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Disaster risk reduction and interdisciplinary education and training

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ABSTRACT

Natural and technological disasters and health emergencies are increasingly causing human and economic losses and disruptions. Disaster risk reduction can be effectively achieved only through a comprehensive approach aimed at connecting and integrating all the actors involved in forecasting, preventing, managing and mitigating disaster risk and its consequences. Furthermore, disaster risks can certainly be minimized by transferring to the relevant institutions and the general public valid and reliable knowledge on the nature, causes and effects of such disasters. A virtuous and effective approach to this matter is shown by the innovative Academic Upgrading Course on Territorial, Environmental and Health Emergencies (EmTASK) offered by the University of Modena and Reggio Emilia (Italy), which has proved to be a powerful tool for sharing experiences and raising attention and awareness on disaster risk reduction needs within both the workforce involved in disaster management and the general public. Before introducing the EmTASK Course, this paper provides an overview of the environmental, socio-economic and health issues related to the main natural and technological disasters recently occurred in Italy, focusing also on epidemics including the ongoing COVID-19 pandemic. Special attention is paid to the Emilia-Romagna region (northern Italy) that was hit by severe disasters in the last decade, caused by earthquakes, floods and landslides. The experience achieved in emergency and disaster management by local, regional and national institutions clearly shows that interdisciplinary policies and interventions, moving beyond traditional public health and emergency responses and activities, are needed to prevent or minimize the effects of disasters. New and innovative approaches, such as the EmTASK education and training initiative, should be pursued and enhanced, since they facilitate the integration of knowledge and experience achieved during past emergencies, and definitely raise preparedness to better cope with risks and related emergencies at different scales and levels.

1. Introduction

The incidence of natural or technological (i.e. anthropogenic) hazards and health emergencies is steadily increasing all around the world. The Global Risks Report (2020) [1] confirms that natural hazards "account for three of the top five risks by likelihood and four by impact". However, also human-induced hazards reveal very high levels in terms of likelihood and impact (Fig. 1).

Preventing the effects of hazards requires interdisciplinary and transdisciplinary policies and interventions, moving beyond traditional public health and emergency services. The socio-economic impact of a disaster is a function of hazard and vulnerability that is usually defined as a function of exposure, sensitivity, and adaptive capacity [2]. For instance, according to Watt et al. [3], "owing to impressive poverty reduction and health adaptation efforts, this increase in weather-related disasters has not yet been accompanied by any discernible trend in number of deaths or in number of people affected by disasters. One plausible conclusion is that this represents an increase in health service provision and risk reduction". Despite this, the health impact of disasters (natural and technological) is foreseen to increase in the next few decades, also in high income countries, proving that no country is immune [4].

As commonly recognized, several conditions contribute to rising impact of disasters through increased individual and collective vulnerability, including:

- Increased population density;
- Increased settlements in high-risks areas;
- Increased technological hazards and dependency;
- Increased terrorism;
- Aging populations in industrialized countries;
- Emerging infectious diseases (one among all, COVID-19);
- International travel.

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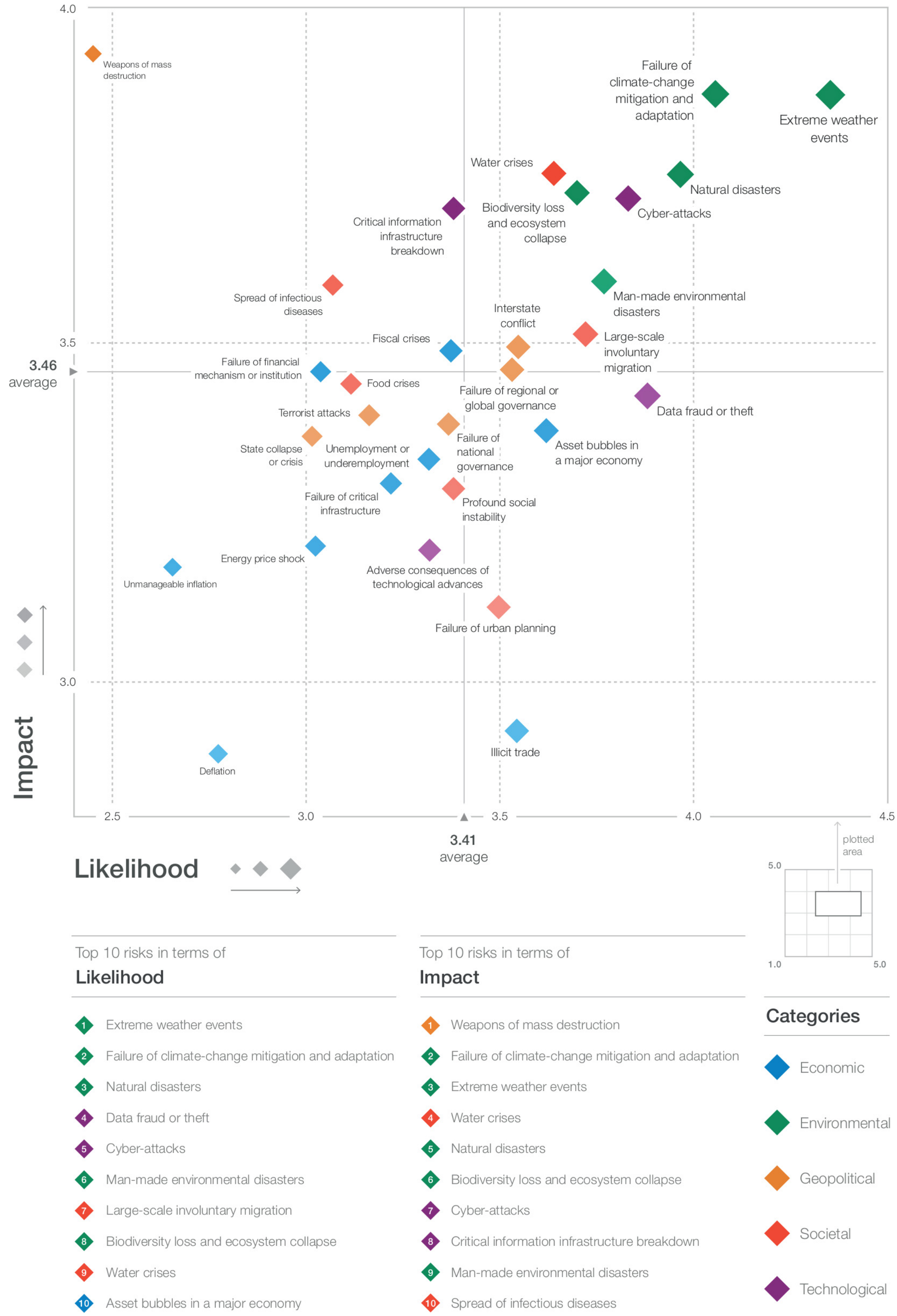

Fig. 1. The Global Risks Landscape 2020. Source [1].

More in general, if the frequency and severity of disasters increase, the cost of catastrophic loss will soar, with governments, corporations, aid organizations and tax payers being left to bear the costs. As such, integrating health and environmental risks in an overarching model may lead to a reduction of societal costs. These intrinsic features could help better overcome the main difficulties encountered in disaster events: lack of integration among institutions, disciplines and professionals (Academia, NGOs, International Organizations, Government) before, during and after the event.

After describing main disaster risk issues in Italy, and referring to the specific context of the Emilia-Romagna region located in the north of the country, this paper presents the EmTASK Upgrading Course on Territorial, Environmental and Health Emergencies – offered since 2017 at the University of Modena and Reggio Emilia - UNIMORE (Emilia-Romagna, Italy) – as a powerful tool for raising attention and awareness of disaster risk reduction needs. The Course has been built with the main goal of providing the participants with interdisciplinary skills that can foster a holistic approach in forecasting, prevention, management and overcoming of emergencies, thus trying to reduce the lack of integration among institutions disciplines and professionals highlighted beforehand. For this reason, we would like to highlight the Course as a reliable educational mean to reinforce the civil-protection and the risk-prevention systems at any level, through the sharing of specific knowledge among the various sectors dealing with disaster management and treasuring the experience acquired in the management of past emergencies at local and national levels.

2. Disasters in Italy: Data overview

According to the worldwide rise of vulnerability to natural and human-induced hazards, the Mediterranean region and Italy are particularly exposed to several natural and technological hazards. In addition, this region is characterized by a high population density and by highly developed productive, industrial and tertiary systems with an international vocation, which can favour the occurrence of health emergencies related to epidemics or pandemics. Disasters and epidemics can have a ruinous impact on the environment, populations and their physical and psychological health, resources and infrastructures of a country – especially when prevention, preparedness and response are not promoted – and can seriously undermine the efforts for sustainable development in the region.

The most significant risks in the Mediterranean region can be ascribed to seismic activity, hydro-geological events (floods and landslides), forest fires, industrial hazards (explosions, chemical accidents or toxic gas leakage), maritime pollution (oil spills), tsunami and extreme meteorological events, also related to climate change [5]. Furthermore, during the last few decades, infectious disease outbreaks, caused by both emerging and endogenous pathogens, have assumed an increasing importance [6].

It must be underlined that natural hazards can trigger technological disasters. Many technological facilities such as fuel storage plants, chemical plants, power generation plants etc., are located in natural hazard-prone areas. The most frequent natural events that can cause technological disasters are extreme rainfall, floods, extreme winds and earthquakes. The potential consequences for technological plants or systems span a very wide range, including release of hazardous material, damage to oil and gas pipelines, damage to lifeline systems etc. In particular, it is worth to mention two examples of huge global impact: Chernobyl [7] and Fukushima [8].

Due to earthquakes, active volcanoes and slope instability, Italy is one of the European countries at greater risk due to natural hazards. The WorldRiskReport 2019 [9] places Italy at the rank n. 121 all over the world with (overall) World Risk Index (WRI) of 4.57. The 2017 edition of the same report [10] underlines that “By way of example: In Italy in 2016, sufficient numbers of emergency rescue services were on hand in Amatrice and the surroundings areas and were able to support or lead relief efforts for the affected population. However, the design of newer building structures and the lack of safeguards against earthquakes in older buildings were heavily criticized.”. This means that preparedness measures for risk minimization and compliance with building regulations, in addition to the safeguarding of infrastructure and long-term structural and institutional adaptation to the impact of extreme natural events and climate change must be highly improved.

The occurrence in Italy of natural disasters over the last 60 years and of technological ones from 1976 onwards, as reported by the Emergency Events Database (EM-DAT) developed by the Centre for Research on the Epidemiology of Disasters (CRED) at the Université Catholique de Louvain, Brussels, Belgium [11], is shown in Fig. 2.

The general tendency in Italy shows that the number of natural emergencies occurred more frequently from the Nineties onward, even though it must be taken into account that in the last 30–35 years data collection improved. Nonetheless, it is noteworthy that technological disasters have also constantly been increasing during the last 20 years.

2.1. Natural hazards and disasters

Human societies have had long experience of naturally occurring climatic changes. The ancient Egyptians, Mesopotamians, Mayans and European populations were all affected by nature's great climatic cycles. More importantly, disasters and outbreaks of disease have occurred often in response to the extremes of regional climatic cycles. Hippocrates already recognized that people cannot understand diseases without looking at the wind, the sun and humidity [12].

As in other areas, populations in Italy are exposed to an increasing frequency and intensity of extreme events and weather variability and to long-term changes in mean temperature and precipitation [13]. The actual future impacts on human health will very much depend on the character, magnitude and rate of climate variation to which “health” is exposed and the actual sensitivity and the ability of populations, governments and health systems to cope with the consequences.

Since the late 1980s, natural hazards have had a stronger impact on the environment. The trend for the annual number of natural hazard accidents is more obviously upward than that for major industrial accidents.

Natural hazards, such as earthquakes and landslides, are often more devastating, in terms of loss of life and environmental damage, and also have the potential to precipitate technological hazards. As with technological accidents, the consequences depend both on the magnitude of the event and on factors such as population density, risk-prevention measures and emergency planning. In general, the more a population is characterized by socio-economic fragility, the more extreme will be the consequences of the natural events. We will return to this point later.

The natural disaster trend in Italy is shown in Fig. 3. Ground movements are constantly relevant throughout the overall period. Heat waves, extra-tropical storm, drought and severe winter condition and riverine flood are getting more and more frequent in the last 20 years.

The ten most serious disaster events according to the impact in terms of number of deaths occurred in Italy from 1960 are shown in Table 1. The 2003 extreme temperature has been the most harmful. The same order of magnitudes in terms of mortality effects have been observed all over Europe [14,15]. In 1980 the most relevant disaster in terms of number of deaths occurred in Irpinia (Southern Italy) hit by an earthquake with a magnitude of 6.9 causing more than 4600 deaths, 7700 injured and 250,000 homeless [16,17]. After that event, in Italy, it has been settled the Civil Protection Agency, which now guarantees an effective response to emergencies organization. The 1963 landslide happened close to the Vajont dam caused a wave of 250 m and 50 million cubic metres of water overtopping the dam and leading to the complete destruction of several buildings and more than 1900 deaths [18–20].

In general, earthquakes have been the most harmful events in terms of deaths, number of people involved and cost damage, causing 5 over the 10 most impacting natural disasters in Italy. As such, it is of outstanding importance to understand and prevent such a risk. However, recently, it has been raised the importance of meteorological extreme events, mainly for their impact on agriculture. In 2018, in Italy, there have been 1042 extreme meteorological events in comparison with 395 in 2008. They increased three times (+164%) involving all the regions from the north to the south [21].

2.2. Technological hazards and disasters

Although agencies measure the severity of disasters by the number of people killed, it is becoming increasingly important also to look at the number of affected ones. Across the world, almost a thousand times more people are affected by disasters than are killed [11] and, for many of these people, survival after the disaster is becoming increasingly difficult, leaving them more vulnerable to future shocks. This point is relevant not only for natural disasters but also for technological disasters, especially in the case of chemical accidents whose effects on exposed people may become apparent after years or even decades. Addressing human vulnerability to hazards is at the heart of risk preparedness and prevention strategies.

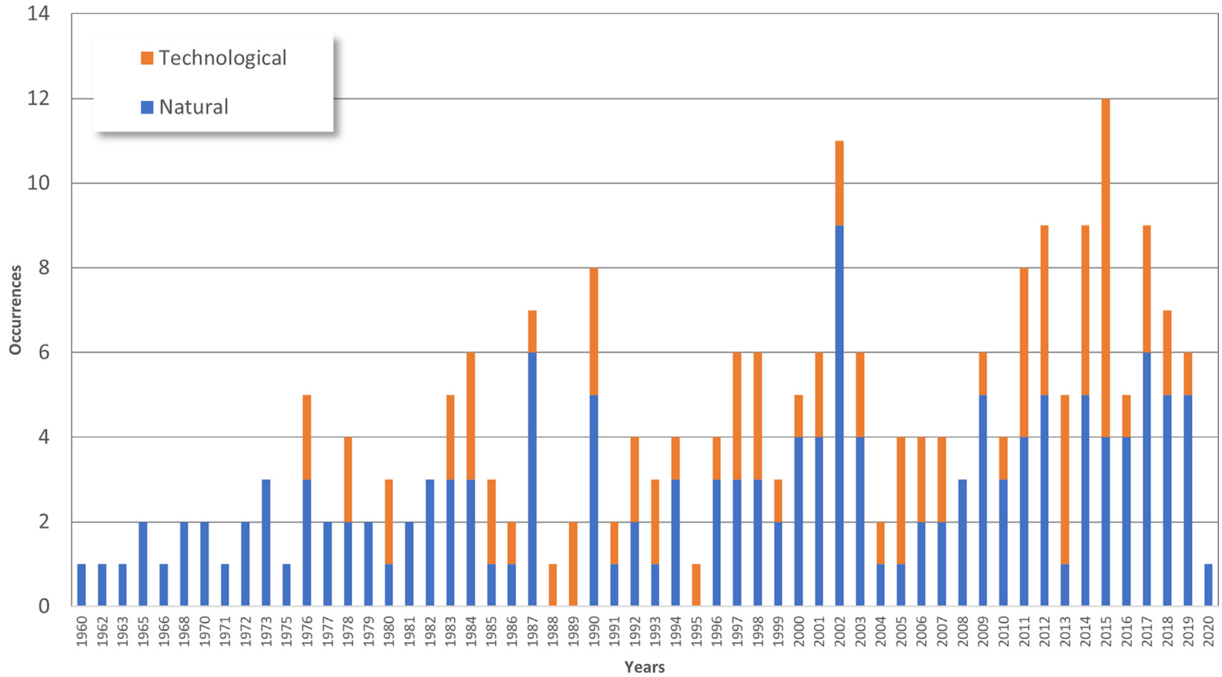

Fig. 2. Time trend of disasters in Italy 1960–2020. Created on October 7th, 2020. Source: [11].

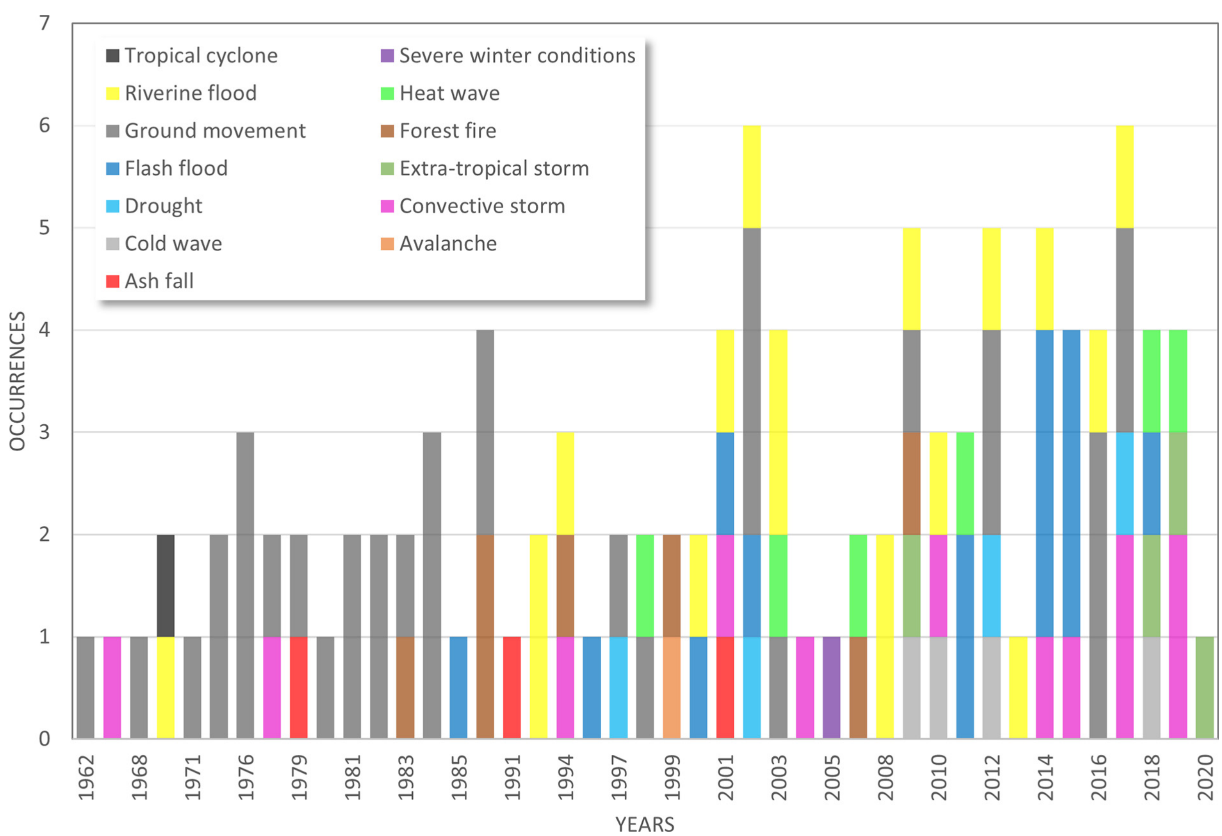

Fig. 3. Time trends of natural disasters in Italy 1962–2020. Created on October 7th 2020. Source: [11].

The first documented chemical disaster with industrial origins goes back to the 1600s [22]. Today's chemical disasters differ in the way they happen and in the type of chemicals involved. Their potential hazard is a function both of the inherent nature of the chemical and the quantity that is present on site. A common feature is that they usually are uncontrolled events involving fires, explosions or releases of toxic substances that result either in the death and injury of a large number of people inside or outside the plant, extensive property and environmental damage, or both.

Overt disasters are environmental releases, which leave no ambiguity about their sources and their potential harm.

Table 1
The ten most serious natural disasters in Italy from 1960 on. Source: [11].

Type	Date	Place of occurrence	Totals deaths
Extreme temperature	16/07/2003	All Italy	20,089
Earthquake	23/11/1980	Avellino, Potenza, Caserta, Naples (Campania Region)	4689
Landslide	09/10/1963	Vajont dam, Longarone, Belluno and surroundings (Veneto and Friuli-Venezia-Giulia regions)	1917
Earthquake	06/05/1976	Friuli-Venezia-Giulia Region	922
Earthquake	24/08/2016	Marche, Umbria, Lazio regions	296
Earthquake	06/04/2009	L'Aquila Province (Abruzzo Region)	295
Earthquake	15/01/1968	Belice Valley (Western Sicily)	224
Landslide	01/05/1998	Campania Region	160
Flood	02/11/1968	Asti, Biella, Novara (Piedmont Region)	72
Flood	4/11/1966	Florence, Venice etc.	70

The industrial disaster occurred in Seveso [23] (northern Italy) plays the role of prototype for overt chemical industrial disasters. The accident took place on 10 July 1976 in the Seveso area, close to Milan, Italy, in a plant where trichlorophenol was produced, and it caused the contamination of several square kilometres of populated countryside by the powerfully toxic 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). More than 700 people were evacuated, and restrictions were applied to another 30,000 inhabitants and both acute and long term health effects occurred [23].

Slow-onset disasters may become apparent only because human targets are clearly and rigorously investigated, as happened for the ILVA steel plant in Taranto (Apulia region, Southern Italy), a case widely known across the world.

The ILVA steel plant is the largest in Italy and the EU with an annual production capacity about 10 million tons of steel, 40% of Italian steel production. It started its production in 1965, as a state-controlled company and, afterwards, it has been run by some private companies. Such a vast industrial site was built very close to residential areas of Taranto which currently has about 200,000 inhabitants [24]. An epidemiological survey produced as part of the Court of Taranto's judicial proceedings showed that the exposure to industrial emissions had caused an impressive level of pathologies and mortality in the area, including 386 deaths, 237 cases of malignant tumour, 247 coronary events and 937 cases of hospitalization for respiratory diseases, mostly in children. More recent and sophisticated studies confirmed such figures and conclusions [25].

In Italy in the last 20 years the technological disasters due to transports (via water, road, air and rail) are becoming more and more frequent and deathly (Fig. 4).

2.3. Health emergencies: Epidemics and pandemics

As shown in the two sections above, natural and human-induced disasters often result in significant impacts on people's physical and mental health, causing direct and indirect effects, including deaths, injuries, acute or chronic diseases, disabilities and psychosocial problems.

According to the unprecedented health emergency due to COVID-19 pandemic a specific focus has been devoted to the various issues (i.e. environmental, epidemiological, social) dealing with infectious disease outbreaks, epidemics and pandemics with a particular regard to COVID-19 itself.

When addressing infectious disease outbreaks, it is important to keep in mind that the distinction between global and local has been shown to be largely insufficient. A local "mistake" can quickly "spill over" the planet. More than this, what is now emerging is that nowadays, even more than in the past, combining the environment protection and health is an absolutely necessary choice for the well-being of man and the whole ecosystem. In other words, environmental changes such as climatic ones, even if triggered by regional/local political choices such as deforestation, intensive farming, energy production based on an "all-and-now" profit approach, have the potential to affect all human kind health.

Actually, during the last few decades, infectious disease outbreaks, often favoured by local or regional environmental changes and distress, have assumed an increasing importance worldwide. From 2000 to 2019, thousands of outbreaks across countries were recorded [11,26]. Major epidemics related to new and re-emerging infectious diseases, such as Ebola

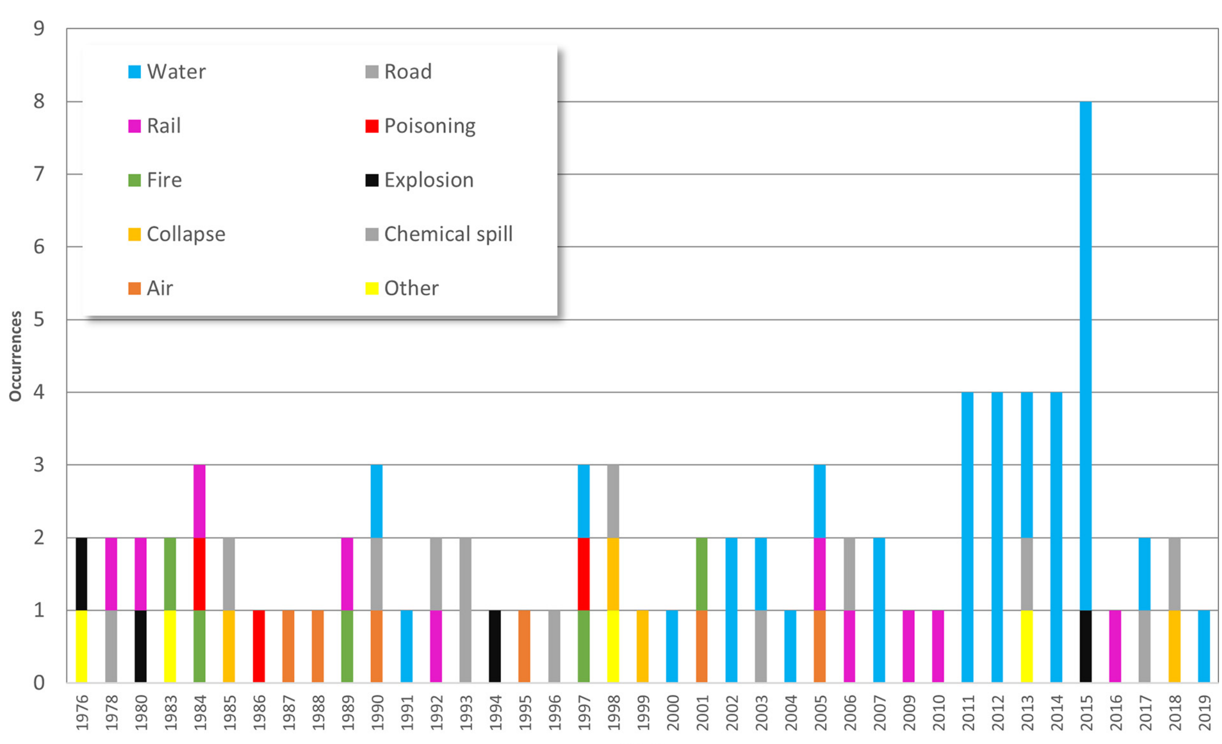

Fig. 4. Time trend of technological disasters in Italy 1976–2019. "Water, Road, Rail and Air" are Transport Main Type Disaster. Created on October 7th 2020. Source: [11].

virus disease (EVD), Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and cholera, have affected many highly vulnerable communities and caused a large number of deaths worldwide. Furthermore, after the 3 well known flu pandemics occurred in the last century (the 1918, the 1957–1958 and the 1968 flu pandemics), in 2009 a new flu pandemic spread across the world causing an estimated number of deaths ranging between 100,000–400,000, 80% of which occurred in people younger than 65 years of age [27].

Finally, at the end of 2019 a new infectious disease, the coronavirus disease 2019 (COVID-19) caused by a novel beta-coronavirus of the same subgenus as the one responsible for SARS, and, therefore, named the Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2), was firstly detected in China. From this country, it has rapidly spread worldwide, becoming one of the most difficult health emergencies faced by humanity in modern history due to its severe clinical presentations, its fatality rate and its highly effective in inter-human transmission. With its great potential of overwhelming health systems, this pandemic represents a serious threat not only to global health, but also to global economy and security. Since 31 December 2019 as of 28 February 2021, over 113 million confirmed cases of COVID-19 have been reported worldwide (Fig. 5), including more than 2,5 million deaths [28,29].

Massive response and reorganization of hospital infrastructures - together with national lockdown measures and specific public health preventive measures aimed at contrasting transmission via droplet of SAR-COV-2 - have been implemented worldwide to respond to the epidemics and to mitigate its impact on population according to Strategic preparedness and response plan set up by World Health Organization [30]. The economic and social impact of the pandemic is dramatic; according to the International Monetary Fund, the global economy now faces its worst downturn since the Great Depression [31]. To support the global response and to help fight coronavirus and protect states with weaker health systems WHO has activated the COVID-19 Solidarity Response Fund asking for important donations and support by countries, private and public sectors and general population [32].

Italy was one of the first countries involved in the pandemic and one of the most affected. The first confirmed cases were detected on 31 January 2020, when two Chinese tourists in Rome tested positive for the virus. Later a cluster of cases with the first deaths was detected in a northern region (Lombardy) on 21 and 22 February and, by the beginning of March, the virus had spread to all regions of Italy. As of 28 February 2021, over 2.9 million cases were detected and ca. 97,000 deaths were recorded (Fig. 6). However, due to the limited number of swabs performed at least at the beginning of the epidemics, the real number of infected people is estimated to be much higher than the official count [33].

Further, recently, in Italy epidemics caused by vector-borne diseases, are (re)-emerging as well. They are mainly due to an increase in the spread, since the 1990s, across different parts of the European region of invasive mosquitoes, in particular, *Aedes albopictus* and *Aedes aegypti*, both known vectors of arboviruses such as Dengue, Chikungunya and Zika virus [34] [35]. Moreover, in 2018 in Italy an outbreak of West Nile disease, caused by an imported virus effectively transmitted also by the native Culex mosquito, has been reported as well (Fig. 7). It has been responsible for a total number of 576 infections, of which 68% developed the most serious neuroinvasive clinical manifestation ending with death in 46 cases, with a 10.9-fold increase of cases compared to the previous transmission season [36].

The European Centre for Disease Prevention and Control (ECDC) has therefore produced guidelines to support the implementation of tailored surveillance for invasive and native mosquito species of public health relevance providing accurate information and technical support for focused data collection and suggesting adaptations according to the evolution of the epidemiological situation [37].

Recurring clusters of communicable diseases, such as the Legionnaires' disease caused by a water-borne Legionella pneumophila, or meningitis and invasive diseases caused by different bacteria, virus or other microorganisms, are occurring in different Italian areas. All these clusters require important public health actions in order to stop transmission and mitigate health effects, including epidemiological investigations of the source of transmission, case and contact tracing and surveillance, environmental sanitization of the areas involved and, when recommend, vaccination campaigns [38].

Global efforts to reduce the impacts of emerging epidemics mainly focus on outbreak control, quarantine, drug, and vaccine development. However, clinical and public health management of ongoing health emergencies presents many challenges and highlights many weaknesses at local, national and international levels. Massive pandemics clearly show that no single country is adequately prepared to tackle effectively the sudden spread of a disease, emphasizing the importance of a careful planning and implementation of preventive policies and programs during the preparedness phase of a pandemic management cycle. Traditionally, health sector activities have focused on response to health emergencies and epidemics. However, actions undertaken during the response phase are able to mitigate promptly the impact and the consequences of epidemics only if during the preparedness phase a more proactive approach is set up with the aim of enhancing health systems capacity and flexibility and to build up the resilience of countries and communities, including fragile, low- and high-resource settings and populations.

For all these reasons, health impacts related to epidemics or caused by natural or human-induced disasters could be more effectively reduced by a comprehensive approach connecting health to the other sectors that are involved in preventing and reducing consequences of natural or technological emergencies and disasters. To address this issue, the WHO has recently set up a guideline framework merging health emergency and disaster risk management (health EMRM) in order to develop and to consolidate common multisectoral approaches and practices able reduce health risks across a continuum of prevention, preparedness, readiness, response and recovery [39].

3. Environmental, economic and social health fragility: Some principles and experiences

3.1. "One-health" as paradigm of global emergency preparedness

On the occasion of the current COVID-19 emergency an exceptional attention has been paid to the relationship between environment, animal and human health (One Health approach [40,41]). Over 30 new human pathogens have been detected in the last three decades, 75% of which are zoonoses, that have originated in animals and then have spread to humans [42,43] as is the case of COVID-19. Ecosystem health, wildlife health and human health are therefore strictly interconnected and there is a need to develop a coordinated plan to monitor projects and activities that focus on the impact of environmental changes on zoonotic and parasitic infections [44–49].

Actually, often epidemics highlight the existence of a complex relationship between infections and environmental health. Local, national, large scale and systemic environmental changes and disruptions, such as biodiversity loss, disruption of natural habits, climate change, pollution, and urbanization, together with social and demographic changes, including urbanization, increase mobility and population aging, can act as important proximal or distal determinants of different epidemics. Most of the recent epidemics and pandemics had a zoonotic origin, as they originated in animals, mostly wildlife; however, their emergence often involved dynamic interactions among populations of wildlife, livestock, and people within rapidly changing environments. Environmental and social factors may play different role as they can both facilitate the occurrence of new or reemerging infectious diseases or greatly modulate their health impact. Climate change is helping the spread of vectors-borne infectious diseases that is occurring in Europe. Disruption of natural habitat together with demographic changes have played an important role in favouring the emergence and the spread of Sar-Cov-2 [50]. Environmental pollution, such as air pollution, may reduce resistance to infection and, therefore, could be associated with more severe clinical manifestations of the disease.

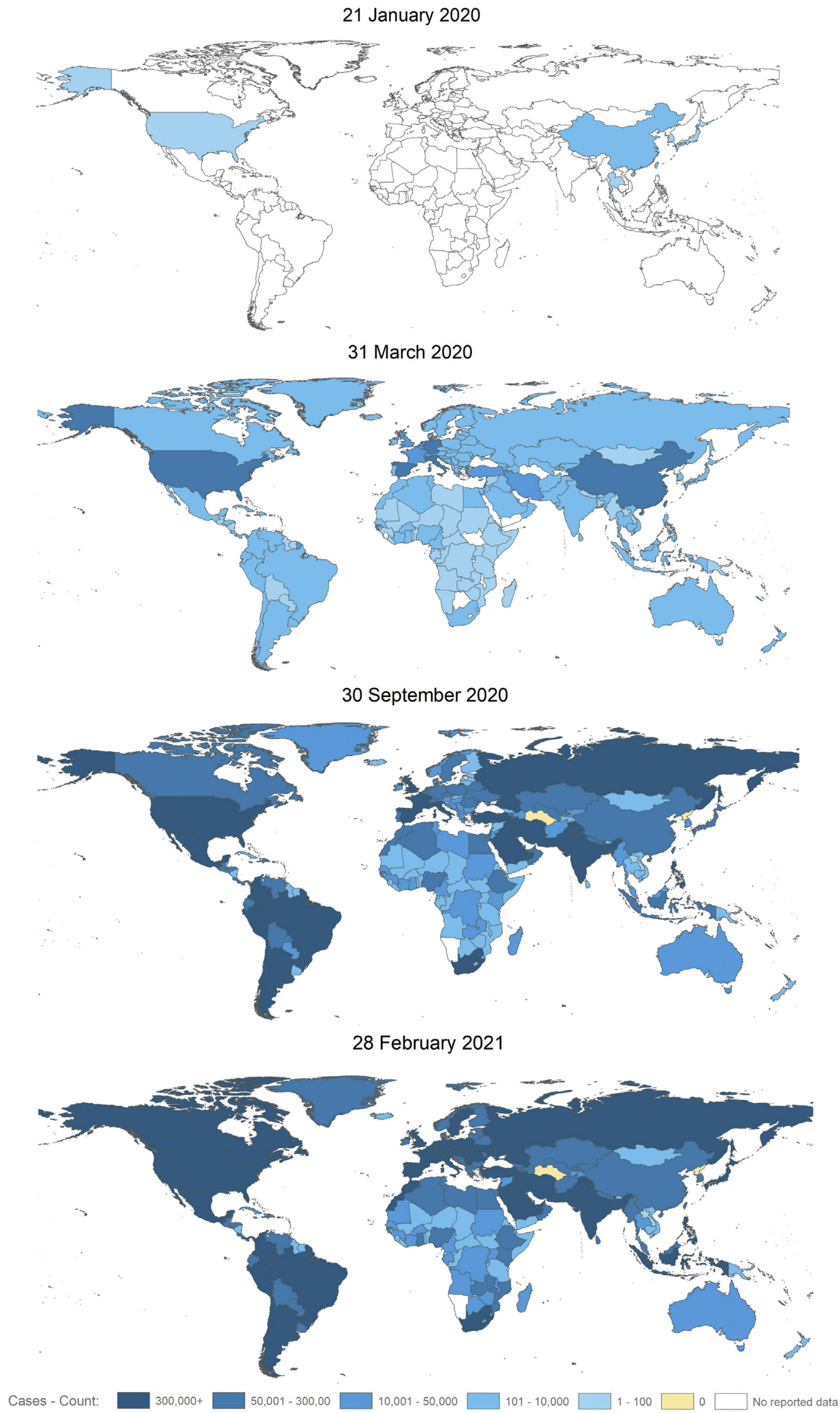

Fig. 5. Geographic distribution of cumulative numbers of COVID-19 confirmed cases at different dates: 21 January 2020 (WHO Situation report 1); 31 March 2020 (WHO Situation report 71); 30 September 2020 (WHO Weekly Epidemiological Update – 5 October 2020); 28 February 2021 (WHO Weekly Epidemiological Update – 2 March 2021). Source: [28].

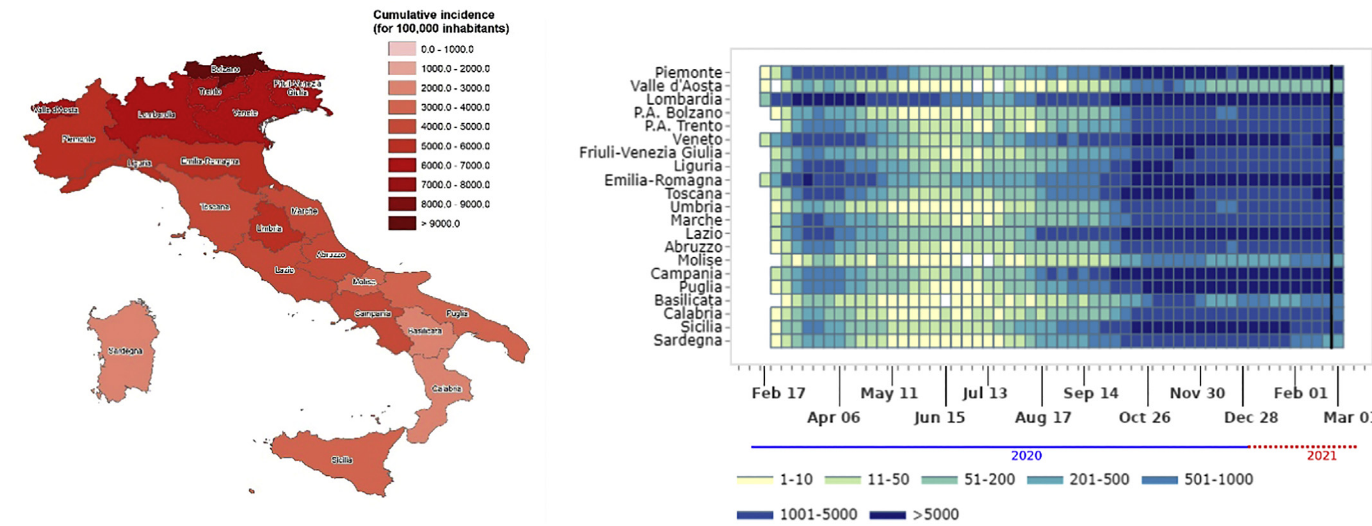

Fig. 6. Cumulative incidence (100,000) and weekly numbers of COVID-19 confirmed cases in Italian regions (including the Autonomous Provinces of Bolzano and Trento) as of 28 February 2021. Source: [33].

Notably, international, regional and national entities have made efforts to enhance the contribution from the veterinary sector in the International Health Regulations (IHR 2005) which define the core capacities that countries should develop and maintain to strengthen global health security [51]. Meanwhile, Joint External Evaluations have been set by WHO as a part of a voluntary, collaborative and a multisectoral process to assess country capacities to prevent, detect and rapidly respond to public health risks. The Joint External Evaluation tool contains a specific set of indicators for zoonotic disease, antimicrobial resistance (AMR) and food safety, as well as for core capacities such as surveillance, emergency preparedness, and emergency response operations [52, 53].

Further, health emergencies and epidemics require effective cross-border governance response and recovery at international level, as neither political nor geographical boundaries stop the spread of etiological agents of diseases and of their vectors. Health experts and communities alike acknowledge the globally interconnected nature of communicable disease risks. Vulnerabilities in one part of the world can contribute to outbreaks in other parts of the world. Shared and integrated international strategies and policies should, therefore, be established and implemented and national, regional or local plans and actions should be coherent and aligned with them in order to prevent and to minimize health risks and consequences.

Under the EU Framework on Health Security, the European Commission works with EU Member States to enhance preparedness and response planning for serious cross-border threats to health, aiming also to implement the IHR (2005). Decision 1082/2013/EU [54] addresses serious cross-border threats to health in the EU. This Decision addresses surveillance, early warning and response, and preparedness and response planning, emphasizing consultation and coordination between the Commission and Member States. Also relevant in the EU is Decision 1313/2013/EU [55] on a Union Civil Protection Mechanism, which aims to ensure a high level of protection against disasters, to enhance preparedness at Member State and Union levels, to facilitate rapid and efficient response in the event of disasters or imminent disasters, and to increase public awareness and preparedness for disasters.

One Health is therefore a concept that has emerged from collaboration between the human health and veterinarian/food sciences sector and has developed to gradually include additional branches of science, notably the environmental sciences and social sciences. It is a constantly evolving concept and shares many similarities with emerging concepts such as Planetary Health [56,57].

Defined by the Wildlife Conservation Society in the Manhattan Principles (2004) as the 'One World One Health' paradigm [58], the One Health approach to global health security recommends a holistic view of the interface between human, animal and ecosystem health domains. One Health promotes an international, interdisciplinary, intersectoral perspective to disease emergence and control. A One Health approach can be used in designing and implementing programmes, policies, legislation and research where multiple sectors collaborate to achieve better public health outcomes. One clear advantage of implementing a One Health strategy is highlighted by the cost-effectiveness of early detection in animals, thus reducing the impact on human lives (Fig. 8) and adding genuine value.

Within Europe, the One Health aspects in the EU Health Security framework are legally grounded with Decision 1082/2013/EU [54]. Currently, key areas of focus include animal health and food safety, preparedness and response to zoonotic threats, and AMR. The European Commission adopted the European One Health Action Plan against AMR in 2017 [60]. The European Commission also supports simulation exercises and workshops, and promotes activities to improve coordination between sectors.

Relatedly, in 2016 and 2017 the European Commission has published an Action Plan on the Sendai Framework for Disaster Risk Reduction 2015–2030 [61], the European Environment Agency has considered disaster risk reduction in the context of climate change [62], and the Disaster Risk Management Centre of the European Commission has published a report on Science for Disaster Risk Management, with one section specifically focusing on epidemics [63].

3.2. Extreme events and socio-economic fragility

From the point of view of mainstream economic, extreme events are considered exogenous phenomena in relation to the functioning of the system of exchanges and allocation of resources considered as "normal". However, the probability that an extreme event does not turn into a social, economic and environmental catastrophe is always strongly correlated to the type of structure and functioning of the economic system itself; to the care of common goods (health, territory, public infrastructures etc.); to the resources dedicated to risk prevention and mitigation measures; to the education and to the information provided to communities; to the active participation developed by the community itself [64]. In other words, not only are the consequences of extreme events important, but the causes that make natural events "extreme". The hypothesis to be investigated is that the degradation phenomena - defined by the progressive loss of the fertility of the resources, and therefore of their economic value - are the real cause of the reduction of the resilience of the communities and, therefore, of the greater exposure to the effects of extreme events. This is why it is important to deal with the onset, diffusion, intensity and effects of

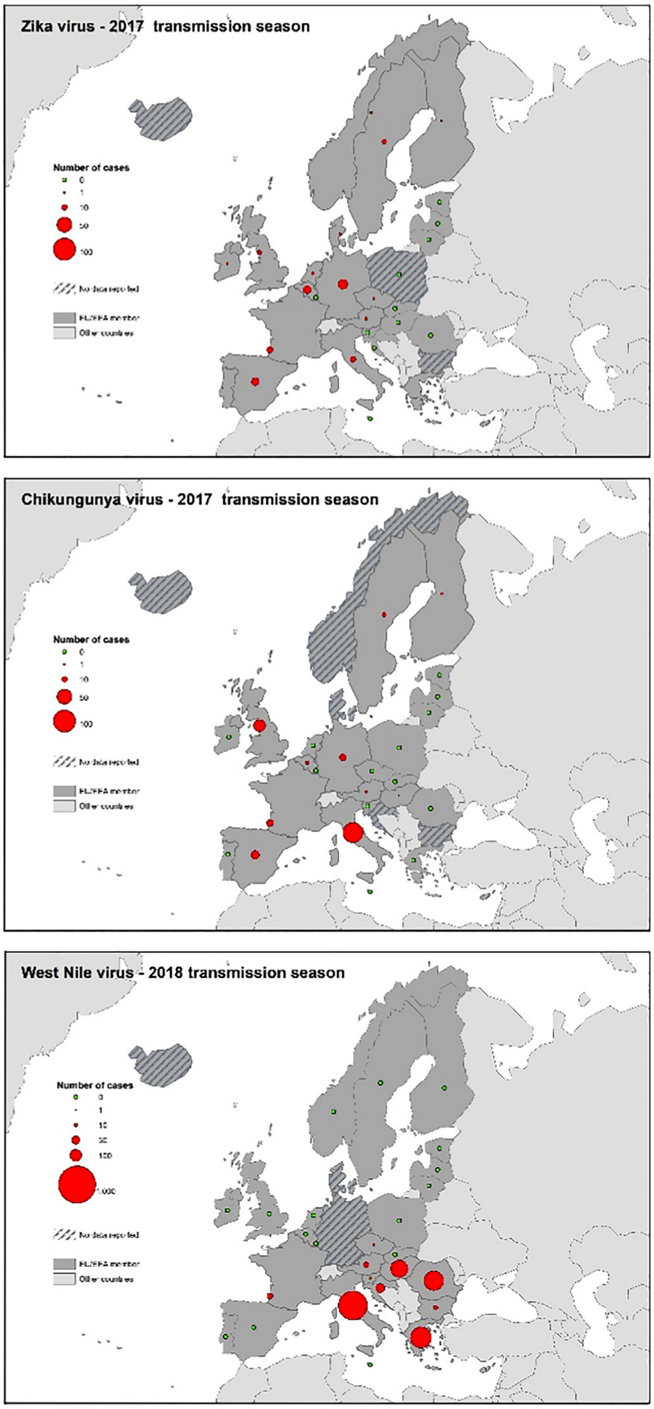

Fig. 7. Vector-borne infections by affected areas, Europe. in the EU/EEA Member States and EU neighbouring countries: Zika virus - 2016 transmission season; Chikungunya virus - 2017 transmission season; West Nile virus - 2018 transmission season. Source: [34–36].

degradation on a given eco-social system. This also in relation to the economic-natural environment in which this system is inserted and, therefore, the reasons for greater exposure to risk.

It is important to underline that, from this perspective, the concept of degradation is the inverse relationship with that of economic sustainability. At the same time, from an interdisciplinary point of view, both economic concepts are congruent with that of "One-health" mentioned above.

The need to change the analytical perspective also emerges from the evolution of the focus of the literature on the socio-economic consequences

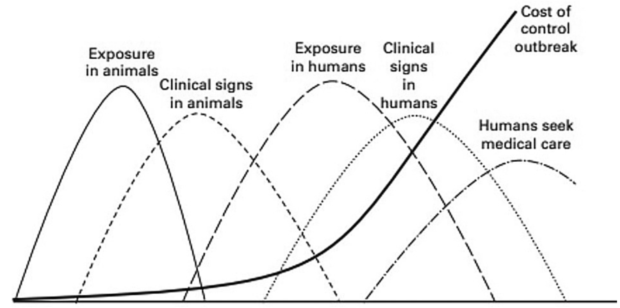

Fig. 8. Relationship between time of detection of emerging zoonotic disease and total cost of outbreak. Source: [59].

of extreme events. As many authors have noted [65,66], before the mid-seventies the problem of the effects of catastrophic events was studied only from an engineering and geological point of view.

Only later do the studies highlight how vulnerability is determined also by social, economic and political processes and that, ultimately, these factors define the danger itself [67–71]. However, although attention to the problem has grown over time, it seems to have affected sociological investigations much more than economic ones.

The environmental risk assessment is generally built on three measures: the hazard (probability of the event); the vulnerability (number of people and infrastructure exposed to the event); the value of the damage estimated following the event itself. For many events, however, the probability that the event exceeds a certain threshold and the value of the damage caused, cannot be calculated effectively for two reasons. The first is that both measures are dependent of the degree of vulnerability (for example, a high level of economic and social degradation of a community and a territory lowers, ex ante, the economic value of the estimated damage). The second is the extreme difficulty of establishing the scale of the danger to which the phenomenon can reach, if not placed in relation to the context in which it occurs and the protection tools available and practically usable. Availability and use are, in turn, linked to the institutions that are responsible for preparing and maintaining efficient protection tools. Vulnerability and eco-social degradation are therefore the main indicators, the most robust "independent" variables in risk prediction.

The degradation of eco-social systems is not one of the themes of economic theory because - based on the axioms of methodological individualism - it is not considered a possible outcome of the same economic relations between agents. In other words, analysing degradation from an economic point of view means solving a paradox: how is it possible that the loss of capacity occurs if the agents behave rationally, always trying to maximize the value of the resources available to them?

In general, it is one of the subjects of the economics discipline to consider risk and uncertainty in individual choices. However, the same attention is not paid to the assessment of the risks of eco-social systems and, therefore, to the assessment of the link between economic, social and environmental degradation and vulnerability.

It is interesting to note that, even in the specific case of the COVID-19 pandemic, the assessment and attempt to reduce the risk considers the aggregate impact of social factors (exposure, behaviour and social policy) to be around 50%, i.e. the same risk produced by the set of factors related to health status/age of people [72].

"The vulnerability to natural and technological disasters is largely a public bad: such disasters affect the community in general, not isolated individuals. Likewise, measures to reduce vulnerability are largely public goods" [73]. Then the proposal, in economic terms, is not to pay attention on the "public bad," but its reciprocal: the access and enjoyment to the "security".

The degree of safety - for example, in the sense of public health - has an ineliminable, very large component of the common good from which the value of the other types of goods also derives: my health (safety) depends on the level of health of my environment and from the health of those around me; therefore, if others cannot access my same level of safety, their condition can be intrinsically rival and not excludable in my enjoyment of health/safety. Another example: in a seismic event, even if my home has been effectively protected, thanks to my private expenses (for example in providing it with effective anti-seismic systems), what value will it have if it is surrounded by the rubble of the community that has not had the same chance of defence? Given this condition of necessity in equity in access to security, in order for this condition to have a full and effective economic value, it is necessary that it will be considered "valuable" also in the design of economic prevention policies, and in training and the information to given at subjects at risk. It should be noted that the degree of equity, necessary to ensure an acceptable collective security standard, is a perfectly generalizable indicator to predict the type and intensity of the social and economic impact resulting from each extreme event.

The pervasiveness of the current COVID-19 pandemic highlights the close relationship between extreme events and social fragility, whatever the analytical perspective - economic, social and environmental [74]. For example, the institutions and bodies operating in the area, and possessing sensors capable of descending into the depths of social hardship, show daily how the extreme event affects the economic "invisibles" with particular harshness: regular non-workers; non-business; occasional and precarious activities non-VAT numbers. To these social groups, which are accustomed to being forgotten (think of the countless slums that gather agricultural workers), are added - with the same dramatic progression of the pandemic - the categories that belong to the strata, gradually, higher and higher in the social pyramid. The relationship between public health, economic health and social impact turns out to be so close that the question of who will pay for all this, and with what resources, goes far beyond understandable concerns about the timing of the restart.

In disasters, the consequences are the mirror of the causes: fragility and social and environmental degradation are multiplying factors of the impact of the extreme event. For example, even if a precise causal link has not yet been demonstrated, the geography of the pandemic and the intensity of its effects is largely superimposable on the pollution map, just as contagion and mortality are strongly correlated to living and working conditions; the spread of contagion and its rapid expansion is favoured by the destruction of the diversity of ecosystems; the health hazard of wet/wildlife markets has historically been linked to the pressure of the demand for low-priced food resources by the poorest shares of the Chinese population [75].

Furthermore, it should never be forgotten the quantity and quality of public goods and common goods available for public safety. The provision of infrastructures and the prior development of defence protocols made the difference in the number of deaths in a systematic dismantling public health system, as in Italy. This is true if the comparison is made with what has happened in Korea, whose previous experience in the SARS pandemic has been memorized by the institutions and has become a treasure immediately available to face the COVID-19 now. Moreover, is to note the different mortality recorded in Germany, which already had a health plan against possible pandemics and a number of acute-care beds per 1000 people that slightly doubles Italy's one (6 vs 2.6) [76].

Finally, it is important to emphasize the strategic problem of risk prevention through training and increasing risk awareness in communities. An important example is the experience of Chile. The earthquake and related tsunami of 2010 marks a turning point in the country's security policy. From the analysis of that disaster, which caused about 500 victims, the idea of implementing community resilience was consolidated through a vast program to raise population awareness, school training, the definition of public spaces and safe escape routes: safety is no longer just a matter of building resistance, but it is increasingly based on the implementation of social capital and common goods [77]. The opinion of the experts and officials of the various entities interviewed is that there is still a long way to go for the full application of the plan; however, it is also important to note how attention to the role of education, social responsibility and training has proved to be of great importance when the disaster risk has extended, over time, to phenomena more closely linked to climate change (e.g., fires and floods), which have grown exponentially in Chile, becoming the main source of risk in the country.

In summary, the degree of vulnerability can be compared to the outcome of a "slow earthquake", caused by the progressive loss of economic capacity of human and natural resources. Therefore, if the affirmation of the structural engineers is true, that "the walls have memory", the extreme event must be considered only an accelerator of time that brings out, in a moment, the "cracks "and weaknesses already existing in human and environmental ecosystems.

4. The Emilia-Romagna context

Emilia is the central-western sector of the Emilia-Romagna region (Italy), hosting a rare if not unique example of university based in two cities, Modena and Reggio Emilia, which in 2017 conceived the EmTASK course. The Emilia's territory stretches from the low plain of the Po river to the highest mountain peaks of the northern Apennines, showing rapidly changing physiographical environments with active natural processes such as landslides, river floods and earthquakes (Fig. 9). At the same time, it is one of the highest-populated areas in Italy, with a long tradition in agriculture, manufacture and industry.

The employment defence policy, implemented by local administrations after the Second World War, was based on incentives to locate productive activities. In the peripheries of all the towns - small and large - of the north-east regions, equipped areas were created for craft production activities and for small and medium-sized enterprises. The subsequent economic development was characterized by the increase in economic transactions between local businesses, in an increasingly interconnected network of relationships. This type of development has numerous strengths, just as many weaknesses have emerged over time. In fact, if on the one hand the division of labour between companies has increased specialization and organizational flexibility, on the other hand the localization of activities has led to an increase in urban sprawl, to an increase in the consumption of the territory, to a growth in the mobility of people and goods, to the presence of one of the highest pollution rates on the planet. Finally, all these phenomena were welded itself to the development and mobility models of the western areas of the country, with the oldest industrial tradition and with higher industrial and population density. Unfortunately, the mobility of people and goods, and the economic relations have also been the highways with which the pandemic by the COVID-19 has spread [78].

Emilia-Romagna is therefore the perfect lab-territory to study and tackle the interaction between epidemics, natural and technological hazards and high-vulnerability areas, potentially leading to disasters.

Since the end of the Second World War, Emilia has undergone a remarkable economic growth, thanks to the inborn attitude of the local population to consider work as a "value", being conscious that the solution of problems depends primarily on the commitment of the individual. Besides that, other factors contributed to the rapidly increasing wealth: the initiative of private and cooperative enterprises, flexible economic and education system that often anticipated and accompanied the socio-economic growth, the political stability and the actions of local governments [79].

With economic growth came also the impacts on the environment and on human health. Pollution of air and waters, the presence of relevant-incident industries have since the Seventies of the last century led local public administrations to take action, setting up innovative regulatory frameworks and implement actions that would eventually be adopted also at national level. Environmental agencies have been created, with the commitment to set up monitoring networks for different natural components, in order to prevent further impacts and impose mitigation actions. Most of the times this was done in good cooperation with private industries, sometimes leading to "green" technical innovations.

Besides impacts to the natural environment caused by the rapid economic growth, the generalized urban sprawl increased the probability that natural hazards (mainly floods) could affect human settlements. In this case too, local administrations (in some cases after the active solicitation of citizens in public demonstrations) were able to adopt mitigation

Fig. 9. Effects of the disastrous 2012 earthquake and 2014 flood that hit the Province of Modena. a) collapse of the Finale Emilia Castle; b) surface seismic-liquefaction effects in an orchard; c) a manufacture district; d) the main square of the town of Bomporto after the 2014 rupture of the River Secchia embankment. Pictures a, b and d, courtesy of D. Castaldini (UNIMORE); picture c, courtesy of Roberto Ferrari (Civil Protection Modena).

measures which proved to be of durable positive effect, such as the construction of flood retention basins. Territorial planning at municipality and provincial scale revealed to be an important instrument to govern the interaction between economic growth and the environment, and this could become possible with a tight collaboration between local and provincial administrations and the academic world.

Bearing in mind this historical peculiar relationship between humans and natural environment which characterizes the Emilia territory, the kind of reaction that the Emilia's population has had during the disasters occurred in recent years can be better understood. To mention the two most impressive ones: the earthquake in 2012 that struck the Modena plain [80–82], Reggio Emilia and Bologna provinces, and the flood that in 2014 affected the territory north of Modena [81,83,84]. In both cases, a well-coordinated civil-protection system was capable to assist the population and mitigate the severity of the circumstances, quickly reorganizing the territory and the socio-economic network. An effective management has made the post-earthquake reconstruction period the shortest in Italy since ever, re-starting the economy, despite a still enduring global economic crisis.

Other natural hazards have threatened Emilia, with less damages and human losses, but nevertheless with increasing frequency and intensity: tornadoes (never experienced in the past in this area), flash floods, landslides, severe hailstorms, heat waves, all of them tightly linked to the ongoing changes in the global climate pattern.

Recently, the Emilia-Romagna region has been involved in different epidemics related to new and re-emerging infection diseases as well. For instance, during summer 2007, the first European autochthonous Chikungunya outbreak due to the local transmission of the virus by invasive *Aedes albopictus* mosquitoes took place in this region, and the small town of Castiglione di Cervia reached an international fame [85]. The outbreak was responsible for 337 suspected cases, 217 of which confirmed by blood analysis and the areas of Ravenna, Forlì-Cesena, Rimini and Bologna were the most hit. Chikungunya outbreak posed considerable problems for public health authorities. It highlighted that good routine programs of vector surveillance and control are essential to be able to mitigate the effects of a vector-borne outbreak together with other important public health interventions, including active epidemiological surveillance of cases and contacts and prompt management of blood safety and supply [86].

Further, in 2018 it was one the most affected Italian areas by the West Nile disease outbreak, with at least 100 cases of the most serious neuroinvasive clinical manifestation that caused 21 deaths (about 50% of all deaths observed in Italy) [36]. Once again, implementation of appropriate surveillance and control measures for vector and vector-borne disease resulted crucial to mitigate the epidemics. Critical issues that raised during the management of the epidemics were once again the lack of human resources capacity, particularly in the area of entomological surveillance and vector management, and the need to strengthen the capacity of medical workers on emerging and non-endemic vector-borne diseases for early detection and rapid containment of the spread of vector-borne diseases. Timely and tailored communication resulted as well essential for raising public awareness and, consequently, triggering response actions from the public health authorities [87].

Finally, Emilia-Romagna is one of the most affected Italian areas by the COVID-19 epidemics. Since the beginning of the pandemics as of 28 February 2021, more than 276,000 confirmed cases occurred in the region with more than 10,700 deaths (Fig. 6) [88]. The epidemics is causing a dramatic impact on the regional health system and important economic and social disruptions due to the implemented lockdown measures. However, the regional health system set up an effective response to the epidemics thanks to the flexibility of the hospital infrastructures that were able to react promptly by changing functions and mobilizing staff and to the extensive presence in the region of well-organized public health and primary health care services. An effective and well-coordinated collaboration with all the other the sectors involved in the management of emergencies has been proving crucial too in trying to control and mitigate the spread of the infection, the management of cases and the contact tracing and to respond to general population needs during the lockdown periods.

5. The EmTASK academic upgrading course

As a consequence and in relation to the disastrous events that affected the Emilia-Romagna region during the last decade, a number of territorial institutions approached the University of Modena and Reggio Emilia to discuss about the need of an innovative educational and training programme which could take advantage of the experience achieved in emergency management. As a result, an academic upgrading course (EmTASK) has been set up and offered by the UNIMORE on the critical theme of 'Territorial, Environmental and Health Emergencies' [89]. The course started in 2017 and since the beginning it has represented an "agora" open to people from different cultural backgrounds and work fields where sharing knowledge and producing awareness on disaster risk reduction issues and emergency management (Fig. 10). The training programme foresees merging of experience and knowledge and tight links between academics and researchers, on the one hand, and practitioners, employees of local governments and agencies, on the other hand.

The EmTASK Course has taken advantage of the experience acquired in the management of emergencies due to earthquake, flood and landslide events occurred in Emilia in recent years, which caused severe socio-economic damages and hardly tested the functioning of institutional services, and especially the regional civil-protection system. Among the others, the course is organized in co-operation with the Italian Army, environmental and civil-protection agencies of the Emilia-Romagna Region and the Regional Fire Corps, with the aim to provide the participants with a sound knowledge and interdisciplinary skills that can foster a holistic approach in forecasting, prevention, management and overcoming of emergencies in the spirit of the UN Sendai Framework for Disaster Risk Reduction 2015–2030: "*to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years*" [90].

5.1. Motivation

The EmTASK Course aims at offering additional skills to those who already operate in the field of civil protection (either as professionals or volunteers) and emergency management. It is open to the general public (a high school diploma is needed as the requisite for admission) but, due to its nature, it is especially addressed to graduates and post-graduates in relevant fields, Army's personnel, firefighters, public security corps, civil servants, civil-protection operators, hospital attendants, cultural-heritage operators, and volunteers. The strength of the Course is that those skills are brought in by those who have taken action, at different levels, in past emergencies, sharing their experience, uncovering good practices and problems still to be solved. The skills acquired in the field are merged with strong theoretical bases from the academic world. The time devoted to brainstorming and sharing ideas between students and lecturers, both indoor and outdoor, has proved to be an added value to the course, as well as the practical activities guaranteed in the form of individual and group traineeships. The latter have taken place outside the University, by visiting civil-protection centres and sites severely affected by disastrous events both in the region and in other Italian areas (e.g., the area surrounding the deadly Vajont landslide).

Fig. 10. The EmTASK word cloud showing its holistic approach to risks.

Besides, after a general part offered to all the participants, the Course is subdivided in three branches: i) Scientific and technological curriculum, ii) Medical-biological-health curriculum and iii) Legal-economic-social curriculum.

5.2. Planning and development

The EmTASK Course has been financially supported by the "*Fondazione di Modena*", a bank foundation tightly connected to the local territory for which it exclusively pursues utility and social-solidarity purposes and promotes economic, social, cultural, scientific, human, ethical and civil development.

Seven UNIMORE departments have been involved in the planning, development and management of the Course providing a wide range of expertise:

- Department of Biomedical, Metabolic Sciences and Neural Sciences;
- Department of Chemical and Geological Sciences (teaching and administrative coordination);
- Department of Economics 'Marco Biagi';
- Department of Engineering 'Enzo Ferrari';
- Department of Law;
- Department of Life Sciences;
- Department of Studies on Language and Culture.

The partner Institutions of the Course are as follows.

- Agency for territorial security and Civil Protection, Emilia-Romagna Region;
- Regional Agency for Prevention, the Environment and Energy of Emilia-Romagna (Arpae);
- Regional Directorate of Fire Brigade, Emilia-Romagna;
- Italian Army, by means of the Military Academy, which is based in Modena since 1678 (first among all military academies in the world);
- Municipality of Modena.

The Course spans an entire year and its structure comprises (Fig. 11):

- Lessons (210h) regarding the basic knowledge on risk forecasting and prevention and emergency management in different disciplinary and operational contexts; of those 210 h, 150 h are dedicated to topics common to the three curricula while 60 h are curriculum-specific, enriched by training activities in groups.
- Common traineeship (25 h) including visits to civil-protection centres and of areas affected by different kind of disasters.
- Individual traineeship (175 h) through which practical experience at public institutions or bodies, companies and associations can be achieved.
- Reporting on the individual traineeship activities (50 h) through the writing of a brief dissertation.

Course activities are normally held during weekends, so to give the chance to the trainees to participate outside their working or studying hours. In case of inability to attend the lessons, 30% of the general part of the course can be followed online.

The scheme initially chosen for this educational and training activity was that of an Upgrading course ('*Corso di Perfezionamento*' in the Italian academic system) – instead of a Master degree – to let non-graduates the chance to participate. It should be noticed that the percentage of participants with a high school diploma was remarkable in the first edition of the Course (29.2%) and even increased in the second one (37.5%), showing that the choice of the course scheme was effective (Table 2). This reveals that there is an increasing interest of non-graduates to acquire skills and expertise in the field of disaster risk reduction and emergency management in Italy. It should be underlined that a significant number of employees of

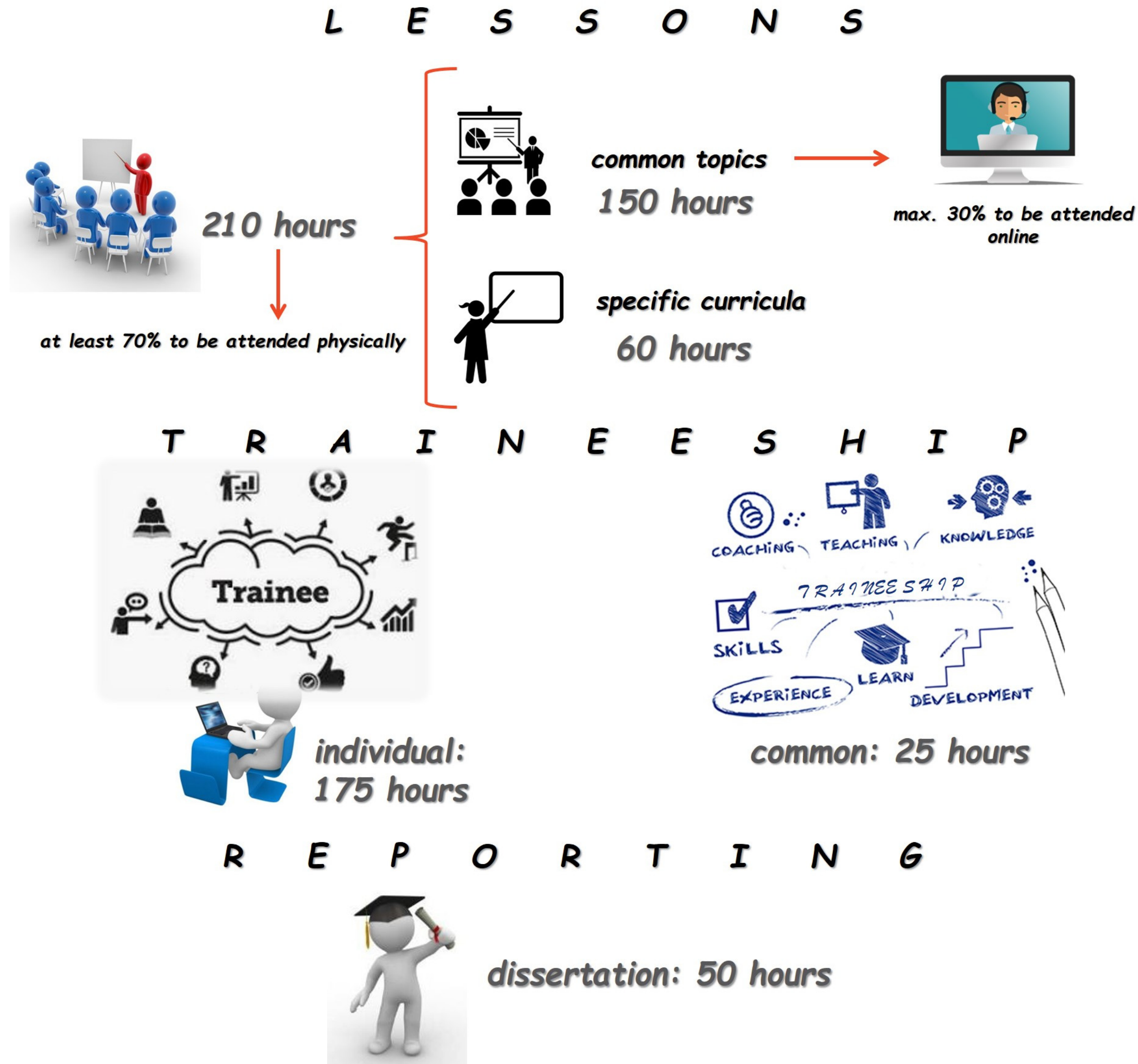

Fig. 11. Structure of the EmTASK Course.

Table 2
The numbers of the EmTASK courses.

		2017 Edition	2019 Edition
	Seats available	65	50
	Admission requests	100	55
Students	Admitted students	65	48
	With high-school diploma	19(29.2%)	18(375%)
	With academic degree	46(70.8%)	30(62.5%)
	Types of academic degrees	20	17
	Students from partner institutions	28(43.1%)	19(39.6%)
	Italian regions of origin	7	6
	Youngest student (age)	21	23
	Oldest student (age)	62	71
Lecturers	UNIMORE	34(41%)	39(46.4%)
	Army	8(9.6%)	8(9.5%)
	Arpae[a]	7(8.4%)	5(6.0%)
	AUSL[b] Modena	7(8.4%)	7(8.3%)
	Others[c]	27(32.5%)	25(29.8%)
	Total	83	84

[a] Regional Agency for Prevention, the Environment and Energy of Emilia-Romagna.
[b] Local Health Authority of Modena.
[c] Public agencies, companies and research institutions.

Italian public offices as well as many volunteers dealing with civil protection are not graduated, and the EmTASK Course represented and will represent an extraordinary chance for their professional improvement.

Information regarding students and lecturers of the first two editions of the EmTASK Course, including their background and expertise, is shown in Table 2.

Individual traineeships have been carried out at different public agencies, research institutions and private companies, municipal administrations, Arpae, civil-protection centres, First-aid, Interregional Agency for the Po River, hospitals, fire brigades, Army, as well as within UNIMORE departments.

The common traineeships (i.e. carried out in groups involving students, lecturers and emergency managers) occurred at sites affected by disasters (e.g., Vajont landslide, Venetian Prealps), Stava valley (Autonomous Province of Trento), areas affected by the 2016 earthquake in Central Italy, areas affected by earthquakes and floods in the Province of Modena during the last decade.

The intensive and deeply interdisciplinary character of the EmTASK Course has made it a powerful mean for building relationships among persons with different backgrounds and operating in various fields related to risk mitigation and emergency management. This, in turn, has favoured an effective sharing of knowledge and the development, in each participant, of a clearer and more complete perspective of emergency issues.

The post-activity interviews and evaluation questionnaires regarding teaching organization, course contents and acquired skills showed that the expectations of the attendees were largely met, totalling 89.6% and 93.8 the satisfaction degree of the 1st and 2nd edition, respectively. As a matter of fact, the individual traineeship enabled a significant number of attendees to be he hired by the institutions and companies where they were hosted as trainees, thanks to of the skills and expertise achieved during the EmTASK Course.

Based also on the feedback of the attendees, it is desirable that, in future editions, the Course could benefit from the participation of other key actors of the civil-protection system, such as media operators (journalists, bloggers, scientific popularisers etc.). It has in fact become clear, focusing on various case studies, how media can strongly influence the citizens' perception of risk, modifying their behaviours and thinking in relation to disasters.

It should be emphasized that the trans-disciplinarity of the course strongly enhanced the skills and professional experiences of the attendees in a broader cognitive framework. This resulted also in the request to EmTASK former students (EmTASKers) to become lecturers in a training and consultancy course offered by an important non-profit company operating in the region, in the sector of welcoming migrants and in the mediation of conflicts. The path ended with the full satisfaction of all the participants, and the request to the EmTASKers to continue the collaboration for a more efficient organization of the internal information system (classification of the types of social fragility, environmental risk mapping etc.) and for the formulation of future territorial action projects.

6. Conclusions

Natural, technological disaster and health emergencies are increasingly causing human and economic losses. Disaster risks can certainly be minimized by transferring both to the personnel involved in disaster management and to the public valid and reliable knowledge on the nature, causes and effects of such disasters. Sharing such knowledge will help citizens in better understanding the risks they might be exposed to and consequently in better protecting themselves against disasters. After all, citizens should be part of the civil-protection system, being stimulated and trained to self-protection, which would certainly enhance community resilience.

Disaster risk assessment and mitigation, as well as emergency management in European countries is mostly based on state management and civil-protection systems which rely on a sound public awareness of risks and prevention measures which is often missing. Therefore, it is crucial to enhance citizen awareness on the (i) types of disaster risk existing in specific areas (cities, mountains, plains, coasts etc.); (ii) intensity and frequency of the events that can occur; (iii) possible consequences of such events on individual citizens and the community. Promoting a culture of safety information, addressed also to new generations, is paramount importance. This is the type of knowledge that the EmTASK Course intends to deliver - based on an interdisciplinary and integrated approach and by means of suitable training - to a wide range of participants, including local authority representatives, civil-protection servants, hospital attendants and volunteers.

The students are taught that fear and concern of people should be replaced by a widespread culture of preparedness. Risk and emergency management should be always preceded and accompanied by forecasting and prevention actions. This has been performed within the EmTASK Course by (i) creating a common knowledge and awareness based on the involvement of top national and international experts; (ii) showing the need of a holistic approach to disaster risk reduction; (iii) favouring common multi-disciplinary approaches and practices across a continuum of prevention, preparedness, readiness, response and recovery; (iv) disseminating knowledge in multiple languages to reach a wider audience.

Preventing or minimising the effects of disasters, such as those related to global climate change and pandemics, requires interdisciplinary policies and interventions, moving beyond traditional public health and emergency services. New and innovative approaches to disaster risk reduction should be pursued, by merging knowledge and experience achieved, and by gathering academics, practitioners, employees of local governments and agencies to discuss common issues seen from different perspectives.

Declaration of Competing Interest

None.

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