcare Facilities and their expert technical operators in maintaining them.

Furthermore, as suggested in a recent article of EEA (European Environment Agency), the sharing of examples could give a relevant contribution in diffusing in Europe the perception of the need for a Preparedness that covers the new challenges of the Climate Change, that is becoming more and more unpredictably aggressive.

## KEY CONCEPTS

**European Green Deal:** it represents a comprehensive and ambitious plan to address Climate Change and environmental challenges while fostering economic growth and social progress. The primary objective is to achieve net-zero greenhouse gas emissions by 2050.

**Net-zero GHG emissions:** means achieving a balance between the amount of greenhouse gases produced and the amount removed from the atmosphere. It aims to minimize human-caused greenhouse gas emissions to as close to zero as possible, with any remaining emissions offset by an equivalent greenhouse gas removed from the atmosphere.

**Climate Drivers:** Are the factors that influence Earth's climate. They can be natural or human-caused.

### Natural

- **Solar Irradiance:** The amount of energy the Sun emits can vary slightly over time, affecting Earth's temperature.
- **Volcanic Eruptions:** Large volcanic eruptions can release ash and aerosols into the atmosphere, reflecting sunlight and causing temporary cooling.
- **Ocean Currents:** Ocean currents like the Gulf Stream transport heat around the planet, significantly influencing regional climates.
- **Earth's Orbit and Tilt:** Subtle changes in Earth's orbit and tilt around the Sun occur over very long periods (Milankovitch cycles), impacting the distribution of sunlight and contributing to ice ages.
- **El Niño-Southern Oscillation (ENSO):** This natural climate pattern involves fluctuations in sea surface temperatures and atmospheric pressure in the Pacific Ocean, leading to widespread weather changes.

The climate drivers interact in complex ways, making it challenging to predict the exact impacts on climate. However, scientific evidence strongly suggests that human activities are the primary driver of the current rapid warming trend.

Among the major **Human-Caused Climate Drivers** there are:

- **Greenhouse Gas (GHGs) Emissions:** The burning of fossil fuels (coal, oil, natural gas), deforestation, and industrial processes release greenhouse gases like carbon dioxide, methane, and nitrous oxide into the atmosphere. These gases trap heat, causing global warming.
- **Land-Use Change:** Deforestation, urbanization, and agriculture alter the Earth's surface, affecting how it absorbs and reflects sunlight, and impacting local and regional climates.
- **Aerosols:** Human activities also release aerosols (tiny particles) into the atmosphere, which can have both warming and cooling effects on the climate.

**Resilience:** Hospital resilience refers to a hospital's ability to withstand, absorb, and respond to disasters while maintaining critical functions, and then to recover to its original state or adapt to a new one.

**Redundancy in Healthcare Facilities** refers to the practice of having backup options or alternatives in place to ensure the continuity of operations.

## REFERENCES

The references reported and the end of each page or paragraph dealing with the issues examined, could be considered an adequate indication for further information. To facilitate the reader in the consultation, we have reported the full list of the foot notes, keeping the same number that the text.

- **01.** Daniela Pedrini, Simona Ganassi Agger “Sustainable and Climate Change Resilient Healthcare Facilities in Europe: The Challenge” S.I.A.I.S -Library -Technical Report n.1/2018
- **02.** IHEEM-IFHE-IFHE.EU- cef-NHS Countess of Chester Hospital-Hegma – “A Healthcare Engineering Roadmap for delivering net ZERO CARBON”
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By: Imogen Tennison, Sonia Roschnik et al: ”Health care’s response to Climate Change: a carbon footprint assessment of the NHS in England”
- **20.** <https://northeastnorthcumbria.nhs.uk/our-work/wider-impact/sustainable-healthcare/the-newcastle-upon-tyne-hospitals-nhs-foundation-trust/>
- **21.** <https://breeam.com/> Since 1990, BREEAM’s third-party certified standards have helped improve asset performance at every stage, from design through construction, through use and refurbishment. Millions of buildings around the world are registered to BREEAM’s holistic approach to achieve environmental and social governance (ESG), health, and net zero goals.
- **22.** <https://www.europarl.europa.eu/topics/en/article/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu#:~:text=Parliament%20adopted%20the%20EU%20Climate,global%20fight%20against%20climate%20change.>
- **23.** <https://www.catalyze-group.com/fund/horizon-europe/cluster-1-health/>

- 24. [https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages\\_en](https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages_en)
- 25. [https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union\\_en](https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union_en)
- 26. [https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/eu4health\\_en](https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/eu4health_en)
- 27. <https://eu4health.eu/an-inclusive-eu4health-programme-to-better-meet-the-needs-of-people-in-europe/>
- 28. [https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-of-life/european-health-union\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-of-life/european-health-union_en)  
[https://www.who.int/europe/groups/european-health-information-initiative-\(ehii\)#:~:text=The%20European%20Health%20Information%20Initiative,in%20data%20collection%20and%20reporting](https://www.who.int/europe/groups/european-health-information-initiative-(ehii)#:~:text=The%20European%20Health%20Information%20Initiative,in%20data%20collection%20and%20reporting)
- 29. [https://www.who.int/europe/groups/european-health-information-initiative-\(ehii\)#:~:text=The%20European%20Health%20Information%20Initiative,in%20data%20collection%20and%20reporting](https://www.who.int/europe/groups/european-health-information-initiative-(ehii)#:~:text=The%20European%20Health%20Information%20Initiative,in%20data%20collection%20and%20reporting)
- 30. <https://www.thelancet.com/action/showPdf?pii=S2666-7762%2821%2900180-0> Authors of the article: Michael Anderson, Rebecca Forman, Elias Mossialos
- 31. [https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-of-life/european-health-union\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-of-life/european-health-union_en)
- 32. **EEA Report 1/2024 European Climate Risk Assessment Report (PDF)** Publ.11 Mar 2024  
<https://www.eea.europa.eu/en/analysis/publications/european-climate-risk-assessment>
- 33. [https://climate-adapt.eea.europa.eu/en/metadata/publications/2023-xdi-global-hospital-infrastructure-physical-climate-risk-report?set\\_language=en](https://climate-adapt.eea.europa.eu/en/metadata/publications/2023-xdi-global-hospital-infrastructure-physical-climate-risk-report?set_language=en)
- 34. [https://www.europarl.europa.eu/doceo/document/TA-10-2024-0014\\_EN.pdf](https://www.europarl.europa.eu/doceo/document/TA-10-2024-0014_EN.pdf)
- 35. The four climate drivers are: 1. The Sun; 2. El Niño Southern Oscillation (ENSO); 3. Madden Julian Oscillation (MJO); 4. : Southern Annular Mode The Southern Annular Mode (SAM). Depending on the season, a certain climate driver may get a bigger influence than other drivers. That driver would then have a bigger influence on the weather that occurs during that season
- 36. Data from documents of the “World Meteorological Organisation”, documents of “UNDRR the United Nation Office for Disaster Risk Reduction” among others
- 37. <https://www.sciencedirect.com/science/article/pii/S0013935122020369>  
**“Climate change and health care facilities: A risk analysis framework through a mapping review”** authors: Jérémy Guihenneuc, Sarah Ayraud-Thevenot, Sonia Roschnik, Antoine Dupuis, Virginie Migeot
- 38. [https://www.who.int/health-topics/one-health#tab=tab\\_1](https://www.who.int/health-topics/one-health#tab=tab_1) One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.
- 39. <https://www.who.int/activities/promoting-health-in-all-policies-and-intersectoral-action-capacities> HiAP (Health in All Politics) is about integrated governance which promotes health and equity objectives and at the same time achieves mutual benefits for partnering sectors.
- 40.  
[https://www.google.com/search?q=european+climate+risk+assessment+eea+report+01%2F2024&rlz=1C1UKOV\\_itIT984IT984&oq=&gs\\_lcrp=EgZjaHJvbWUqCQgEECMYJxjqAjIICAAQIxnGOoCMgkIARajGCcY6gIyCQgCECMYJxjqAjIICAMQIxnGOoCMgkIBBAjGCcY6gIyCQgFECMYJxjqAjIPCAyQLhgnGMcBGOoCGNEDMgkIBxajGCcY6gLSAQ03NDE1ODYzMTlqMGo3qAIIIsAIB&sourceid=chrome&ie=UTF-8](https://www.google.com/search?q=european+climate+risk+assessment+eea+report+01%2F2024&rlz=1C1UKOV_itIT984IT984&oq=&gs_lcrp=EgZjaHJvbWUqCQgEECMYJxjqAjIICAAQIxnGOoCMgkIARajGCcY6gIyCQgCECMYJxjqAjIICAMQIxnGOoCMgkIBBAjGCcY6gIyCQgFECMYJxjqAjIPCAyQLhgnGMcBGOoCGNEDMgkIBxajGCcY6gLSAQ03NDE1ODYzMTlqMGo3qAIIIsAIB&sourceid=chrome&ie=UTF-8)
- 41. <https://unfccc.int/process-and-meetings/the-paris-agreement> The Paris Agreement is a **legally binding international treaty on Climate Change**. It was adopted by 196 Parties at the UN Climate

Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016.

- 42. [https://climate.ec.europa.eu/eu-action/adaptation-climate-change\\_en](https://climate.ec.europa.eu/eu-action/adaptation-climate-change_en)
- 43. [https://science.nasa.gov/climate-change/adaptation-mitigation/The goal of mitigation](https://science.nasa.gov/climate-change/adaptation-mitigation/The%20goal%20of%20mitigation) is to avoid significant human interference with Earth's climate, “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to Climate Change, ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner” (from the 2014 report on Mitigation of Climate Change from the United Nations Intergovernmental Panel on Climate Change, page 4)
- 44. <https://www.oecd.org/en/topics/health-system-resilience.html>
- 45. <https://www.aha.org/sustainability>
- 46. In early February, the Boston area experienced historically low temperatures, causing four local emergency rooms to close due to flooding from burst pipes. A February 19 article in The Boston Globe reported on the closures and explored a larger question: As Climate Change continues, and extreme weather events become more common, how will hospitals and health systems cope?
- 47. <http://rimed.org/rimedicaljournal/2021/11/2021-11-55-climate-baugh.pdf>  
“Beyond the Hazard Vulnerability Analysis: Preparing Health Systems for Climate Change “  
Authors: J.Baugh,K. Kemen, J. Messservy, P.Biddinger
- 48. <https://www.eea.europa.eu/en/analysis/publications/european-climate-risk-assessment>
- 49. <https://www.england.nhs.uk/wp-content/uploads/2023/02/B1697-Net-Zero-Building-Standards-User-Guide.pdf>
- 50. **Risk can be reduced by having redundant assets.** Redundancy involves the use of duplicate assets in critical areas in order to provide a backup in the event of failure, as well as to allow for operational flexibility during day-to-day operations.
- 51. Joshua BAUGH, Katie Kemen, John Messervy, Paul Biddinger “Beyond the Hazard Vulnerability Analysis: preparing health Systems for Climate Change” (link in previous not
- 52. <https://www.copernicus.eu/en>

## **References for cover page images**

### **Photo 1.** (top left)

Mercy Hospital - Joplin Missouri destroyed by tornado EF5

Photo from the presentation of Henry Powderly – article of Feb 09, 2015

Mercy readies new hospital in Joplin after tornado destroyed former facility

<https://www.healthcarefinancenews.com/slideshow/mercy-readies-new-hospital-joplin-after-tornado-destroyed-former-facility>

### **Photo 2.**

Rescue workers transfer medical workers with a boat at the Fuwai Central China Cardiovascular Hospital which was flooded following heavy rainfalls in Zhengzhou, Henan province, China July 22, 2021. China Daily via REUTERS. The photo appeared in an article by [Mariejo Ramos,Bukola Adebayo](#) Published: 12/02/2023

<https://www.context.news/climate-risks/thousands-of-hospitals-at-high-risk-from-climate-change>

### **Photo 3.** (bottom right)

After a flash flood overtook the hospital with raging waters 5-8 feet high, helicopters rescue staff and patients from the roof of Ballard Health's Unicoi County Hospital in Erwin, Tennessee -Virginia State Police photo.

[Ballard Health hospital knocked out by flooding, patients evacuated via helicopter from Hurricane](#)

### **Photo 4.**

Floods in Emilia-Romagna (Italy). Firemen help to evacuate patients of the Cotignola Hospital.

<https://www.cesenanotizie.net/cronaca/2023/05/19/cotignola-intervento-dei-vigili-del-fuoco-allospedale-maria-cecilia-hospital/>



## ANNEX

### Some conclusions from the responses to the survey's questionnaires

#### 1. The context

The Questionnaire was conceived as a significant way of understanding, in the area in which IFHE-EU is present with members and activities, the awareness regarding the problems relate to climate change inside the healthcare systems and the measures for resilience and mitigation taken specifically for and inside hospitals and in general healthcare facilities.

Obviously also from the responses of few, it is possible to learn, or at least to make hypothesis regarding certain aspects, as stimulus for further explorations.

This is what it is the aim to propose with these notes, which require a word of warning also regarding the fact that the situation highlighted is referred to answers collected before there was an intensification and increase in frequency of destructive events. Possibly some responses would need updating, because of the awareness acquired of the connection between such disasters and climate change has increased, and in parallel also the consciousness of the influence on such change of human activities, including also the ones deriving from healthcare services.

#### 2. The blank Questionnaire

##### **IFHE-EU study on the environmental impact of the healthcare sector**

###### *Introductory Note to the Questionnaire*

[S.I.A.I.S.](#) (*Italian Society of Architecture and Engineering for Healthcare*) is realising a study for [IFHE-EU](#) (*International Federation of Healthcare Engineering*) regarding the awareness of the Healthcare Top Management that the Healthcare sector is responsible for 4-5% of global total carbon emissions and generates significant demands for energy and materials, as well as dangerous waste streams that may cause air, soil and water pollution.

With the European Green Deal programme of the European Union, as you certainly known, the EU commits to reducing net greenhouse gas emission by at least 55% by 2030, and to reach zero net emissions by 2050, and the health and care sector is called to contribute.

In this framework, S.I.A.I.S. and IFHE-EU consider important to have a better understanding of the awareness, as said above, of the Top Management regarding the present situation and in the meantime to register the preparedness to act in taking the necessary, urgent and possible measures to make the Healthcare Systems green /greener and sustainable. In their function of entities devoted to the diffusion of knowledge and improvement of their members, they will be better equipped to perform this role, especially in the area of fighting climate change and related human and environmental risks.

We are certain that, understanding the strategic importance of this goal, you will collaborate with us compiling this questionnaire, which results will be diffused as well as the initiatives that will be proposed, together with other organisations in the Healthcare field, that are already giving support to our initiative.

Thank you for your cooperation

President of S.I.A.I.S.  
(Eng. Daniela Pedrini)

#### **General data**

1.Name of the Healthcare Authority and location

2.Name of the Hospital/Hospitals belonging to the same Authority

3.Type (general Hospital / children's Hospital/ etc.)

4.Size by n. of beds

- ☐ up to 200
- ☐ 201-500
- ☐ 501-1.000
- ☐ more than 1.000

5.Total number per year of inpatients

- ☐ 10000
- ☐ 10000/ 50000
- ☐ more than 50000

6.Total number per year of outpatients

- ☐ 10.000
- ☐ 100.000
- ☐ 500.000
- ☐ more than 500.000

7.Total number of the staff, of which n. of medical staff

8.Area of catchment by location of inhabitants' approximate percentage

- ☐ local 80% or more
- ☐ metropolitan, 80% or more
- ☐ regional, 80% or more
- ☐ national, 30% /50% or more

### General questions

9.General Director: First Name and Last Name

10.Person answering the form (if different from the General Director)

First Name, Last Name and Role:

11.Do you consider climate change an important issue?

- ☐ Yes
- ☐ No

12.Do you think Climate Change has an impact on the environment?

- ☐ Yes
- ☐ No

13.Do you think Climate Change has an impact on human health?

- ☐ Yes
- ☐ No

14.It is estimated that the health care sector globally is among the highest producers of Green House Gases (GHG). (Source: EU – European Green Deal), Are you aware of this?

- ☐ Yes

☐ No

### Hospital's Emissions

15. According to Climate Change Researchers and Technical Experts, the following hospital areas and related activities are the main responsible for GHG emissions:

- Buildings and plants management, including energy-intensive loads fed with non-renewable sources;
- Transportation: hospital staff movements, ambulances, patients' family members' trips;
- Sanitary waste, including single-use plastic items;
- Food waste;
- Anaesthetic gases, drugs and medical devices;
- Devices for outpatients' tests and analyses.

Do you agree?

☐ Yes

☐ No

16. Would you exclude/include any item from/to the list?

### Actions undertaken by the Hospital

17. Did you undertake any action /project in your hospital to reduce GHG emissions in one or more of the above areas?

18. Can you briefly describe them?

19. Did you measure the results?

20. Can you express the results obtained in tons of oil equivalent and/or tons of CO<sub>2</sub> avoided?

21. Can you give us some documentation or tell us where to find it?

22. Did you measure the level of resilience of your infrastructure with respect to climate change-related events (e.g. storms, fires, floods and other extreme weather/natural event)?

23. Did you take any adaptation or mitigation action?

24. Do you have an emergency plan for climate change risks?

### Actions planned

25. Do you have projects and plans of intervention for your hospital in one or more of the above areas?

26. Can you briefly describe them?

27. Have you planned how to measure the results?

28.Can you give us some documentation or tell us where to find it?

29.In case of no actions or plans: reasons for no activity

- ☐ Lack of financial support from the regional /national institutions
- ☐ Difficulties to find the expertise to plan, implement and evaluate the interventions.
- ☐ Difficulties to find time to plan, implement and evaluate the interventions.
- ☐ Lack of regional or national guidelines
- ☐ Others

30.Which of the following areas would you prioritize?

- ☐ Buildings and plants management, including energy-intense loads fed with non-renewable sources
- ☐ Transportation: hospital staff movements, ambulances, patients' family members' trips
- ☐ Sanitary waste, including single-use plastic items
- ☐ Food waste
- ☐ Anaesthetic gases, drugs and medical devices
- ☐ Devices for tests and analyses

*Submit the questionnaire*

### **3. The answers**

Regarding the areas of origin of the answers there are:

- Austria                      5 answers of which one concerning a group of 7 hospitals and another of 6
- Belgium                    3 answers
- France                      4 answers one representing 13 public hospitals
- Greece                      6 answers mostly in islands and serving groups of islands
- Iceland                    1 hospital
- Italy                          6 one representing 6 public hospital and one private
- Switzerland              1 hospital
- United Kingdom        4 one regarding 10 NHS Hospitals and another 3

In total they were received 30 answers, partially covering the European Union. In addition, the United Kingdom, Iceland and Switzerland.

The majority was constituted by Public General Hospital, some included a Children sector, one only Children Hospital, a couple were private Hospitals.

It is very difficult to try conclusions regarding the staff and the medical part of it, nor it was possible to establish a correlation with the number of the facility beds or the yearly patients and outpatients. This due to the fact that many did not put numbers, simply using what was printed in the questionnaire (e.g. 501-1000 as n. of beds).

It is not possible to make considerations with regard to the numbers given for the staff and the medical staff because of the different mode of giving the numbers (e.g. some with all the staff together, some making subdivisions into medical categories).

A part few do not answers, the numbers were in general high.

- The questions from D.11 to D.14 with issues regarding Climate Change as an important issue, its impact on human health etc. the answer was in all the questionnaires received *YES*, there were however 4 not aware (or disagreeing) (D. 14) that the healthcare sector is a high producer of GHGs.

**This is certainly an aspect that IFHE-EU should take into consideration in the actions to increase awareness**

- The question D.15 furthermore was listing the major activities of the hospital responsible for producing GHGs and received 100% of yes. Interesting the D.16 follow up asking to take away or add items to that list. The majority was further stressing some items like surgery gases – waste and textile. The addition list in some answers was detailed, further stressing plastic packaging, transport and activities performed for services out of the hospital (e.g. laundry, sterilisation).
- Regarding questions from D.17 up to D.23, the answers, as a whole, look quite unsatisfactory: Only a few (England- Scotland and Iceland) state to have taken action, some give some measurement of the results obtained. Measures for resilience and mitigation have been taken by few and some indicate them basically with actions for energy saving or introduction of renewable energy.

**In other terms: as general evaluation of these groups of answers it can be stressed that a lot of activity needs to be done.**

- The questions from D.24 and D.28 concern the realisation of an emergency plan connected to Climate Change related risks. A part a certain number of cases of avoiding the question, the answer “yes” was present in several responses, in many more cases than the other types of protection, such as mitigation, resilience etc. It is relevant that some of the questionnaires that indicated what they have done, declared to have realised barriers against flood, which matches the known vulnerability in same parts of Europe related to floods.
- Answer D.29 deserve attention first for the many no – answer at all. Among the respondents two indicated the lack of money assigned by National and Regional Governments. Some have stressed the lack of regional guidelines, one stressed the difficulty in finding expertise.
- Answer D.30 was requested of the area to prioritize for actions to reduce GHGs the answers were not numerous and the indications were touching several areas such as Anaesthetic gases, drugs and medical devices, management of buildings and plants, more renewals, one indicated sanitary waste, plastic use and especially mono-use.

In the questions asking about what they had done, some respondents posted links for more information.

The list is reported here.

#### **4. Links related to survey's answers**

##### **1. North East England NHS - District General Hospital**

<https://www.nth.nhs.uk/resources/our-green-plan-2021/#:~:text=We%20know%20that%20we%20need,by%20a%20minimum%20of%205%25.>

##### **2. I.R.C.C.S. Burlo Garofolo di Trieste**

[www.tecnicaospedaliara.it/irccs-burlo-garofolo-tra-efficienza-e-sostenibilita/](http://www.tecnicaospedaliara.it/irccs-burlo-garofolo-tra-efficienza-e-sostenibilita/)

##### **3. National hospital of Iceland, Reykjavik, Iceland**

<https://www.landspitali.is/um-landspitala/spitalinn-i-tolum/starfsemistolur/#Tab7>

[https://www.landspitali.is/library/Sameiginlegar-skrar/Gagnasafn/Rit-og-skyrslur/Umhverfismal/Overview of environmental aspects 2013-2022.pdf](https://www.landspitali.is/library/Sameiginlegar-skrar/Gagnasafn/Rit-og-skyrslur/Umhverfismal/Overview%20of%20environmental%20aspects%202013-2022.pdf)

##### **11. Oberösterreichische Gesundheitsholding (ÖÖG) - Austria, Upper Austria, Linz**



[https://www.ooeg.at/fileadmin/media/ooeg/Dateien\\_PDFs\\_Worddokumente\\_/Geschaeftsbericht\\_OOEG\\_2021\\_Finanzteil.pdf](https://www.ooeg.at/fileadmin/media/ooeg/Dateien_PDFs_Worddokumente_/Geschaeftsbericht_OOEG_2021_Finanzteil.pdf)-->Page No.9

[https://www.ooeg.at/fileadmin/media/ooeg/Dateien\\_PDFs\\_Worddokumente\\_/Strategiefolder.pdf](https://www.ooeg.at/fileadmin/media/ooeg/Dateien_PDFs_Worddokumente_/Strategiefolder.pdf) last page based on this we are just working out an "action plan" on all ESG (environment, social and governance) parts

**13. Barmherzige Brüder Österreich / St. John of God Austria**

EMAS certification: reduce energy consumption, Recycling of Anaesthetic gases, switch to renewable energy, optimisation waste management

**14. NHS Western Isles Scotland: (1) Western Isles Hospital; (2) Uist & Barra Hospital; (3) St Brendans Hospita**

<https://www.wihb.scot.nhs.uk/about-us/publications/>

<https://lanthide.org/outer-hebrides-climate-rationale-and-case-for-action/>

**23. Regional Health Authority of Peiraeus and Aegean, Greece**

[www.vardakeio.gov.gr](http://www.vardakeio.gov.gr) and all our participation presentations in GGHH seminars and conferences

**29. Centre Hospitalier Universitaire de Nantes – France**

<https://bilans-ges.ademe.fr/bilans/consultation/93b85316-b1cd-11ed-8fce-005056b7acd1/fiche-identite>

**Note:** the number before the name of the hospitals refers to the list of the 30 questions received.

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## **Società Italiana dell'Architettura e dell'Ingegneria per la Sanità - ETS**

## **Italian Society of Architecture and Engineering for Healthcare - TSO**

**Member n. A044 of IFHE – International Federation of Healthcare Engineering**

**Member of IFHE-EU Regional Group**

S.I.A.I.S. - TSO, the Italian Society of Architecture and Engineering for Healthcare is a nonprofit association registered as a Third Sector Organization (TSO) under Italian Legislative Decree No. 117/2017.

The Society brings together professionals, academics, institutions, and companies involved in the planning, design, construction, and management of healthcare facilities and systems.

We promote innovation, quality, and sustainability in healthcare architecture and engineering. Our mission is to improve the built environment of healthcare settings through interdisciplinary dialogue and the integration of scientific, technological, and human-centered approaches.

Our Activities are:

- Organizing national and international conferences, seminars, and workshops,
- Promoting research and best practices in healthcare facility design,
- Supporting education and professional development in healthcare architecture and engineering,
- Facilitating collaboration between public and private stakeholders,
- Participating in European and international projects in the healthcare and social infrastructure sectors.

We believe that well-designed healthcare environments play a crucial role in delivering high-quality care, enhancing patient experience, and supporting the work of healthcare professionals. Our goal is to contribute to the development of resilient, inclusive, and future-ready healthcare infrastructures.