PHD COURSE IN LIFE AND ENVIRONMENTAL SCIENCES

Report Form for PhD student annual evaluation (XXXVI and XXXVII cycles)

Name of PhD student: ....Noemi Marchetti..

Title of PhD research: COVID-19 outbreak: informing and harmonizing pandemic preparedness and response

Name of PhD supervisor: ....Fausto Marincioni...
Research lab name: ......Disaster Risk Reduction Laboratory...

Cycle:
[X] XXXVI
[ ] XXXVII

PhD Curriculum:
[ ] Marine biology and ecology
[ ] Biomolecular Sciences
[X] Civil and environmental protection

DISVA instrumentation labs/infrastructure eventually involved in the project:
[ ] Actea Mobile Laboratory
[ ] Advanced Instrumentation lab
[ ] Aquarium
[ ] MassSpec lab
[ ] MaSBiC
[ ] Simulation/informatics lab
[ ] Other. Please, indicate: ....

ABSTRACT (1000 characters, including spaces):
The 30 January 2020 the World Health Organization declared the international outbreak of COVID-19 establishing the beginning of a global pandemic emergency. The new Coronavirus spread is characterised by speed and hight capacity of infection. In such a challenging background, every hit Country run for a rapid solution. Italy is one of the Countries most damaged by the COVID-19 pandemic (Chintalapudi, 2020), but the virus did not reach every area with the same impact during different waves. In this PhD project, the study area is the Marche Region, and the analysis focuses on the pandemic preparation and response phases. Starting from the scrutiny of the fragmented governance of the pandemic emergency, highlighting the misalignment between theoretical and practical emergency response model, this research aims at providing guidelines to enhance resilience of the local health system for future pandemic emergencies.

Part 1. Scientific case of the PhD Research (2 to 3 pages, including figures)

- BACKGROUND

Our planet is alive, dynamic, and hazardous. The Earth's ecosystem produces hazardous phenomena which have natural origin, but those become disasters when intersect human actions. Humans have transformed hazardous natural phenomena into risks capable to cause damage, death, and destruction (Barberi et al., 2004). At the global level, disasters are growing and consequently the number of victims and damages is increasing (Alexander, 2016). Moreover, the environmental crisis is exacerbating certain types of hazards, creating new scenarios of impact to which we are ill prepared greatly increasing the potential loss of life and assets (UNDRR, 2021). COVID-19 is one such example, where a hazardous virus has sent shock waves through the world causing circa 6,5 million of casualties and triggered the largest global economic crisis in more than a century. Our preparation to handle pandemic emergencies appeared incredibly weak and insufficient. Therefore, this research project aims at investigating the shortfall of the current pandemic emergency preparation and proposing guidelines for pandemic response plans.

- SCIENTIFIC AIMS

The misalignment between the theoretic and practical models for mitigating the effects of a pandemic emergency, the health system performance and resilience, the administrative fragmentation, and the psychological aspects of a global emergency such as COVID-19 are the main point of this PhD research. Comparative studies of how local healthcare systems managed the surge in intensive care therapy requests should help defining guidelines to better prepare for pandemic emergencies.

- WORKPLAN AND RESEARCH ACTIVITIES

WP 1. Objective.

Selection of indicators to assess health system resilience in pandemic environment.

Methods.

This first work package comprises various stages, mostly carried out through a wide literature review on COVID-19 pandemic.
The first step was to define the state of the art of pandemic management around the World. Preparedness and planning measures facing epidemic and pandemic have been investigated during the first year of my doctorate.
The second step focused the research on local Health System Resilience. In particular, the aim was to definition "resilience" in the context of health care systems, and preservation of services/functions during pandemics.
The third step focus on the examination of Multi-Criteria Decision Analysis methods in order to manage quantitative and qualitative data.

Expected/Obtained Results.

Microorganisms, bacteria, virus, parasitic, toxins infection could be considered as biological hazards, which could become a risk in zoonosis conditions. Generally, medical and health interventions stop the virus diffusion, yet occasionally these biological agents become insidious and more difficult to eradicate. On 31 December 2019, Chinese scientists communicate to the World Health Organization (WHO) the appearance of a new Coronavirus, causing Severe Acute Respiratory Syndrome (SARS-CoV-2), de facto marking the beginning of the COVID-19 pandemic, (Kamps & Hoffmann, 2021). As the contagion spread worldwide, it deeply affected the local and national social, economic and political spheres (Lazzerini & Putoto, 2020).
The information collected to characterize impacts and response of the health care system have been divided in five macro areas or indicators: health & safety, socio-psychological, politic & economic, demographic, pandemic. Figure 1, depict these selected indicators and their relations.
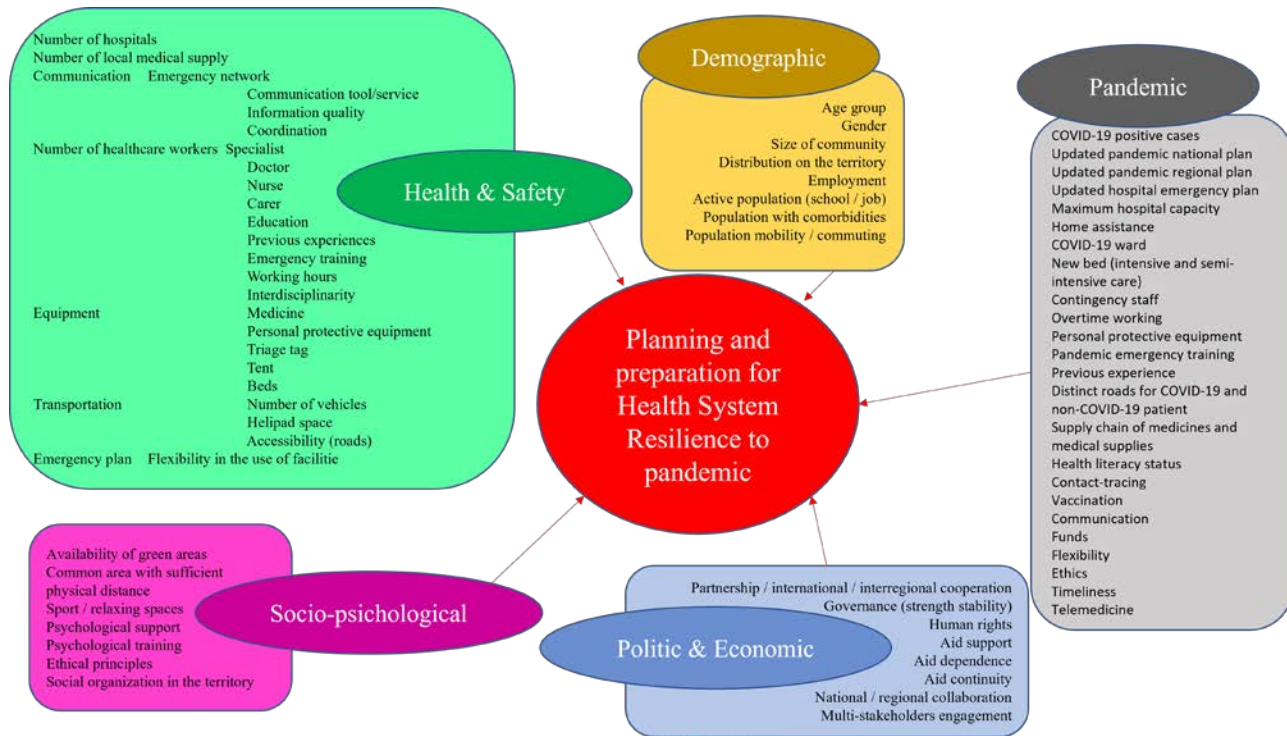
Figure 1. Indicators collected in the literature review to assess the Health System Resilience

WP 2. Objective.

Collection and elaboration of quantitative and qualitative data.

Methods.

Application of Multi-Criteria Decision Analysis to collected data.
The above-described indicators have been examined through Multi-Criteria Decision Analysis methods (Table 1).

MCDA Mult-Criteria Decision Analysis	
Method	*Characteristics*
MAUT	represents the perceived utility given to the option on a specific criterion
AHP	comparisons are evaluated on a ratio scale
MACBETH	comparisons are evaluated on an interval scale
PROMETHEE	involves indifference and preference thresholds
ELECTRE	entails indifference, preference, and veto thresholds
TOPSIS	involves ideal and anti-ideal options
ANP	criteria change

Table 1. Multi-Criteria Decision Analysis methods (elaboration from Multi-Criteria Decision Analysis methods and software (Ishizaka & Nemery, 2013)).

So far, four hospitals of the Marche Region have been selected for data collection and analysis. The primary focus is their involvement in the emergency pandemic management. These are the San Salvatore hospital of Pesaro, Reunited Hospitals Torrette of Ancona, Hospital of Civitanova Marche, Madonna del Soccorso Hospital of San Benedetto del Tronto.

Data have been gathered through technical reports, hospitals databases, national and regional data repositories (statistical). Moreover, interviews have been administered to the top managers and responsible of the selected hospital in the Marche Region.

Expected/Obtained Results.

The use of Multi-Criteria Decision Analysis methods is not very frequently used in pandemic environment. Possibly, the more suitable methods are Analytic Hierarchy Process (AHP), Preference Ranking Organization METHod for Enriched Evaluation (PROMETHEE) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), because these methods all deal with different indicators comparing them on a ratio scale, the weight of indicators is unknown, the indicators are independent (Ishizaka & Nemery, 2013). The assessment of the health system resilience of studied hospital has been performed through the TOPSIS method (see Appendix A).

WP 3. Objective.

Healthcare workers perception of pandemic risk.

Methods.

Questionnaire on pandemic risks and mitigation measures have been administered to healthcare workers. Questionnaires have been designed trying to gauge pandemic risk perception of healthcare workers engaged in the first aid wards and critical care units during the COVID-19 emergency.

Expected/Obtained Results.

Throughout the analysis of healthcare workers perception, this research project aims to support planning for pandemic emergencies. The analysis of the first aid wards' resilience and the healthcare workers' risk perception should highlight the weaknesses of the current pandemic response plan. The intent is to better prepare for the next pandemic, avoiding uncertainties and unpreparedness. This analysis should highlight those indicators with greater influence on pandemic response and preparedness. For example, the availability of resources (human and technical) in the macro area of health & safety, the psychological stress and the ethical principles in the socio-psychological macro area, the indication of administrations in the macro area of politic & economic, the population density and the population in good health in the demographic macro area, and lack of pandemic guidelines at local level in the macro area of pandemic.

WP 4. Objective.

Compare analysis between the case studied in the Marche Region and Auckland Region (New Zealand)

Methods.

Replication of data collection methods and analysis performed in the Marche Region in selected hospitals in the Auckland Region in New Zealand.
This is the next step of the analysis, planned for this spring (January-June 2023). Interviews, questionnaires, Multi-Criteria Decision Analysis, and data collection will be carried out in selected hospitals in Auckland Region, under the supervision of Prof. Ailsa Holloway at the Auckland University of Technology – School of Public Health.
Comparison of data and results from the Marche and Auckland study cases will be performed to highlight similarities and differences in the handling of the COVID-19 pandemics in Italy and New Zealand.

Expected/Obtained Results.

New Zealand is among the Countries who appeared to have effectively managed the COVID-19 emergency.
The plan is to spend the Spring of 2023

During my period abroad as a visiting scholar at the Auckland University of Technology - School of Public Health, I will collect information about the health system resilience of a few Auckland selected hospitals. I will also carry out interviews and administer questionnaires to local healthcare workers to replicate the analysis performed in the Marche Region. Comparing results from the two Countries I expect to obtain important indicators on how to better prepare and strength resilience for pandemic emergencies.

Results will provide information and lesson learned upon which build new approach and guidelines for effective pandemic emergency response.

REFERENCES

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Part 2. PhD student information on the overall year activity (courses/seminars/schools, mobility periods, participation to conferences)

List of attended courses/seminars/schools

1. "Innovation and technology transfer" course Prof. Donato Iacobucci

2. "Designing research: European projects" Prof. Nicola Paone

3. "Methods of Disaster Research" Prof. Fausto Marincioni

4. "Introduction to LaTeX environment for the editing of scientific documents" Prof. Spinozzi

5. "Theory and application of complex networks" Prof. Maria Grazia Ortore (in progress)

6. "Human, environment and geology" Prof. Alessandra Negri

7. Individual exercise (48 hours - 6 CFU): Participation in the work of the "National Civil Protection Operational Committee on the Covd 19 pandemic emergency" Prof. Mario Caroli

8. Theoretical-practical workshops on advanced instrumentation (24 hours – 3 CFU): Laboratory of oceanographic instruments" Pierpaolo Falco

9. "FameLab Public Speaking: comunicazione efficace per la scienza" course Mattia Crivellini

List of periods spent abroad

1. From 10 May to 24 June 2022: Implementation of PhD research information about Multi-Criteria Decision Analysis at the Institute of Energy Systems and Environment, at Riga Technical University, in Riga, under the supervision of Professor Francesco Romagnoli.

2. Expected visit in New Zealand from January to June 2023 to collect analyze data from the Auckland hospitals.

List of conferences/workshops attended and of contributions eventually presented

1. Presentation <u>Marchetti N</u>. "Strategie di adattamento climatico nelle regioni Adriatiche: il progetto Europeo Interreg Italia-Croazia RESPONSe" Webinar "Adattarsi ai cambiamenti climatici: la risposta di Montemarciano" (Montemarciano, 13 November 2020, online).

2. Participation to the X Giornata di Studio di studio in Geografia economico-politica "Oltre la Globalizzazione - Feedback" contribution "Sviluppo sostenibile nelle politiche di risposta alla crisi climatica della regione Adriatica" Gioia E. – <u>Marchetti N.</u> (Firenze, 11 December 2020, online).

3. Presentation at the XXXIII Congresso Geografico Italiano, contribution "Integrazione delle diseguaglianze sociali nella risposta ai cambiamenti climatici" <u>Marchetti N</u>. – Casareale C. (Padova, 8-10 September 2021, online).

4. Presentation at the XI Giornata di Studio "Oltre la Globalizzazione - Catene/Chains", Società di Studi Geografici, contribution "La geografia sociale nella seconda ondata del COVID-19 nella regione Marche" <u>Marchetti N</u>. – Gioia E. (Sessione 10, Napoli, 10 dicembre 2021 in presence)

5. Poster presentation at the CONECT 2022 - International Scientific Conference of Environmental and Climate Technologies, contribution "Definition of indicators for Multi-Criteria Decision Analysis of COVID-19 emergency response and Health System resilience in Italy" <u>Marchetti N</u>. – Marincioni F. (11-13 May 2022 in presence).

Part 3. PhD student information on publications

If not yet published, please indicate the publication status (submitted, accepted, in preparation...)

List of publications on international journals

J1. Casareale, C., Gioia, E., Colocci, A., <u>Marchetti, N</u>., Carone, M.T., Marincioni, F. "Fostering Geoethics in Flood Risk Reduction: Lessons Learned from the EU Project LIFE PRIMES" Geosciences 12, 131 (2022). DOI: 10.3390/geosciences12030131

J2. Gioia, E., Colocci, A., Casareale, C., <u>Marchetti, N</u>., Marincioni, F. "The role of the socio-economic context in the spread of the first wave of COVID-19 in the Marche Region (central Italy)" International Journal of Disaster Risk Reduction, ID: IJDRR-D-22-01248

List of publications on conference proceedings

C1. Gioia, E., Colocci, A., Marchetti, N. "Strategie di adattamento e mitigazione ai cambiamenti climatici in adriatico: analisi delle frontiere in Adriatico", Società di Studi Geografici, Memorie Geografiche, "Oltre la Globalizzazione. Confin(at)i/Bound(aries)", 18, Firenze (2020). ISBN 9788890892660, http://www.societastudigeografici.it

C2. Gioia, E., Marchetti, N. "Sviluppo sostenibile nelle politiche di risposta alla crisi climatica della regione Adriatica", Società di Studi Geografici, Memorie Geografiche, "Oltre la Globalizzazione. Feedback" 19, Firenze (2021). ISBN 978-88-90892684, http://www.societastudigeografici.it

C3. Marchetti, N., Casareale, C., "Integrazione delle diseguaglianze sociali nella risposta ai cambiamenti climatici", Atti del XXXVIII Congresso Geocartografico Italiano, Padova (accepted).

C4. Marchetti, N., Marincioni, F. "Definition of indicators for Multi-Criteria Decision Analysis of COVID-19 emergency response and Health System resilience in Italy" Environmental and Climate Technologies, 26, 1, pp. 767-773, (2022). https://doi.org/10.2478/rtuect-2022-0059, License CC BY 4.0, https://content.sciendo.com

C5. Marchetti, N., Gioia, E. "La geografia sociale nella seconda ondata del COVID-19 nella regione Marche", Società di Studi Geografici, Memorie Geografiche, "Oltre la Globalizzazione - Catene/Chains", (accepted), http://www.societastudigeografici.it

List of other publications (books, book chapters, patents)

B1. Casareale, C., Gioia, E., Colocci, A., Marchetti, N., Marincioni, F. "Perception of the self-exposure to geohazards in the Italian coastal population of the Adriatic basin" in "Geohazards and Disaster Risk Reduction: Multidisciplinary and Integrated Approaches" volume, Springer (submitted)

B2. Casareale, C., Marchetti, N., Colocci, A. "Sense of belonging and response to climate change: How the relation with local territories influences climate resilience" Disaster Resilience and Human Settlements - Emerging Perspectives in the Anthropocene, Advances in 21st Century Human Settlements, Springer, Series Ed.: Dahiya, Bharat, ISSN: 2198-2546, (2021), (submitted)

B3. Marincioni, F., Gioia, E., Casareale, C., Colocci, A., Marchetti, N., "L'evoluzione del contagio in relazione ai territori delle Marche" in "Atlante COVID-19 Geografie del contagio in Italia", Collana Atlanti Copyright © 2022 Casa editrice A.Ge.I. Roma, (2022). ISBN 978-88-942641-4-2 ISBN 978-88-942641-6-6 (eBook)

03.10.2022

    Student signature   Supervisor signature

Appendix A: table of the closeness coefficient for resilience (example for the first wave of COVID-19)

Hospital	STEP 6 - Calculate the relative closeness coefficient (Pi) or performance score	Final rank
San Salvatore hospital of Pesaro	0,592	1
Reunited Hospitals Torrette of Ancona	0,410	4
Hospital of Civitanova Marche	0,505	3
Madonna del Soccorso Hospital of San Benedetto del Tronto	0,554	2

Legend: Final rank runs from 1 (closeness coefficient to the ideal index) to 5 (furthest coefficient to the ideal index).