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First Scientific Symposium
Health and Climate Change

Istituto Superiore di Sanità
Rome, December 3-5, 2018

ABSTRACT BOOK

Edited by
W. Ricciardi, S. Marcheggiani, C. Puccinelli,
M. Carere, T. Sofia, F. Giuliano, E. Dogliotti and L. Mancini

ISTITUTO SUPERIORE DI SANITÀ

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ABSTRACT BOOK

Edited by
Walter Ricciardi (a), Stefania Marcheggiani (c),
Camilla Puccinelli (c), Mario Carere (c), Tonino Sofia (b),
Fabiola Giuliano (b), Eugenia Dogliotti (c) and Laura Mancini(c)

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(b) Office of the President, National Institute of Health
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Istituto Superiore di Sanità
First Scientific Symposium Health and Climate Change. Istituto Superiore di Sanità. Rome, December 3-5, 2018. Abstract book.
Edited by Walter Ricciardi, Stefania Marcheggiani, Camilla Puccinelli, Mario Carere, Tonino Sofia, Fabiola Giuliano, Eugenia Dogliotti and Laura Mancini
2018, xxix, 268 p. ISTISAN Congressi 18/C5

Climate changes affect social and environmental health determinants such as clean air, ecosystems health, safe drinking water and sufficient food. Globally, people at greatest risk of adverse health effects associated with climate change include the children, the elderly and vulnerable groups. Socio-economically disadvantaged groups and areas where infrastructure and/or social services are not efficient will fail in adaptation to climate change and related health hazards. Temperature-related death and illness, extreme events, polluted or stressed ecosystems represent relevant issues raising concern for both health and economic consequences. The aim of the Symposium is to promote an intersectoral and multidisciplinary approach to estimate, and to prevent, climate change-related events as well as to prepare the authorities to put in place measures to reduce adverse health effects.

Keywords: Climate changes, Human health, Adaptation, Sustainability, Scenarios, Advanced technologie, Innovative tools, Resilience, Management policy, Children's health, Urban cities, Ecosystems, Green areas, Extreme events

Istituto Superiore di Sanità
Primo Simposium Scientificio: Salute e Cambiamenti Climatici. Istituto Superiore di Sanità. Roma, 3-5 dicembre 2018. Riassunti.
A cura di Walter Ricciardi, Stefania Marcheggiani, Camilla Puccinelli, Mario Carere, Tonino Sofia, Fabiola Giuliano, Eugenia Dogliotti e Laura Mancini
2018, xxix, 268 p. ISTISAN Congressi 18/C5 (in inglese)

I cambiamenti climatici influenzano i deteminanti della salute come la qualità dell'aria, la salute degli ecosistemi, la sicurezza idropotabile e la disponibilità di cibo. A livello globale, le persone a maggiore rischio di effetti avversi sulla salute associati ad i cambiamenti climatici includono i bambini, gli anziani ed i gruppi vulnerabili. Aree dove i servizi sociali e le infrastrutture sono poco efficienti e le comunità che hanno svantaggi economici non posseggono misure di adattamento adeguate per fronteggiare i cambiamenti climatici ed i loro effetti. Patologie e decessi causati dall'aumento della temperatura, eventi estremi, ecosistemi alterati e/o inquinati rappresentano dei problemi rilevanti per le conseguenze negative sanitarie ed economiche. L'obiettivo del simposio è quello di promuovere un approccio multidisciplinare ed intersettoriale per stimare e prevenire gli eventi connessi ai cambiamenti climatici e di preparare le autorità politiche a predisporre delle misure per ridurre gli effetti avversi sulla salute.

Parole chiave: Cambiamenti climatici, Salute umana, Adattamento, Sostenibilità, Tecnologie avanzate, Metodologie innovative, Resilienza, Gestione, Salute dei bambini, Città, Ecosistemi, Aree verdi, Eventi estremi

Responsabili scientifici: Walter Ricciardi, Eugenia Dogliotti, Laura Mancini

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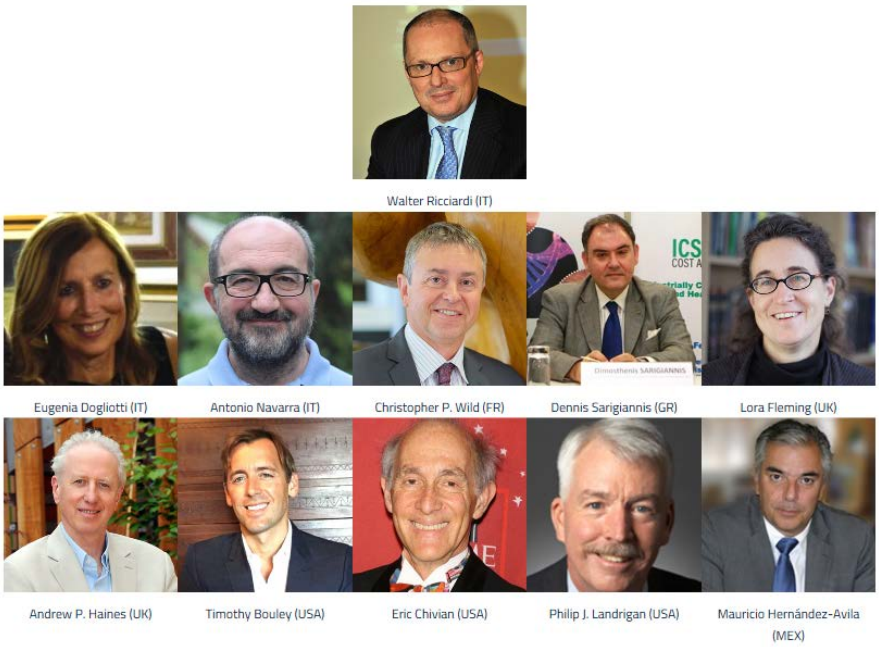

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TABLE OF CONTENTS

Wensday, December 5, 2018

PROGRAMME

Monday, December 3, 2018

8:00 Registration

9:00 Welcome remarks and opening address

Walter Ricciardi
President of the Istituto Superiore di Sanità

Institutional Representatives and Special Guests

Giulia Grillo
Minister of Health

Sergio Costa
Minister of Environment

Stefano La Porta
Istituto Superiore per la Protezione e Ricerca Ambientale

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Massimo Inguscio
Consiglio Nazionale delle Ricerche

Gaetano Manfredi
Conferenza dei Rettori delle Università Italiane

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World Organization for Animal Health, OIE

Tedros Adhanom Ghebreyesus
World Health Organization

Alexander Jones
Food and Agriculture Organization of the United Nations

Christopher Wild
International Agency for Research on Cancer

10.30 Coffee Break

11.00 Institutional Representatives and Special Guests

Maria P. Neira
World Health Organization

Andre Jol
European Environment Agency

Tobin Robinson
European Food Safety Agency

Eric Chivian
Director Emeritus Center for Health and the Global Environment Harvard Medical School

Opening Plenary session

Chair:**W. Ricciardi**

11.30 *The impact of pollution on plenary health Emergence of an Underappreciated Risk Factor*
P.J. Landrigan

12. 00 *Climate Change: Through a Planetary Health Lens*
H. Frumkin

12.30 *Towards climate smart healthcare: paving the way for a low-carbon, resilient health system*
T.S. Rabie

13.00 Lunch Break

Oral Session 1 (Pocchiari room)
ENVIRONMENT AND HEALTH

Chairs: **E. Dogliotti and C. Wild**

14.15 *Interplay of climate change and air pollution on health*
H. Orru

14.45 *Children environmental health and climate change*
I. Iavarone

15.00 *Methods for estimating ingestion exposure to common contaminants: linking land contamination, climate change and ingestion behaviours*
R. Hams

15.15 *Does climate change increase toxic cyanobacterial human health risk*
M. Manganelli

15.30 *Contrasting-climate skin temperature gradient effects*
K. Makris

15.45 Discussion

Oral Session 2 (Bovet room)

CLIMATE CHANGE AND ZOONOSES

Chairs: **Umberto Agrimi and Romano Marabelli**

14.15 *Climate change impacts on zoonotic diseases*
K. Murray

14.45 *Syste*matic *and global effects of land use on zoonotic host communities*
R. Gibb

15.00 *Early warning for tick-borne encephalitis hazard. climatic variables and host density successfully explain co-feeding tick transmission in northern Italy*
A. Rizzoli

15.15 *West nile virus in north-eastern Italy: preliminary results of surveillance activities in 2018*
P. Mulatti

15.30 *Mediterranean spotted fever spatio-temporal distribution, and its association with meteorological factors in Spain*
A.R. Vidal

15.45 Discussion

Poster Session (Marotta room)

14.00 Poster Corner

16.00 Coffee Break

Oral Session 3 (Pocchiari room)

CLIMATE CHANGES SCENARIO

Chairs. **A. Navarra and V. Kendrovski**

16.35 *The challenge of climate science*
A. Navarra

16.55 *Projected health effects of climate change in WHO European Region*
V. Kendrovski

17.15 *What may happen when tropical microalgae spread in temperate waters? The case study of Ostreopsis spp. From health impact to chemistry and viceversa*
C. Dell'Aversano

17.25 *Impact of mycotoxins on health in climate change scenario*
P. Battilani

17.35 *Future health impacts of temperatures and heatwaves considering high resolution climate change scenarios in Italy*
F. de'Donato

17.45 *Climate change and river ecosystems: insight from long-term environmental research*
S. Larsen

17.55 Discussion

Oral Session 4 (Bovet room)

CLIMATE CHANGE AND CHILDREN HEALTH

Chairs. **M. Cipparone and P. Michelozzi**

16.35 *Parks. gateways to healthy living for people and the planet*
D. Allen

16.55 *Climate Change, environmental exposures, urban green and children health*
P. Michelozzi

17.15 *Greeness and air pollution exposure on children health a cross sectional study in southern Italy*
S. La Grutta

17.25 *Effect modification by socio-economic position and green spaces of short-term exposure to heat and air pollutants on preterm-birth risk. A time series study in rome, 2001-2013*
F. Asta

17.35 *The restorative effects of outdoor environmental education*
G. Carrus

17.45. *Nature: an important ally for children's health*
A. Tavone

17.55 Discussion

Oral Session 5 (Marotta room)

HEALTHIER CITIES

Chairs: A. Lenzi and M.R. Milana

16.40 *Latest developments with EU Climate Change Adaptation Policy and links with health*
J. Milos

17.10 *Social interventions to limit. the mortality increase during the summer 2017 heat waves in Rome Italy*
G. Liotta

17.20 *Reducing urban heat waves risk: heat health adaptation plan in Italy*
P. Michelozzi

17.30 *Climate and health in large urban areas of Italy: following the change through a dedicated meteorological network*
C. Ferrari

17.40 Discussion

Tuesday, December 4, 2018

Oral Session 6 (Pocchiari room)
MENTAL HEALTH AND CLIMATE CHANGE

Chairs: **E. Alleva and M. Biondi**

09.10 *Climate change and mental health*
M. Biondi

09.30 *The impact of climate change on persons with mental health conditions*
A. Preti

09.50 *Mental health care in Italy and the climate change challenge*
L. La Sala

10.10 *Extreme weather events on mental health*
D. Marazziti

10.20 *Natural, urban and historical-urban environments on children affected by ADHD in Italy*
F. Di Carmine

10.30 *Changes in feeding due to climate modulated human mental processes and preferences about food*
R.I. Rumiati

10.40 Discussion

Oral Session 7 (Bovet room)
WATER, SANITATION AND CLIMATE CHANGE

Chairs. **L. Lucentini and O. Schmoll**

09.15 *Water safety planning for climate resilience*
R Moses McKeown

09.50 *The Protocol on Water and Health tools to increas resilience to climate change and water-related disasters*
N. Nikiforova

10.10 *Water and sanitation in extreme weather events. environment and health risks and vulnerabilities*
L. Sinisi

10.25 *Assessment of climate change impacts on groundwaters of semiarid regions. health-risk for floods*
C. Masciopinto

10.40 Discussion

Oral Session 8 (*Marotta room*)
BLUE AND GREEN SPACE

Chairs. **L. Fleming and C. Puccinelli**

09.10 *The effects of weather and daylight on current and future nature-based recreational physical activity in England*
L. Elliott

09.45 *Healthy Parks Healthy People. Using Europe's network of parks and protected areas as 'Natural Health Centres'*
C. Castell

09.55 *Labirinth, a way to integration*
S. Panigutti

10.05 *BlueHealth community level interventions: The case study of Appia Antica Park*
C. Puccinelli

10.15 *The Environmental Cultural Center of the Italian Naval League (Lega Navale Italiana) for the propagation of an environmental culture*
V. Manfrini

10.25 Discussion

10.45 Coffee Break

Oral Session 9 (Pocchiari room)
COMMUNICABLE DISEASE AND CLIMATE CHANGE

Chairs: **G. Rezza and L. Busani**

11.25 *Climate and other drivers of infectious disease threat events in Europe*
J. Semenza

12.00 *Risks maps of adedes albopictus in Spain*
D.Gómez-Barroso

12.15 *Quantifying the spatiotemporal spread of mosquito-borne infections in non-endemic areas*
G. Guzzetta

12.30 *The second autochthonous Chikungunya outbreak in Italy: lessons learned and future challenges*
F. Riccardo

12.45 Discussion

Oral Session 10 (Bovet room)
HEALTH AND CLIMATE CHANGE. JOINT ACTION FOR SUSTAINABLE DEVELOPMENT

Chairs. **B. Menne and R. Stancliffe**

11.*25* *Health, climate change and sustainable development*
B. Menne

11.45 *Transforming healthcare for a sustainable future*
R. Stancliffe

12.05 A ten year journey in England's NHS: practical steps towards a sustainable health and care system
D. Pencheon

12.15 *The WHO UNCCC first Italian Country Profile on Climate and Health*
L. Lucentini

12.25 *Improving agriculture sustainability through farm's management optimization; the Water-Energy-Food nexus to reduce inputs requirement in intensive cropping systems*
S. Fabiani

12.35 *Water reuse in the context of climate changes and sustainable development. The European Project FRAME*
M. Carere

12.45 Discussion

Oral Session 11 (Marotta room)
EVERYTHING ELSE ON HEALTH AND CLIMATE CHANGE

Chairs: **E. Testai and E. Funari**

11.25 *Global warming effects on skeletal anomalies in fish*
C. Boglione

11.35 *Drought effects on freshwater macroinvertebrate community in the Mediterranean: ecological network analysis as an innovative tool for bioassessment*
G. Pace

11.45 *Modelling Aedes albopictus dynamics and related arbovirus outbreaks risk in central Italy*
M. Manica

11.55 *A modelling analysis of West Nile virus transmission and human infection risk in Veneto (Italy)*
G. Marini

12.05 *Spatial correlations of climatic and eco-environmental factors with incidence of human leishmaniasis in Spain*
J. Lopez Moreno

12.15 *The Mediterranean basin like a pathogen's soup.*
A *concern for cetacean species inhabiting the Pelagos Sanctuary and the zoonotic significance of some pathogens involved*
C. Grattarola

12.25 *Risk evaluation of malaria reemerging in non-endemic areas with a temperate climate*
C. Severini

12.35 Discussion

13.00 Lunch Break

Oral Session 12 (Pocchiari room)
AIR QUALITY, LOW CARBON POLICY HEALTH AND CLIMATIC CHANGE

Chairs: **M.P. Neira and A. Haines**

14.10 *Addressing Climate Change, a major opportunity for human health*
M.P. Neira

14.40 *Health in the low-carbon economy*
A. Haines

15.10 *Short-term effects of temperature on mortality and hospital admissions in Italy during 2000-2010. Results from the beep project*
F. de Donato

15.20 *Low carbon footprint technologies to recover and reuse safe resources within the urban water cycle*
F. Fatone

15.30 *The interactive effect of temperature and air pollution on mortality: a time series analysis in 25 cities.*
M. Scortichini

15.40 *Respiratory infectious mortality rates in Italy: the climatic indexes as long term prediction instruments*
S. Bonomo

15.50 Discussion

Oral Session 13 (*Bovet room*)
ECOSYSTEM AND HEALTH

Chairs: **L. Mancini and D. Barceló Cullerès**

14.10 *The Eu Globaqua project on multiple stressors in rivers under water scarcity and global change. A reconnaissance study in selected european river basins and the water-energy-food nexus*
D.Barceló Cullerès

14.40 *Addressing key challenges of water scarcity affecting warm Mediterranean reservoirs*
MG Antoniou

14.55 *An Italian network for the detection of eco-genotoxicological effects in a river basin characterized by flooding and water scarcity*
M. Carere

15.10 *"Summer Rain" - increased risk of gastrointestinal anrespiratory infections after urban pluvial flooding in the Netherlands*
A. Mulder

15.25 *Evaluation of the ecotoxicological impact of municipal wastewaters on wildlife*
F. Spina

15.40 *Soil sealing and urban growth in Italy*
M. Munafò

15.55 Discussion

Poster Session (Marotta room)

14.00 Poster Corner

16.00 Coffee Break

Oral Session 14 (Pocchiari room)
GLOBAL HEALTH AND CLIMATE CHANGE

Chairs: **S. Vella and M. Marceca**

16.35 *Impact of climate change on chronic non-communicable diseases*
S. Vella

17.05 *One health: the MediLabSecure effort towards integrated survellaince of Arbovirus infections in the context of environmental changes*
S. Declich

17.15 *Perception of change, loss of social capital and mental health in migrants from African countries divided by index of vulnerability to climate change*
P. Michielin

17.25 *Effect of global changes in gene polymorphisms on health protection at workplace*
P. Chiarella

17.35 *Climate change, migration and consequences for host Countries*
O. Punzo

17.45 Discussion

Oral Session 15 (Bovet room)

TOOLS AND NEEDS

Chairs. **D. Sarigiannis and M. Scrimshaw**

16.35 *The climate exposome. a new tool for addressing the health impacts of climate change*
D. Sarigiannis

17.05 *Heavy Metals Detection using Screen printed Carbon electrodes*
A. Merkoçi

17.20 *How can smart technologies address measures for human health protection when extreme events happen? The Challenges of INTCATCH project*
S. Marcheggiani

17.35 *Summer work. Prevention of the effects of Heat Waves (HW) on the health of workers*
S. Macchiaroli

17.50 Discussion

Oral Session 16 (Marotta room)

FROM THE ENVIRONMENT FRIENDLY GREEN TO THE HEALTHY HOSPITAL

Chairs: **G. Capobianco and L. Bertinato**

16.35 *Hospitals and healthcare system at disaster situations; characteristics and future suggestions*
N. Bitterman

17.05 *Communicating the Risk of Adverse Health Outcomes Related to a Changing Climate to Policy Makers and the Public in Maryland, USA*
S. Soneja

17.15 *Sustainable and Climate Change Resilient Health Facilities in Europe: The Challenge*
D Pedrini

17.25 *Reduction of inflammatory parameters in asthmatic children in an alpine hospital free from allergens and pollutant*
E. Baldo

17.35 *The short-term effect of pollen on Emergency Room visits in Rome*
M. De Sario

17.45 Discussion

Wensday, December 5, 2018

Oral Session 17 (Pocchiari room)
FOOD SECURITY -FOOD SAFETY AND CLIMATE CHANGE

Chairs: **T. Robinson and R. Clarke**

09.15 *Climate change and emerging risks for food safety*
A. Maggiore

09.45 *Climate changes and "one health". examples from the safety assessment of primary production*
A. Mantovani

09.55 *Presence of harmful Dinophysis species and okadaic acid toxicity in shellfish bred in Sardinia (Italy)*
A. Mudadu

10.10 *Identifying and preventing climate change threats adversely affecting seafood production, nutritional value and safety*
F. Cubadda

10.25 *Cyanotoxins and climate change. Any consequences for food safety?*
S. Vichi

10.40 *Are ciguatoxin-like producers Gambierdiscus spp. and Fukuyoa spp. spreading in the Mediterranean?*
J. Diogène

10.55 Discussion

Oral Session 18 (Bovet room)
STAKEHOLDERS ROUND TABLE

Chair. **M.R. Iardino and A. Di Benedetto**

09.00 Round Table
B. Rossi, A.Miozzi, A. Citterio, D. Biagioni, G. Bortone

Poster Session (Marotta room)

*Chairs.***S. Marcheggiani, M. Manganelli, M. Carere**

09.00 Poster presentations

11.00 Coffee Break

Plenary session (Pocchiari room)

Chair: **L. Rosi**

11.35 *Thinking outside the box. Translating science into innovation for policy, advocacy, and business*
T. Bouley

12.00 *Communication of environmental risks*
A. Contri

12.30 *Migration and Climatic Change*
I. Annesi-Maesano

13.00 Lunch Break

Final Plenary Session (Pocchiari room)

Chair: **Walter Ricciardi**

14.00 *Policy and Science*
A. Bergman

14.30 *Evidence and economic interests*
G. Negro

15.00 Coffee Break

15.30 *Closing remarks/Awards/Rome Declaration*
W. Ricciardi, E. Dogliotti, A. Haines, P.J. Landrigan, M. Gracheva, M.P. Neira

PREFACE

On 3-5th December 2018, the Italian National Institute of Health (ISS), located in Rome, will host the First International Scientific Symposium on Health and Climate Change.

Climate change is becoming an increasingly urgent issue and the application of measures and actions to prevent and mitigate the impact on environment and human health are needed at all levels; for this reason the symposium will bring together several national and international actors (E.g. Universities, Scientific Institutions, Hospitals, Local Authorities, stakeholders), involved in different fields, with the aim to define a series of actions that can contribute to prevent, mitigate and adapt to the effects of climate change.

The impacts and consequences of Climate change related events on human health are dramatic, WHO states that 1) vector-borne diseases will increase with more humidity and heat, 2) food production will be destabilized by drought, 3) air pollution will lead to more allergies and asthma, 4) warmer waters and flooding will increase the risk of water-borne diseases. WHO estimates that climate changes are expected to cause an additional 250.000 deaths worldwide per year between 2030 and 2050.

Climate changes threatens our health whether you live in a rural village, on a small island, in coastal areas or a big city; everyone is at risk.

In this context it is important to recognize and highlight the signals that our planet is sending us, in particular our ecosystems that are closely connected with the wellbeing and health status of populations. The signals of ecosystem alteration or deterioration must be considered as an alarm by the policy makers to apply prevention, mitigation and adaptation measures to protect human health. WHO states indeed that a new perspective is required which focuses on ecosystems and on the recognition that long-term good health in human populations relies, above all, on the continued stability and functioning of the biosphere's life-supporting systems.

Due to the complex and far reaching impacts of climate change on health the topics included in the Symposium are intersectoral and include, *inter alia*, environment and health, communicable and non communicable diseases, food security, zoonoses, green economy, migration, mental health, ecosystems and Health, drinking waters, healthier cities, air quality, blue-green Space, innovative tools.

At the end of the Symposium the Rome Charter on Health and Climate Change will be presented in which a series of actions and recommendations, discussed and shared by all the participants, will be delivered to the policy makers and all the stakeholders involved in the management of climate changes.

The International Scientific Committee involved in the organization is made up of experts recognized worldwide for their scientific and policy contribution in relation to the protection of human health and the environment.

I am sure this event will add to the precious work already being carried out in this field and contribute to promote a series of actions that are strongly needed to face the effects of climate changes.

Walter Ricciardi

Opening Plenary Session

Chair

Walter Ricciardi

THE IMPACT OF POLLUTION ON PLANETARY HEALTH: EMERGENCE OF AN UNDERAPPRECIATED RISK FACTOR

Philip J. Landrigan
Schiller Institute for Integrated Science and Society, Boston College, Boston, USA

Pollution is a massive, overlooked cause of disease, death and environmental degradation. To address the neglected problem of pollution, we formed the *Lancet* Commission on Pollution and Health. The goals were to raise awareness of pollution's great magnitude, end neglect of Pollution-Related Disease (PRD), and mobilize the resources and political will needed to control pollution and prevent PRD.

Pollution was responsible in 2015 for 9 million premature deaths - three times as many deaths as caused by AIDS, tuberculosis and malaria combined. 92% of PRD occurs in Low and Middle-Income Countries (LMICs), and in the hardest hit countries, PRD is responsible for more than 1 death in 4. Household air and water pollution, the traditional forms of pollution, are decreasing, and deaths from pneumonia and diarrhea are down. But ambient air, chemical and soil pollution are all on the rise, and Non-Communicable Diseases (NCD) caused by these forms of pollution are increasing. Pollution and climate change are closely linked; both arise from the same sources, and both can be controlled by similar solutions. PRD causes great economic losses. These include productivity losses that reduce gross domestic product in LMICs by up to 2% per year as well as health care costs that account for 1.7% of health care spending in high-income countries and up to 7% in LMICs. Welfare losses due to pollution are estimated to amount to $4.6 trillion per year, 6.2% of global economic output.

Pollution and PRD are not the unavoidable consequences of economic development. The notion that LMICs must pass through a phase of pollution and disease as they grow is obsolete data and not well substantiated. Proven, cost-effective pollution control strategies are available today to countries at every income level. These solutions are based on law, policy and technology, and the most effective eliminate pollution at source.

Pollution control and PRD prevention will require that affected countries, international agencies, major foundations, research institutions, and civil society make pollution prevention a high priority; to set firm targets for PRD reduction; to establish data systems for monitoring pollution and PRD; and to end the externalization of pollution by enforcing the 'polluter pays' principle. The donor community can provide much needed technical and financial support. Advocacy for the issue is also critical. Pollution control is a winnable battle.

CLIMATE CHANGE:
THROUGH A PLANETARY HEALTH LENS

Howard Frumkin
Our Planet, Our Health, Wellcome Trust, London, UK

Our planet is changing in multiple ways, driven in substantial part by human activity. Climate change is the most widely recognized planetary change; other changes include biodiversity loss, altered land use and reduced soil quality, changes in the hydrology of both marine and freshwater systems, environmental loading with persistent chemicals, and changes in phosphorus and nitrogen cycling.

Urbanization, while not a change to natural systems, represents another global trend. Each of these trends, and the complex interactions among them, have important implications for human health and well-being.

The emerging field of Planetary Health proposes that these earth system changes are now so far-reaching that they drive a substantial, and increasing, proportion of the global burden of disease. This presentation places climate change, the topic of the conference, in the broader context of Planetary Health, and proposes approaches that may point the way to sustainable solutions.

TOWARDS CLIMATE-SMART HEALTHCARE: PAVING THE WAY FOR A LOW-CARBON, RESILIENT HEALTH SYSTEM

Tamer S. Rabie, Maria Gracheva, Stephen Dorey
World Bank, Washington DC, USA

The health impacts of climate change are significant, with up to 250,000 additional deaths per year. Additionally, costs of between US$2-4bn for healthcare are predicted by 2030 with far-reaching impacts on the wider economy. Unless concerted action is taken more than 100 million people are predicted to be pushed into extreme poverty by 2030, with climate related health impacts playing a major role. Looking to the future, the world needs to feed 9 billion people by 2030, reduce emissions and provide electricity to 1.1 billion, whilst transitioning from fossil fuels. Preparations need to be made for 2 billion new urban dwellers, whilst simultaneously reducing the carbon footprint of cities and improving urban resilience. There is no doubt that climate change is the defining challenge for this and future generations. The sustainable development goals will only be achieved through increased climate action, commitment and financing. This requires multi-sector coordination including; energy, transport, agriculture, industry, and of course health, to name but a few. Though most of the carbon footprint comes from outside the health sector, the sector's contribution to this problem should not be underestimated. Across low- and middle-income countries, it is conservatively estimated that 3-5 percent of total greenhouse gas emissions come from health, the situation is much worse when considering high-income countries, where levels have been estimated for example to reach as high as 10 percent of the US's total emissions. In the health sector, greenhouse gases are released from practices related to procurement, energy consumption and transport, among others. For example, primary healthcare tends to have a particularly high carbon footprint from the procurement of medication, whilst hospitals are energy intensive, consume significant resources, and produce large amounts of waste – all of which hugely contribute to the sector's overall carbon footprint. Transport emissions, on the other hand, are intimately tied to both supply of, and demand for, access to care. The way forward will be through shifting to Universal Health Coverage that is climate-smart. This means; firstly, establishing systems for fair, efficient and sustainable financing of health outcomes that are also climate adaptive. Secondly, ensuring equitable access to affordable, quality health services that are also resilient. Thirdly, leveraging climate-smart interventions in other sectors to strengthen health results and generate public goods. Such an approach sits at the intersection of low carbon healthcare and resilience.

Oral Session 1

Environment and Health

Chairs

Eugenia Dogliotti and Christopher P.Wild

INTERPLAY OF CLIMATE CHANGE AND AIR POLLUTION ON HEALTH

Hans Orru (a,b), Kristie L. Ebi (c), Bertil Forsberg (b)
(a) Department of Family Medicine and Public Health, University of Tartu, Tartu, Estonia
(b) Department of Public Health and Clinical Medicine, Umea University, Umea, Sweden
(c) Center for Health and the Global Environment, University of Washington, Seattle WA, USA

Air pollution significantly affects health, causing up to 7 million premature deaths annually with even larger number of hospitalizations and days of sick leave. On the interplay, climate can affect air quality, air quality can affect climate change, and both can directly or indirectly affect health. The two major effects of climate change on air quality are degrading the removal processes (dispersion, precipitation) and amplifying the atmospheric chemistry. These will affect the concentrations of primary (e.g. soot particles) and secondary (e.g. ozone and sulfate particles) pollutants.

The interactions between air quality and health are manifold. First, particles, especially from combustion, can affect cardiopulmonary mortality, hospitalization and respiratory disease (e.g. asthma, chronic bronchitis, rhinitis). Recent evidence supports associations with diabetes, rheumatic diseases, cognitive functioning and neurodegenerative diseases. Furthermore, gases such as the secondary pollutant ozone are related to all-cause, circulatory and respiratory mortality as well as chronic respiratory diseases such as asthma. Studies have connected higher ozone concentrations with preterm birth, reproductive health and cognitive decline.

Quantifications of the impacts of climate on air pollution-related health effects usually use: 1) future air pollution concentrations, 2) current and/or future population and mortality data and 3) concentration-response functions between air pollution exposure and mortality/morbidity from earlier epidemiological studies. The future air pollution models used input from global climate models that were downscaled to drive a regional, numerical model in higher spatial resolution, to simulate local conditions in greater detail. Global climate models apply different greenhouse gas emission scenarios that modify the magnitude and pattern of climate change in different projections. Based on future modelled air pollutants exposures and mortality/morbidity rates, the future impacts of climate change on air pollution-related health effects have been evaluated.

Recent research confirms that climate change will likely increase the concentrations of near-surface ozone and particulate matter, with associated adverse health consequences. However, the results highly depend on the climate change scenario used and on projections of future air pollution emissions, with relatively high uncertainty. Studies primarily focused on mortality; projections on the effects on morbidity are needed.

As there are very limited options for reducing human vulnerability to air pollutants, protecting population health under future, warmer climates will require complex regulatory interventions such as for reducing greenhouse gas emissions. Research is also needed to quantify the magnitude and pattern of future risks, considering the full range of morbidity and mortality.

CHILDREN ENVIRONMENTAL HEALTH AND CLIMATE CHANGE

Ivano Iavarone
Department of Environment and Health, Istituto Superiore di Sanità, Rome, Italy

Children's environmental health is on the 2030 Agenda for Sustainable Development. Based on recent WHO estimates, every year, 1.7 million children under 5 years die due to environmental risk factors, including indoor and outdoor air pollution and unsafe water. Ambient particulate matter pollution is responsible alone for a large amount of deaths due to lower respiratory infections in children worldwide. Important sources of children exposure to hazardous chemicals is represented by areas contaminated by industrial activities which are often located near densely populated areas.

The Italian Institute of Health (ISS) monitors children health in contaminated sites of concern for remediation (National Priority Contaminated Sites - NPCS), through an epidemiological surveillance system named SENTIERI. NPCS are mainly located close to areas with either active or dismissed industrial complexes, or incinerators or dumping sites of industrial or hazardous waste. Many of these sites are characterised by the presence of complex mixtures of pollutants contaminating all environmental media and food-chain.

Children's growth and development from infancy to adolescence makes them more vulnerable to environmental hazards related to climate changes. Moreover, children spend more time outdoors than adults, which increases their risk of being exposed to extreme heat and higher average temperatures, allergens, and pollutants in air and water.

Urbanisation and industrialisation are proceeding rapidly and in parallel in many areas of the world, and to protect child health climate changes-related health hazards must be quantified. Epidemiological surveillance in highly contaminated areas should be carried out to monitor the combined impact of climate changes and environmental pollution in children. These objectives can be achieved building on large networks of countries and institutions like the one made available by the COST Action on Industrially Contaminated Sites and Health (http://www.icshnet.eu).

METHODS FOR ESTIMATING INGESTION EXPOSURE TO COMMON CONTAMINANTS: LINKING LAND CONTAMINATION, CLIMATE CHANGE AND INGESTION BEHAVIOURS

Rebecca Hams (a,b), Gerard Hoek (c), Giovanni Leonardi (b)
(a) Field Epidemiology Training Programme, Public Health England, London UK
(b) Environmental Epidemiology, Centre for Radiation, Chemicals and Environmental Hazards, Public Health England, London, UK
(c) Institute for Risk Assessment Sciences, Utrecht University, Utrecht, The Netherlands

Background. Industrially contaminated land is a public health concern across the world. Past and current activities have shaped the landscape and increased social inequalities with more disadvantaged populations living closer to industrially contaminated land. The impact of climate change will advance this public health challenge further. This project aims to develop methodology that can be used to estimate ingestion exposure to common contaminants and how to apply the methods To Industrially Contaminated Sites (ICS). This included reviewing food characteristics such as consumption of "local" versus "non-locally" sourced foods linking to food security and climate change concerns.This research collaboration has arisen through the European Cooperation in Science and Technology (COST) Action, Industrially Contaminated Sites and Health Network (ICSHNet), COST Action IS1408.

Methods. Were developed to estimate the proportion of specific food items grown by consumers within different regions. This methodology drew on information from several sources including; average population uptake of grow your own food crops, analysis of the most frequently grown food crops and regional agricultural profiles. This information could then be linked to a specific ICS or applied at larger geographies e.g. regions. A further potential use is to link to climate change estimates to link to future potential food production.

Results. The developed methods will be tested using case studies to illustrate estimated ingestion exposure to common contaminants, the impact of ICS and climate change. If selected for presentation the full results of this project would be shared with recommendations for future public health action.

Discussion. While this work is ongoing several themes have emerged in relation to data quality, this includes the representativeness of local data when estimated at a national level and how this relates to individual ICSs and the regional impacts of climate change. The issues identified through this work highlight the complex interactions between individual behaviours, population characteristics and international threats, for example a link has been demonstrated between socio-economic status and dietary behaviours, this suggests that those in the poorest areas (potentially closest to ICS) consume the least fruits and vegetables. This could offset the increased risk of living in an area close to ICS however the impact on health of consuming a diet lacking fruit and vegetables may result in greater

health complications that consuming fruit and vegetables with potential contaminants - especially if the fruit and vegetables are not locally sourced. Further identified issues will be highlighted.

DOES CLIMATE CHANGE INCREASE TOXIC CYANOBACTERIAL HUMAN HEALTH RISK?

Maura Manganelli (a), Franca M. Buratti (a), Enzo Funari (a), Simona Scardala (a), Mara Stefanelli (b), Emanuela Testai (a), Susanna Vichi (a)
(a) Istituto Superiore di Sanità, Dipartimento Ambiente e Salute, Rome, Italy
(b) Dipartimento Innovazione Tecnologiche e Sicurezza degli Impianti, Prodotti e Insediamenti Antropici, INAIL, Roma, Italia

Cyanobacteria are a morphologically diverse group of photosynthetic pelagic or benthic prokaryotes that occupy a wide range of niches, from freshwater to brackish and sea waters, salty lakes, hydrothermal vents, desert rocks and Antarctic lakes. Several cyanobacteria species produce toxins as secondary metabolites, which can impact on ecosystems, animal and human health. The increased expansion and frequency of cyanobacterial blooms, with the formation of scums in certain conditions, can be attributed to nutrient over-enrichment in watersheds with relevant human activities and changing climatic conditions. Specifically, the increase in frequency and intensity of heavy rainfall and floods has been associated with the spreading of cyanobacteria in coastal and estuarine waters. Together with the identification of marine species this represents an additional reason of concern, since cyanotoxins may accumulate into edible aquatic vertebrates and invertebrates that are not routinely checked for their presence to provide a 'safe' product to consumers. Predicting future scenarios is a major challenge to ensuring protection of human health and to identify the appropriate management strategies to be adopted to protect water resources, mitigating the negative ecological and biogeochemical impacts and economic losses in both the short and long run.

The knowledge of the environmental factors possibly affecting the toxicity of cyanobacteria is therefore crucial. Most of the studies published so far (>80%) were dedicated to microcystins and Microcystis sp. Both in field and laboratory studies different environmental parameters (nutrient levels, particularly P and N; temperature, CO2 levels, light, iron, inorganic carbon) were considered with respect to MC production and/or microcystin synthetase (mcy) genes expression (the presence of which gives indication about the cell competence in toxin production), but results are quite often controversial. Environment plays a very complex role in the toxicity of the bloom, in terms of fitness of the potentially toxic genotype, of regulation of MC production/quota (e.g. limitation in the quantity of a necessary nutrient, or influence in the regulation of gene expression). It seems clear that elevated/not limiting nutrient levels are the base for an abundant bloom, which is also the assumption for a risky situation, even if the thresholds can be different for the various species. Less clear is the nutrient role in the toxicity of the bloom. Indeed, limiting N can increase the toxicity of the bloom via increased MC production or by shifting the relative ratio of toxic/non-toxic genotype towards higher values, but again some contrasting results are reported.

CONTRASTING-CLIMATE SKIN TEMPERATURE GRADIENT EFFECTS ON METABOLIC HORMONES

Konstantinos C. Makris, Anastasia Perikkou, Alexandra Akrotiriatou, Corina Konstantinou, Costas A. Christophi
Cyprus International Institute for Environmental and Public Health, Limassol, Cyprus

Introduction. High temperature weather conditions that are long sustained within a season appear to have a direct impact on human health by affecting the body's ability to regulate its internal temperature. A randomized 2 x 2 cross-over ambulatory study of healthy, non-obese adults (n=50) was proposed to prospectively study the effectiveness of the proposed intervention, which entails a 7-day long stay in a mountainous, cooler climatic environment with the goal to improve the metabolic hormonal profile relative to that obtained in an urban environment/climate. There are studies showing that adapted thermogenesis is reduced in temperatures within the thermal comfort zone, while colder air exposures have been linked with increased energy expenditure/thermogenesis from the brown adipose tissue leading to body weight changes. Reversely, it was hypothesized that systematic exposures to air temperatures above the thermal comfort zone could be associated with metabolic alterations.

Objectives. The study objective was to investigate the association between skin temperature gradient and metabolic hormones in volunteers spending time in two climatologically-distinct study settings during summer: i) urban setting (primary residence in one of the major cities of Cyprus), and ii) mountainous setting of Troodos, Cyprus (altitude >800 meters, at least 8°C ambient air temperature difference with that of the urban environment) where the volunteer spent at least 7 consecutive days in the summer.

Methods. Continuous measurements of armpit skin temperature (as a surrogate of body core temperature) were obtained with a dermal patch wireless sensor coupled with diurnal measurements of personal ambient air temperatures. All time stamped urine voids of the sampling day were collected. Diaries/questionnaires recorded dietary habits, chronotype and sleep/wake/rest patterns. Metabolic hormones (e.g., leptin, adiponectin) and circadian hormones (cortisol, melatonin) measurements were obtained using immunoassays and mass spectrometry, respectively. Associations were assessed using mixed-effect regression models and multiple comparisons were handled using Benjamini-Hochberg correction.

Results. Results showed the association between ambient air temperature gradient with the metabolic hormonal profiles. This non-pharmacological trial will determine the proposed intervention's effectiveness in regulating the magnitude of metabolic hormones in climate-differentiated environments (mountainous *vs* urban) during a typical Mediterranean summertime period.

Oral Session 2

Climate Change and Zoonoses

Chairs

Umberto Agrimi e Romano Marabelli

CLIMATE CHANGE IMPACTS ON ZOONOTIC DISEASES

Kris A. Murray
Department of Infectious Disease Epidemiology and Grantham Institute Climate Change and the Environment, Imperial College London, London, UK

Climate change has had documented influences on all levels of biological organization, from genes to species to entire ecosystems. Given that most human infectious diseases have origins in or require animals including vectors for their transmission, it should not be surprising that these changes also have a number of important implications for zoonotic disease emergence, spread, prevalence or burden. Weather and climate typically help define the behavior, phenology, distributions and abundances of wildlife species that may harbor potential human pathogens. Altering weather and climate regimes are thus altering the distribution or abundance of these hosts or their traits relevant to pathogen transmission. Similarly, weather and climate influence the behavior, activity patterns and distribution of people, livestock and companion animals, and in turn patterns of human-animal contact. In addition to the primary impacts of climate change on disease dynamics, such alterations may further compound other drivers of human or animal ecology (e.g., land-use change, human travel and trade), which could facilitate invasion and contribute to the reshaping of entire ecological communities, again with ramifications for zoonotic disease transmission. Even biodiversity loss, already severe but predicted to become much worse under climate change, could paradoxically increase the risk of zoonotic diseases. Such complexity makes forecasting the impacts of climate change on zoonotic diseases particularly challenging, while both increases and decreases in risk should be expected. Novel tools and approaches that can help anticipate such impacts are urgently required to support public and global health management in an age of radical social and environmental change.

SYSTEMATIC AND GLOBAL EFFECTS OF LAND USE ON ZOONOTIC HOST COMMUNITIES

Rory Gibb, David W. Redding, Kai Qing Chin, Tim Blackburn, Tim M. Newbold, Kate E. Jones
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Climate change will interact with other global change processes (e.g. land use, urbanisation, socioeconomic change) to determine disease risk and burden of many zoonotic and vector-borne (i.e. animal-borne) diseases, however predictive research into global-scale drivers of disease has to date focused mainly on climate effects. Land use change is a dominant global driver of biodiversity change, and is increasingly recognised as a potential driver of human zoonotic disease risk through its impacts on reservoir host populations, pathogen transmission dynamics, and human-wildlife epidemiological contact. In this talk I will discuss recent work from our group towards identifying and predicting interacting effects of land use and climate on zoonotic disease. In particular, although in recent years there has been extensive effort to understand effects of biodiversity change on pathogen transmission (e.g. dilution effects), it remains unclear whether land use has predictable impacts on the overall zoonotic potential of ecological communities (i.e. their host community diversity and composition). By combining global data on local ecological communities from >5700 sites worldwide with data on hosts of human-shared parasites and pathogens ('zoonotic hosts'), we show that the site-level species richness and total abundance of zoonotic hosts are significantly higher in human-dominated (managed and urban) sites than nearby undisturbed (primary) habitat. These overall trends are underpinned by substantial changes in community taxonomic composition, with human-disturbed ecosystems increasingly dominated by rodent, bat and passerine zoonotic host species, whereas primates and carnivores overall tend to decline in modified habitats. These results suggest that ongoing global land transformation is creating increasing opportunities for human-wildlife epidemiological contact, and that predictable ecological community changes may underpin growing evidence of links between agricultural change, urbanisation, and zoonotic disease incidence and emergence.

EARLY WARNING FOR TICK-BORNE ENCEPHALITIS HAZARD: CLIMATIC VARIABLES AND HOST DENSITY SUCCESSFULLY EXPLAIN CO-FEEDING TICK TRANSMISSION IN NORTHERN ITALY

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Tick-Borne Encephalitis (TBE) is a zoonosis of public health relevance in many European countries. The most efficient transmission route for tick-borne encephalitis virus (TBEv) is considered the saliva-activated non-viraemic transmission between co-feeding Ixodes ricinus ticks taking place on specific rodent hosts. A population of yellow-necked mouse, Apodemus flavicollis, was intensively live-trapped in a known TBE focus in the Province of Trento (northern Italy) starting from 2001. Pattern of tick infestation on rodents along with the seroprevalence of TBE antibodies were recorded. As results, the number of co-feeding ticks on rodents and TBE seroprevalence were affected by the combination of climatic condition with the abundance of the feeding tick hosts, in particular rodents and deer. In conclusion, variation of climatic condition, especially during the fall, affects the pattern of tick infestation on rodents the following year. However, early warning indicators of the changing TBE hazard must include knowledge on variation of tick host abundance which co-interact with climatic factors in shaping the pattern of tick infestation on the rodent host and thus the potential of TBE virus intensity of transmission.

WEST NILE VIRUS IN NORTH-EASTERN ITALY: PRELIMINARY RESULTS OF SURVEILLANCE ACTIVITIES IN 2018

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West Nile virus (WNV) has circulated in north-eastern Italy since 2008, and is considered to have become endemic in the area. In 2009, a national surveillance programme was implemented. In 2011 the surveillance plan was re-modulated by the Competent Authorities of the north-eastern Italian regions, to promptly detect WNV seasonal re-activation. Hereby we report the preliminary outcomes of veterinary and entomological surveillance activities in Veneto region in 2018, revealing an intense viral circulation and increased incidence both in animals and in humans.

The surveillance area was defined considering the epidemiological situation of previous years, identifying areas at higher risk of WNV emergence. Active surveillance was performed on a representative sample of residential horses, by searching IgM antibodies indicating recent infections. Entomological surveillance was based on bi-weekly mosquito captures at 55 sites distributed accordingly to a 15x15 km grid, using CDC-CO2 or gravid traps. Pools of Culex pipiens, Ochlerotatus caspius, and Aedes albopictus mosquitoes underwent PCR. Passive surveillance was performed on found-dead birds, and syndromic equines.

In June-July 2018, 1,194 equine sera from 363 farms were screened, with 36 IgM seropositive equines in 29 holdings confirmed by the National Reference Laboratory. As of the end of July, 107,035 mosquitoes of 14 species were identified, and 1392 pools examined; 130 Cx. pipiens and 13 Oc. caspius pools tested positive for WNV lineage 2. A single long-eared owl (Asio otus), out of 42 birds, tested positive for WNV lineage 2.

In 2018 WNV started circulating earlier than in previous years, as the first positive mosquito pool was captured on 7 June. The finding in mosquitoes prompted to hasten the surveillance in equines, and seropositive horses were first detected on 26 June. In less than three weeks, almost all the Veneto provinces were affected.

The inclusion of the entomological and veterinary surveillance into a One-Health approach was fundamental to raise awareness and fine-tune controls for Public Health. In fact, an unprecedented spread of WNV to humans was detected, following the entomological and veterinary surveillance: the first case of neuro-invasive WNV was detected at the end of June, and a total of 19 cases were confirmed in humans by the end of July (8 neuro-invasive WNV, one of which fatal, and 11 cases of West Nile Fever).

Nevertheless, the factors underlying the earlier WNV re-activation are not completely unravelled, prompting for in-depth studies on the ecology of the environment-host-vector-pathogen interaction.

MEDITERRANEAN SPOTTED FEVER SPATIO-TEMPORAL DISTRIBUTION AND ITS ASSOCIATION WITH METEOROLOGICAL FACTORS IN SPAIN

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Introduction. Mediterranean Spotted Fever (MSF) is a rickettsial tick-borne infection caused by R. conorii and transmitted by R. sanguineus. The disease is endemic in several regions of Europe, especially in the Mediterranean basin. It follows a seasonal pattern with an increase of cases in spring/summer. Several environmental factors have been described as possibly associated with the fluctuations in the disease's incidence.

Objective. The aim of the study is to analyze the epidemiological characteristics and the spatio-temporal distribution of MSF and the possible association between incidence and meteorological factors in Spain between 2005 and 2015.

Methodology. We have carried out a retrospective spatio-temporal population-based study, with MSF case-based data reported to the Epidemiological Surveillance National Network (RENAVE) for the period. Meteorological data (temperature and precipitation) were obtained from the Spanish Meteorological Agency (AEMET) at station level. We conducted a descriptive analysis of cases. We have calculated the annual incidence rates for each county and we have made a spatial representation to describe the evolution of the disease both in time and space. We have also made an analysis of time series with MSF cases aggregated per epidemiological week to detect trend and seasonality. Finally, using a Pearson correlation and a generalized linear model of Quasipoisson, we have studied the association between MSF cases and climatic parameters reviewed.

Results. From 2005 to 2015 1,595 MSF cases were reported to RENAVE. The average incidence rate in Spain was 0.36 cases/100,000 inhabitants. 59% of cases occurred in men and the most affected age group was 41-50 years old. The highest incidence rate at county level occurred in an inland region of the country with 3.11 cases/100,000 inhabitants/year. Through the time series analysis we observed a seasonality with a greater number of cases during summer. Trend showed a slight increase of cases since 2010. There was a positive correlation between the maximum weekly average temperature and the increase in MSF cases. [RR=1.06-IC95%(1.05;1.07)]

Conclusions. Most cases occurred in middle-aged men. Although cases were reported during the whole period, the largest number occurred in summer. Spatial distribution of disease was heterogeneous through time on the study area. We detected an increasing

trend and seasonality of the disease; the risk of MSF increases 6% when temperature increases 1 degree centigrade. At the time of submitting this abstract, we are awaiting to obtain results about the influence of the type of soil and hunting grounds on the disease incidence and occurrence.

Oral Session 3

Climate Change Scenarios

Chairs

Antonio Navarra and Vladimir Kendrovski

THE CHALLENGE OF CLIMATE SCIENCE

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A scientific consideration of the climate system requires that we overcome two major issues, namely the scarcity of observations and the difficulty to perform controlled experiments. We are immersed into a rather inadvertent experiment, as we are all together changing the amount of carbon dioxide in the atmosphere. Humans are modifying in unprecedented ways the amount of this gas that is the main regulator of the temperature at the ground via a long chain of feedbacks and processes. An even longer chain of physical and behavioral feedbacks and processes link the climate to society and economic issues and effects.

We have made enormous progress and amassed vast amount of knowledge and evidence that can be used to start considering different options for the future and evaluate However, many points remain to be investigated especially regarding the uncertainties and the propagation of the uncertainties down the chain, from drivers to impacts on society and communities. A quantitative investigation of the climate systems would not be possible without numerical models. They are tools that allow us to open up new physics, new phenomena and where we are able to make experiments and test theories. We can use models to make hypotheses about the concentration of carbon dioxide and other greenhouse gases in the future, insert these emission scenarios in the climate numerical model to get a climate scenario.

Further progress will require a closer integration across disciplines. It is clear that traditional disciplinary boundaries are being made increasingly obsolete by the fast evolution of our global, interlocked society. It is impossible to address the problems posed by climate change without a rational consideration of the physical and human aspects of it. This requirements points to the development of a new scientific discipline, the science of “Climate change”, that will emerge from the convergence of existing scientific streams and communities, with innovative tools and methodologies. The challenge is to educate and train a new generation of scientists capable of developing a scientific conversation encompassing all these different aspects.

PROJECTED HEALTH EFFECTS OF CLIMATE CHANGE IN WHO EUROPEAN REGION

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Evidence about the health impacts of climate change is accumulating, and appreciation of the need to address climate change and its health impacts is increasing. Challenges for health are expected to increase and exacerbate prevailing environmental health exposures and risks. The adverse health effects of climate change are projected to increase across Europe in the coming years and decades.

In our study we include a review of past trends and future projections of selected weather- and climate-related hazards, including their health impacts in European Region.

In 2017, the WHO Regional Office for Europe and the European Commission started a joint 18 month project (December 2016 - June 2018) on addressing the impacts of climate change on health. Results were gained from a desk review of literature and documents available in the public domain. A semi-structured questionnaire was sent to relevant health departments of all EU countries. Twenty out of 28 EU Member States completed the questionnaire and returned it to the project partner (the survey reached a return rate of 71%). Data were summarized and entered for a qualitative analysis into Atlas.ti software.

The predicted climate change concerns in the selected countries were heat stress, respiratory disease, cardiovascular disease, gastrointestinal disease, allergies, asthma, and cold stress. Mostly of the countries listed heat stress as a future health effect of climate change. The changes in climate are predicted to affect the prevalence of vector borne illnesses; all countries reported on a projected increase in prevalence of vector-borne diseases. The third highest concern mentioned is risk of injury due to flooding. Climate change is expected to affect the occurrence of flooding and other weather related natural disasters. Seven countries listed injury risk as main concern from these disasters.

The future health impacts of climate change are difficult to quantify, because of the complex interplay between climatic and non-climatic drivers and the effects of climate change adaptation in the health sector.

The overall objective regarding climate change and health is to strengthen adaptive capacity and resilience to climate change-related health risks, to support measures to mitigate climate change and to achieve health co-benefits in line with the Paris Agreement.

WHAT MAY HAPPEN WHEN TROPICAL MICROALGAE SPREAD IN TEMPERATE WATERS? THE CASE STUDY OF OSTREOPSIS SPP. FROM HEALTH IMPACT TO CHEMISTRY AND VICEVERSA

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Over the last decade massive blooms of the benthic dinoflagellate Ostreopsis cf. ovata, once confined to tropical and subtropical areas, have occurred in more temperate regions worldwide including the Mediterranean Sea. Concurrently, negative impacts on human health mainly due to inhalation of toxic aerosols and/or skin contact were observed together with death of benthic marine invertebrates.

When the first toxic outbreaks related to O. cf. ovata occurred in 2005 along the Ligurian coasts (Italy), little was known on several aspects of the phenomenon. Although some Ostreopsis spp. were known to produce congeners of Palytoxin (PLTX), O. cf. ovata was not known as a toxic species and its metabolic profile had never been investigated. Secondly, although PLTX itself was reported as one of the most potent non-protein marine toxins so far known and tentatively suggested as the causative agent of some fatal food poisonings in the tropics, it had never been suspected to exert toxicity through inhalation. Last but not least, the role of the environmental conditions on O. cf. ovata proliferation and toxin production had been poorly studied. Therefore, the need for increase knowledge on potential risks for humans and ecosystem stimulated research in the field.

An Italian multidisciplinary network was created, including scientists from the Academia as well as operators of the regional environmental protection agencies and food safety laboratories. This joint effort led to clarify many of the aspects related to the Ostreopsis phenomenon that still represent one of the major threats to humans in the Mediterranean area. This presentation is meant to summarize the results of our studies on

O. cf. ovata, highlighting inter- and intra-specific variability of the toxin profiles, structural variability of the detected toxins and, in some cases, linking such differences to the risk that PLTX congeners pose to humans following inhalatory, dermal and oral exposure. The methodological approach, besides addressing many of the palytoxin-related issues, may serve as template for facing in due time any emerging toxin-related threat to humans.

IMPACT OF MYCOTOXINS ON HEALTH IN CLIMATE CHANGE SCENARIO

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Mycotoxins are expected to impact significantly on food security and safety in the ongoing climate change. It is confirmed that temperature and CO2 will increase in the future, but uncertainty will remain the main sureness in climate change. Extreme events are announced, wide variability between years but also during each year. Different biogeography of plants is estimated, fungi (and related toxins) of main concern are expected to change between and within years. Overall, climate change is considered to increase health risks, but the conclusion is uncertain in account of many factors involved, in particular regarding mycotoxin-producing fungi and their metabolites. At least 3 main fungal genera are involved, Fusarium, Aspergillus and Penicillium, with very variable ecological need and different series of mycotoxin synthesised.

Maize in central-southern Europe is an interesting example to stress the system complexity, being a suitable host plant for several very relevant mycotoxin-producing fungi. Fumonisins are the prevalent mycotoxin detected in maize, frequently above the legal limit fixed by the European Commission for human consumption. Aflatoxins, considered the mycotoxin of tropical areas had its first severe outbreak in Italy in 2003; high contamination peaks followed almost each year. Serious events were signalled in Italy and Serbia, but also in Romania and Hungary in 2012, 2015, 2016 and 2017. Then, during the last 14-year period, in Europe, 2014 showed high deoxynivalenol contamination and 2011 was a safe year, with very low detection of all mycotoxins. Uncertainty and variability are the main sureness also regarding mycotoxin contamination.

In this context, the modelling approach becomes essential. Predictive models allow to generate, in the near or far future, weather data, so as to draw reference mycotoxin risk scenarios.

Predictive models run using actual meteorological data as input become crucial, in this uncertain situation, to highlight the dynamics of mycotoxin contamination risk during the crop growing season. They can support farmers, extension services and stakeholders to rationalize pre- & post-harvest crops and products management, in account of the variability between geographic areas.

Risk managers, policy makers, institutions and researchers can receive support from models fed with climate change data to define emerging risks. A very good example recently published regards Aspergillus flavus and aflatoxins in maize at European level. It confirms that aflatoxin occurrence is expected to increase, especially in the +2°C scenario. Experiences in modelling applied to mycotoxins and climate change are very limited, but really interesting to predict the uncertain future.

CLIMATE CHANGE AND RIVER ECOSYSTEMS: INSIGHT FROM LONG-TERM ENVIRONMENTAL RESEARCH

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Streams and rivers are among the most bio-diverse ecosystems on earth, providing a wealth of goods and services. They are also among the most threatened of all ecosystems globally, with rapid rates of species extinction and impairment. Lotic ecosystems are highly sensitive to climate change, but long-term data are scarce globally. The Llyn Brianne Stream Observatory in wales (UK) is one of the world's longest running ecological research stations, and has provided key insight into the ecological effects of climatic change on freshwaters.

As in other European river systems, stream temperatures at Llyn Brianne have increased up to 1°C per decade, with no associated trends in discharge. Changes in benthic invertebrate diversity over three decades reveal how biodiversity loss can be subtle and hidden by traditional richness and diversity metrics. Detailed examination of species' ecological roles shows how specialist organisms – those with specific ecological needs - are systematically declining through time. This is consistent with previous observations linking climatic forcing to the local extinction of the cool-water specialist predator Crenobia alpina. The exact mechanisms involved are still under investigation, but fluctuations in occurrence coupled with limited dispersal ability in many specialist species appear to be involved. Climatic fluctuations through time, like those caused by the North Atlantic Oscillation (NAO), also contribute by increasing year-to-year variability in species composition and altering abundance.

Long-term research at Llyn Brianne has highlighted how biodiversity decline and species extinctions are not necessarily associated with large-scale changes and habitat loss, but can occur subtly as global change effects progress. Such subtle changes in biodiversity could represent an early warning of more profound changes, for example where the loss of specialist species could impair the overall functionality of ecosystems while reducing resilience to further environmental change.

FUTURE HEALTH IMPACTS OF TEMPERATURES AND HEATWAVES CONSIDERING HIGH RESOLUTION CLIMATE CHANGE SCENARIOS IN ITALY

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Background and Aim. Future climate change poses a significant threat for health, and in particular the future burden of changing temperatures and heat waves on mortality. The aim of the study is to estimate the heat wave attributable deaths in major Italian cities for the period 2021-2050 considering two RCP scenarios. Heat waves were defined as 3 or more days with maximum temperature above the 90th percentile during the summer season (June-August).

Methods. The variation in the number of heat waves for the period 2021-2050 compared to 1981-2010 was estimated using the COSMO-CLM model developed by CMCC with a spatial resolution of around 8km. Two scenarios were considered: RCP4.5 (medium range scenario with mitigation of concentrations) and RCP 8.5 (business as usual). City-specific relative risks (RR) in mortality and attributable deaths during heat wave days compared to non-heat wave days was estimated using Poisson regression models. 21 cities were included in the study. Future variations in the impact of heat waves on mortality was calculated by multiplying the change in heat wave days predicted for each scenario and time frame to the number of heat attributable deaths. A population demographic scenario (ageing of the population) was considered together with measures of adaptation (different reduction scenarios due to the introduction of prevention plans).

Results. The increase in the number of heat wave days among the cities included in the study predicted for 2021-2050 was between 5.5 and 8.2 days/year according to RCP4.5 and between 6 and 8.4 days/year for RCP85. Overall around 363 heat wave attributable deaths per year were calculated for the period 1995-2010. Future impacts for both RCP scenarios show an average annual increase in deaths attributable to heat waves of about 100%, equal to about 700 annual deaths, taking into account population aging. The future impact would be reduced to around 500 deaths when taking into account adaptation in both RCP scenarios considered.

Conclusion. In order to contrast the mortality burden of climate change, actions to promote adaptation and mitigation measures need to be strengthened.

Oral Session 4

Climate Change and Children Health

Chairs

Paola Michelozzi e Maurilio Cipparone

PARKS:GATEWAYS TO HEALTHY LIVING FOR PEOPLE AND THE PLANET

Diana Allen
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Parks and protected areas are increasingly recognized for their diverse contributions to public health. One philosphy and approach that is gaining momentum at subnational, national, and international levels is *Healthy Parks Healthy People*.

The *Healthy Parks Healthy People* approach recognizes that contact with nature is essential for human emotional, physical and spiritual health and well-being; and reinforces the crucial role that parks and protected areas play in nurturing healthy ecosystems.

The US National Park Service (US NPS) adopted *Healthy Parks Healthy People* as a philosophy and approach in 2011, and is moving into a second phase to integrate a culture of health into day-to-day management of parks.

The National Park Service has established *Healthy Parks Healthy People*, with a mantra that parks should be places to have fun, learn something, and be healthy. Park and nature-based solutions are reframing parks as a health resource which is translating into healthier people, and a healthier planet. With this focus on health promotion, the US NPS intends to bring about lasting change in American's lifestyle choices, and forge deep and lasting connections with nature and the outdoors

This presentation will share an overview of *Healthy Parks Healthy People* in the US, including examples of promising practices for connecting children to nature for their health.

Key learning outcomes:

- participants will understand the need for and benefits of parks as a health resource, including insight into the research on park as gateways to health for children and youth;
- participants will learn about evidence linking nature experience and pro-social behaviors including kindness, altruism, generosity and resource-sharing;
- participants will learn about the 5-year strategy for *Healthy Parks Healthy People*, adopted by US NPS in 2018;
- participants will learn about promising practices for promoting parks as a health resource, particularly for children and families, that have been identified by the US NPS for national expansion.

SHORT-TERM EFFECTS OF TEMPERATURE ON PEDIATRIC HOSPITAL ADMISSIONS FOR RESPIRATORY DISEASES IN 12 ITALIAN CITIES

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Introduction. Children are often more sensitive than adults to environmental hazards including extreme temperatures; however evidences are scarce and often inconsistent when analyzing the relationship with morbidity, especially for studies regarding the Mediterranean area. The aim of this study is to assess the relationship between high temperatures and Hospital Admissions (HA) for respiratory diseases in children in 12 Italian cities.

Methods. City specific daily time series analysis with Poisson regression were performed on the summer season (May - September). Daily mean air temperature was retrieved from city monitors and daily counts of HA for respiratory causes in subjects of age 0-14 were considered as the outcome of interest for the period 2001-2010. The DLNM approach was used in order to account for a delayed effect up to 3 days and to model the relationship with splines. The effect was expressed as Relative Risk (RR) of ER visits for an increase in temperature from the 75^{th} to the 99^{th} percentile of the city specific distribution. Age category (0-4, 5-14) was considered as a potential effect modifier.

Results. 48,443 HA were registered during the study period (from 118 in Trieste to 10,957 in Palermo). An overall positive effect of high temperatures was observed, with a RR=1.12 (CI95%: 0.97-1.29). The city specific effects ranged from RR=0.99 (CI95%: 0.88-1.13) in Trieste to RR=1.46 (CI95%: 1.02-2.10) in Bari, with a consistent north - south gradient. A stronger relationship was estimated when considering only children under 4 years of age (RR: 1.17, CI95% 0.97-1.41), while almost no effect was observed in age category 5-14 (RR: 1.03, CI95% 0.86-1.23).

Conclusions. An effect of high temperatures was observed on children's respiratory morbidity. Highest effects of heat in southern cities suggest the thermoregulatory system in children could be less prone to adaptation. These findings promote targeted weather-morbidity prevention measures, addressed to protect children, especially when considering climate change scenarios.

GREENNESS, GREYNESS AND AIR POLLUTION EXPOSURE ON CHILDREN'S HEALTH: A CROSS-SECTIONAL STUDY IN SOUTHERN ITALY

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Background. A comprehensive approach is advisable to estimate the health effects of different urban-related exposures. We simultaneously assessed the effect of "green", "grey" and pollution exposure on respiratory/allergic conditions and general symptoms in schoolchildren. Methods: This study involved 219 schoolchildren (8-10 years). Data were collected through self-administered parents and children questionnaires. Exposures to greenness and greyness were measured by using the Normalized Difference Vegetation Index (NDVI) and the CORINE land-cover classes (CLC), respectively. Two specific categories of CLC, namely "discontinuous urban fabric, DUF" and "continuous urban fabric, CUF" areas were found. Exposure to traffic-related nitrogen dioxide (NO2) was assessed using a Land-Use Regression model. A symptom score ranging from 0 to 22 was built by summing affirmative answers to twenty-two questions on symptoms. To avoid multicollinearity, Logistic and Poisson ridge regression models were applied to assess the relationships between environmental factors and self-reported symptoms. Results: A very low exposure to NDVI ≤0.15 (1st quartile) had a higher risk of nasal symptoms (OR=1.47, 95%CI [1.07-2.03]). Children living in CUF areas had a higher risk of ocular symptoms (OR=1.49, 95% CI [1.10-2.03]) and general symptoms (OR=1.18, 95% CI [1.00-1.48]) than children living in DUF areas. Children living in proximity (≤200 m) to High Traffic Roads (HTRs) had a higher risk of ocular (OR=1.68, 95% CI [1.31-2.17]) and nasal (OR=1.49, 95% CI [1.12-1.98]) symptoms. A very high exposure to NO2≥60 µg/m3 (4th quartile) was associated with a higher risk of general symptoms (OR=1.28, 95%CI [1.10-1.48]). Poisson ridge regression model on symptom score showed that children living in

proximity to HTRs (≤200 m) had a higher symptom score (RR=1.10, 95% CI [1.02-1.17]) than children living >200 m from HTRs. Children living in CUF areas had a higher symptoms score (RR=1.11, 95% CI [1.03-1.19]) than children living in DUF areas. Conclusions: Multiple exposures related to greenness, greyness and air pollution within the urban environment account for respiratory/allergic and general symptoms in schoolchildren.

EFFECT MODIFICATION BY SOCIO-ECONOMIC POSITION AND GREEN SPACES OF SHORT-TERM EXPOSURE TO HEAT AND AIR POLLUTANTS ON PRETERM-BIRTH RISK. A TIME SERIES STUDY IN ROME, 2001-2013

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Background and Aim. Evidence of the impact of green spaces on pregnancy outcomes is limited. There is, instead, enough evidence of the effect of short-term exposure to high temperatures and air pollution on preterm delivery. We analyzed green spaces and Socio-Economic Position (SEP) as effect modifiers of the effect of high temperatures and air pollutants (PM10, NO2 and O3) on the risk of Preterm Birth (PB) in Rome.

Methods. A cohort of new-borns in Rome, from April to October, 2001-2013, were analyzed. Pre-terms, identified through the Certificate of Delivery Care Registry, were defined as births between the 22nd and the 36th week of gestation. A time series approach was used, with maximum apparent temperature (MAT), PM10, NO2 and O3 as exposure variables. We used a lag of 0-2 days for all exposure when analyzing preterm births, except for PM10 (lag of 12-22 days). As green indicators we considered both the distance between mothers' residence address and green spaces and the Normalized Difference Vegetation Index (NDVI) within a 100m buffer centered on woman's residence address. Women were also classified according to age, SEP and education level.

Results. We enrolled 56,576 total births, 5.1% of which PB. In our cohort 24% of women were younger than 30 yrs, 36% had a low SEP and 33% completed primary school. We observed a 2.0% (IC95%:0.7-3.2) increase in the daily number of PB per 1°C increase in MAT, adjusting by PM10. Among pollutants only PM10 was associated to a significant increase in PB (+0.7% ; IC95%:0.1-1.3) per 1 mg/m3 increase in PM10 (adjusted by MAT). SEP was an effect modifier for both MAT/PB and PM10/PB relationship; MAT increased the risk of PB only among women of medium or low SEP while PM10 among those of high SEP. Green was an effect modifier of MAT/PB relationship, with the highest effect of MAT on PB among women living very close to green spaces (within 100m).

Conclusions. Socio-economic position resulted to be an important effect modifier for both MAT/PB and PM10/PB relationship. In particular we found the highest effect of temperature on preterm birth risk in women with low socio-economic position and living very close to green areas. How green acts in modifying this association should be further investigated.

THE RESTORATIVE EFFECTS OF OUTDOOR ENVIRONMENTAL EDUCATION

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Outdoor education and experiences of contact with nature in school education might be beneficial for promoting, at the same time, the ecological lifestyles and the wellbeing children, families and teachers. The positive outcomes of these education experiences are arguable on the basis of many theories and empirical evidence on restorative environments, as well as on the foundations of classical pedagogical approaches recognizing the value of the direct experience with natural elements, and the related psychological and educational correlates (e.g., positive emotions, autonomy, self-efficacy, empathy). In this work we present an outdoor education intervention with primary and secondary school children and adolescents in Italy, conducted in the Pantanello natural reserve, located in Lazio Region (about 100 km south of Rome). The targeted participants were elementary and secondary school students. The education program, labelled was part of a larger research and intervention project, supported by the Italian Ministry of Health and other public and private bodies (CURSA, Roffredo Caetani Foundation) and labelled as “NeB” (Natura e Benessere; Nature and Wellbeing), which saw the collaboration of the Roma Tre University (Department of Education), and of the Sapienza University of Rome (Department of Dynamic and Clinical Psychology). Preliminary findings suggest that participating to the outdoor education program has positive outcomes on the wellbeing and ecological orientation of the involved children, of their families and teachers.

NATURE: AN IMPORTANT ALLY FOR CHILDREN'S HEALTH

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Since 15 years, many institutions and organizations have been dealing with the relation between nature and children wellbeing. Amongst them, the "Children and Nature Network" NGO manages an extraordinary international campaign, supported by scientific evidences, which, since 2006, has been promoting outdoor activities as a prevention and treatment of non-infectious diseases, addictions and psycho-attitudinal disorders.

CURSA, the University Consortium that complies this campaign with its own "Team Rete DNA", as partner of the Italian Ministry of Health pilot project "Environment, climate and promotion of the children's health", has set up a line of action to demonstrate the positive effects of contact with nature on children's health. Seminars, workshops and didactic materials have been prepared for different actors: pediatricians, school managers, parks' staff and trainers. Moreover, "Junior Rangers of Nature and Culture", a Team Rete DNA project that in three years involved more than 2,000 children in the Pantanello Park, managed by Roffredo Caetani Foundation, has been adapted at the research needs of the Ministerial project using it as a verification of the benefits of nature contact. The third edition of "Junior Rangers" involved 200 little students, achieving four multidisciplinary educative activities (called "didactic laboratories") to boost interactions with Nature and promote a lifestyle more oriented to the "Wellbeing".

1. Labyrinth of Mediterranean Flora (it linked curricular paths in literature, geometry, science, botanic, physiology, plant ecology, while achieving also an active and personal relationship between the child and the Earth, the Biodiversity and the ecosystem balances that affect health.
2. Healthy as a fish (to deepen anatomy, animal and human physiology in comparison, while building a psychomotor path with children, to promote "higher brain functions" and a healthy psychophysics development.
3. Biodiverse and unbalanced (aimed at the sensorial stimulation, promoting and replicating a cognitive reworking. The didactic laboratory dealt with some environmental issues and the changes induced to the ecosystems by the human activities).
4. EcoArt and emotional map (to boost concentration and creativity, and to encourage an emotional contact with the Nature through art installations in the environment).

The "Junior Rangers" project involved psychologists and educators from the universities "Roma Tre" and "Sapienza", who prepared evaluation questionnaires about the outdoor activities and handed them out before, during and after the didactic laboratories. In the survey, both the parents of the participating children and the children of control classes, not participating in the project, were involved.

The research data are in progress.

Oral Session 5

Healthier Cities

Chairs

Andrea Lenzi and Maria Rosaria Milana

LATEST DEVELOPMENTS WITH EU CLIMATE CHANGE ADAPTATION POLICY AND LINKS WITH HEALTH

Jelena Milos
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The presentation focuses on the recommendations of the recently completed evaluation of the EU Strategy on Climate Change Adaptation that are relevant for the climate change and health nexus. There will also be an outline of current activities and planning of the European Commission's work when it comes to tackling climate change adaptation in urban areas, with a focus on health and wellbeing of citizens.

REDUCING URBAN HEAT WAVES RISK: HEAT HEALTH ADAPTATION PLAN IN ITALY

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Heat waves during summer 2018 in several countries around the world (California, Japan, Europe) are a new evidence of what scientists expect from climate change: longer and more intense heat waves in the next future, with the worst impact on health in the more vulnerable population. Population adaptive capacity needs to be improved over time by heat response plans and mitigation strategies at all levels, taking into account temporal variation of exposure

In Italy, the national heat adaptation plan ias been running since 2004 thanks to the collaboration between the Ministry of Health and the Department for Civil Protection. The plan has a national coverage (34 major cities and 93% of urban residents aged 65 years and over) and HHWWS and prevention strategies are re-defined each year taking into account the observations of previous years; main features will be presented.

Real-time health surveillance allowing summer and period evaluations: the analysis of the 1999-2016 period showed the national heat plan had a role in improving the adaptive capacity of local populations, with a greater reduction in effects related to extreme temperatures when heat warnings are issued and preventive measures are in place. The fraction of heat-attributable deaths decreased from 6.3% in the period 1999-2002 to 4.1% in 2013-2016 in Italy.

- However, in recent years the impact of high temperature is still significant since related not only to specific exposure conditions but also on a range of factors such as demographic phenomena and clinical conditions of the pool of subjects most at risk and other seasonal stressors (e.g. influenza related deaths in the previous winter) which varies from year to year. In Italy an annual increment of 570 heat-related deaths is expected in the near future and the increase will be greater due the aging of the population.
- Recent evidences showed heat effects on new vulnerable subgroups including children, workers and pregnant women, and new communication tools have been developed (salute.gov.it/caldo). In summer 2018 an APP was lanched to reach health and social workers and the general population in a more efficient way.
- A number of health and social interventions implemented in local heat response plans although improvements are needed. In 2018 the Ministry of Health revised the national guidelines, strengthening the focus on modulation of activities on the basis of the warning levels and the need for a longer-term planning including also urban interventions (e.g. housing and greening) as well as promoting individual actions to reduce emissions such as cycling and walking.

– The next steps are to include in the national adaptation plan the other relevant environmental factors influenced by climate change, such as air pollution and pollens exposure, developing the same framework of tools validated for heat waves.

CLIMATE AND HEALTH IN LARGE URBAN AREAS OF ITALY: FOLLOWING THE CHANGE THROUGH A DEDICATED METEOROLOGICAL NETWORK

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Sustainable development Goals related to Health are a priority at international level. The World Health Organization set them in the WHO Agenda 2014-2019. A new WHO/WMO Climate and Health Office has been established to promote the coordinated development and use of climate services to improve public health.

Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, because of malnutrition, malaria, diarrhea and heat stress.

A new concept of health is implied, not merely referred to the physical survival or to the absence of disease but including the psychological aspects and the natural, environmental, climatic conditions. The vision and the analysis of health determinants and risk factors have, therefore, expanded to include social, economic and environmental issues.

Urban climate change must take into account two components: global warming and microclimate variability due to urban growth. More frequent and severe extreme weather episodes and intense urban heat islands are consequences that are already occurring and can be measured.

It is therefore now necessary to adequately and continuously monitor and study the urban climate through weather stations specially dedicated to this purpose. The urban climate is indeed strongly variable in space, both horizontally and with altitude. The complexity of urban texture and of all energy exchanges occurring involves urban weather station siting and representativeness problems. The World Meteorological Organization (WMO) debate on the classification of meteorological stations in urban areas is currently ongoing.

Climate Network is the property urban meteorological network of Fondazione Osservatorio Meteorologico Milano Duomo, internally designed and developed since 2010; it consists of 50 weather stations located in most of the main Italian cities. Same criteria to locate them, same type of sensors, full traceability of measures and reference to national metrological standards allow to compare data from the stations having the documented security of data homogeneity and high quality

To analyse local effects of urban climate change in Italy and their relation with urban residents' heath, a quantitative analysis of hot extreme events in the last decade has been performed.

Bioclimatological indices have been compared to assess local climate discomfort and health problems. Time evolution of their values is presented too.

A quantitative spatial analysis of hot extreme events in Milano is shown, as Milano is subject to stable atmospheric conditions in more than 60% of days per year and it is characterized by a very high heat island.

SOCIAL INTERVENTIONS TO LIMIT THE MORTALITY INCREASE DURING THE SUMMER 2017 HEAT WAVES IN ROME - ITALY

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Background. Heat waves are recurrent extreme climate events associated to increase of mortality, especially among older adults. Social isolation is one of the most important mortality risk factors during a heat wave. The aim of this study is to assess the impact of a program based on social interventions, on community-dwelling older adults mortality during the heat waves which occurred in Rome in the 2017.

Methods. The "Long Live the Elderly!" (LLE) program, carried out by the Community of Sant'Egidio in the centre of Rome since 2004, is aimed at counteracting social isolation by a pro-active monitoring of the over-75 population, providing them personal support in case of need as well as strengthening their social connections at community level with formal and informal caregivers who accepted to be involved in the program. Mortality of the whole population followed up during 2016-2017 (aggregated by month) has been compared with the mortality of an over-75 population sample, resident in the Lazio region, followed up by the University of Tor Vergata, Biomedicine and Prevention Department, that receive the standard of care. Non-parametric tests have been performed to assess differences of death rates and multivariate analysis to assess the impact of risk factors on mortality.

Results. From December 2015 to November 2017, the LLE population and the control population were made up by an average of 5,181 and 528 individuals respectively, comparable for age and gender. The monthly average death rate from June to September 2017 was 6.0/1000 (CL95%: 0.8-11.1) and 6.1/1000 (CL95%: 3.3-9.0) ($p=0.8$) for the control sample and the LLE population respectively. Compared to the summer 2016 mortality, an increase of 100.7% and 12.3% among controls and LLE population respectively has been observed. The multivariate analysis, weighted for the summer 2017 population and adjusted for age, gender and pre-summer 2017 mortality, showed the protective effect of the LLE program ($R^2=0.504$; $\beta=-0.599$; $p<0.001$).

Conclusion. A programme dealing mainly with the individuals' lack of social resources showed to limit mortality of an older adult population, during an extreme climate event, like the heat wave, in a setting with poor community care services, such as the Lazio region. Further analysis are needed to identify the key components able to affect the older citizens mortality as, for example, the role played by the urban heat island effect that is more relevant in Rome than in other regional settings.

Oral Session 6

Mental Health and CC

Chairs

Enrico Alleva and Massimo Biondi

THE IMPACT OF CLIMATE CHANGE ON PERSONS WITH MENTAL HEALTH CONDITIONS

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The influence of weather and climate on health is known since the writings of Hippocrates on airs, water and places (400 BCE). Seasonal impact on morbidity and mortality has been confirmed since the early studies of the "father of modern statistics", Adolphe Quetelet (1796-1874). A greater role on human health is played by sudden variations in ambient temperature that accompany climate change. Fragile people, such as infants, pregnant women, the elderly, those with impaired health or suffering from poor social conditions, are the most exposed to the impact of sudden hot or cold weather.

Whatever the explanation for the current climate change one is willing to accept, solid projections expect that global warming will proceed in the next decades without globally shared actions. It is therefore mandatory to clearly understand the impact of climate change on health. An area of especial vulnerability is mental health.

People diagnosed with a mental disorder are exposed to the seasonal recurrence of their condition, especially in mood disorders, thus they are exposed to global warming's shifting seasons. They also are greatly exposed to the effects of extreme weather on the body, since many prescribed drugs affect thermoregulation, thus increasing the chance of heat stroke and dehydration during extreme heat. The risk of cardiovascular, respiratory, and cerebrovascular disease also might be increased in patients with mental disorders during extreme weather, particularly when homeless or housed in environment with poor thermal comfort.

Global warming affects the social determinants of health, such as clean air, access to safe drinking water and food and to secure shelter. These effects are likely to boost social inequality, which is a factor increasing the chance of suffering a mental disorder and that negatively impacts on its course.

Climate change may become a more direct risk factor for the development of a mental disorder because of the increased chance of weather-related natural disasters (typhoons, droughts, floods), a known cause of stress-related mental disorders such as post-traumatic stress disorder (PTSD), anxiety and depression. More long-term effects are expected be caused by vector-borne diseases transmitted by mosquitoes, ticks and fleas. Vector-borne diseases may reach the brain causing encephalitis and may also increase the risk of fetal brain abnormalities.

Increasing awareness on these problems, building partnerships among agencies involved in facing the challenge, strengthening scientific evidence on the topic, and implementing responses dedicated to vulnerable people are the four pillars of public response to climate change.

CLIMATE CHANGE AND MENTAL HEALTH

Massimo Biondi
Climate Change and Mental Health, Department of Neurosciences and Mental Health, Sapienza University of Rome, Rome, Italy

Very limited literature concerns the effects of planetary climatic changes on mental health, since major alterations (temperature increase, e.g.) are rather recent phenomena and cases are therefore limited, mainly among the consequences of natural disasters. The effects can be indeed only hypothesized by available knowledge and research on some related issues. It is possible to distinguish direct effects on mental health due to biological factors (e.g. neurotransmitters, hormones, etc.) and corresponding behavioural modifications and indirect effects caused by climatic change, in turn affecting environment and human individual assets.

Among the direct effects, it is possible to suppose an increase of emotional distress, even not specific mental disorders in the general population; an increase of aggressive behaviors, considering that several studies associated warm weather and enhanced aggressiveness; sexual crimes; biorhythmic deregulations with possible consequences on mood levels and effects on ciclicity of the bipolar spectrum condition; increased confusional states and behavioural changes due to dehydratation, mainly in aged people and in major metropolitan areas, therefore increasing medical examinations in emergency departments. Finally, it is possible that an increase can be registered of patients suffering a specific conditions such as exhaustion, neurasthenia, neurovegetative dysfunction, also associated to somatization and anxiety. Among the indirect effects mostly will emerge those due to extreme climatic events damaging people and proprieties such as flood, landslides, hurricanes, typhoons, natural disasters, drought, damaged cultivation and consequent farm companies failures. Depression, post-traumatic stress syndrome, acute stress, adjustment disturbances, anxiety, all might increase markedly. In particular, minor (e.g. due to orphanage), abusing has already been observed after those events in exposed populations.

In the worst perspective, even whole communities or cities of coastal stretches could disappear, with subsequent mass migrations and the consequent problems. There may be a greater impact on communities under difficult socio-economic contexts and further marginalization of "weak" or socially disadvantaged people.

Alongside this ‘catastrophist’ perspective, there is still the role of the natural resilience of individual human beings, of the social support of communities that has been highlighted as relevant in similar situations, of the remarkable capacity for adaptation and coping of humans following stressful events and extreme experiences.

The problem of adaptation to climate change and therefore of a positive coping response to stress is mainly related to the chronic nature of these events: the stress literature shows that humans can better cope with single, time-limited catastrophic events, rather than long-lasting, chronic situations, lasting for years and perhaps decades, repetitive (such as the destructive phenomena resulting from heatened atmosphere changes), where the organization of an integrated stress response appears much more difficult.

MENTAL HEALTH CARE IN ITALY AND THE CLIMATE CHANGE CHALLENGE

Liliana La Sala
Directorate General for Prevention, Head of Unit 6, Addiction, Doping and Mental Health, Ministero della Salute, Rome, Italy

Since 2007, media reports on climate change and health have increased by 78% and the academic literature on climate and health issues has tripled.

Climate change affects not only physical health but also mental health in a variety of direct, indirect and overarching pathways.

Extreme weather events as well as incremental climate change, such as rising temperatures and droughts, can trigger a variety of mental problems, not only in terms of mental illness but also of mental wellness, emotional resilience and psychosocial wellbeing. Regarding mental health, marginalized groups, who are especially vulnerable to climate change's impact, tend to be the most affected, even because climate change exacerbates social, economic and demographic inequalities.

Therefore, investments in the field of relationship between climate change and mental health are strongly needed, even for health equity reasons.

Acting on the health consequences of climate change requires actions rooted in both mitigation and adaptation at all levels, from global to local, from all sectors and individuals. Coordination between global commitments (Paris Accord, SDGs etc.) is required to address mitigation and adaptation measures, which include policy responses, surveillance and monitoring, preparation and response, community based interventions and special training for care providers and first responders.

Mental health care system in Italy (ruled by "Basaglia" law n.180/1978, which radically changed the scenario of psychiatric care, closing psychiatric hospitals) is integral part of the National Health System and is based on a "community" model, almost unique in the world.

The heart of this community model is the Department of Mental Health inside local health units, that provide comprehensive psychiatric care for the population.

It manages the local network of services on a unitary basis, providing at least the minimum set of services required by national policy documents. Over time, psychiatric deinstitutionalization inspired policies in other sectors of Italian society, such as those regarding disabilities, drug addictions and management of deviant minors.

Today, forty years after the mental health care reform, the Italian psychiatric community model appears to be particularly suitable to address also mental health problems linked to climate change, especially in terms of care to a larger and not homogenous population, with very diversified needs.

EXTREME WEATHER EVENTS ON MENTAL HEALTH

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Climate change is a global challenge with a great impact on both physical and mental health. There is a growing literature on relationships between climate change and mental health including evidence that extreme weather events, that are more intense under a changing climate can trigger Post-Traumatic Stress Disorder (PTSD), Major Depressive Disorder (MDD), anxiety, depression, complicated grief, survivor guilt, vicarious trauma, recovery fatigue, substance abuse, and suicidal ideation. Incremental climate changes, such as rising temperatures, rising sea levels, and episodic drought, can change natural landscapes, disrupt food and water resources, change agricultural conditions, change land use and habitation, weaken infrastructure and give rise to financial and relationship stress, increase risks of violence and aggression, and displacement of entire communities. The overarching threats of a changing climate, can also incite despair and hopelessness as actions to address the "wicked problem" of climate change seem intangible or insignificant in comparison to the scale and magnitude of the threats. Paradoxically, these same disastrous circumstances may also inspire altruism, compassion, optimism, and foster a sense of meaning and personal growth (otherwise referred to as post-traumatic growth) as people band together to salvage, rebuild, and console amongst the loss of a changing climate.

In addition, extreme heat events and humidity have been noted to increase hospital admissions for mood and behavioural disorders, including schizophrenia, mania, and neurotic disorders. Heat-related mental health morbidity tends to occur most often in people with impaired thermoregulation, namely people with pre-existing mental health illness and problems, people taking prescription medications (specifically lithium, neuroleptic and anticholinergic drugs), and those with substance abuse (alcohol and drugs) problems. Extreme heat is also linked with an increased risk of wildfires, which also directly impact mental health. The direct mental health consequences related to flooding, hurricanes and earthquakeare are also well documented. From the biological point of view, such disorders would be triggered by an overall activation of the stress system leading to cascade events at different levels. Taken together, available data would suggest that prevention of mental health may be implemented also through a deeper attention to climate and respective environmental changes.

NATURAL, URBAN AND HISTORICAL-URBAN ENVIRONMENTS ON CHILDREN AFFECTED BY ADHD IN ITALY

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Attention is essential to development and is important for executive functioning. Unfortunately, a growing number of school children suffer of chronic attention deficit such as the Attention Deficit Hyperactivity Disorder (ADHD). It is important to consider that many of these very young patients are pharmacologically treated and need to deal with side effects that may occur. Most literature on attention functioning in developing age is focused on the role that the social environment plays in child development whereas scarce attention is paid to the physical environment, both built and natural.

Based on Kaplan's Attention Restoration Theory , researchers have widely shown a great impact of Nature contact on cognitive functioning, among other benefits, virtually at zero costs and without side effects. We present two consecutive studies with the aim of evaluating how a walk in three different environments may benefit children with ADHD (Study 1) and how a possible correlation could exist between symptoms' severity (assessed by children themselves, teachers and parents), connectedness with Nature (assessed by children themselves and both parents) as well as the frequency of contact with Nature during the weekend and afterschool activities in the last 12 months (Study 2). In the first study, ART is tested on children aged 7-14 affected by ADHD in Italy (N=21). Attention, impulsivity, emotions were tested before and after the treatment (baseline and post-test); in addition, after the baseline and before the treatment, "mental fatigue" was inducted through 15 minutes puzzle and other tiring tasks (maths exercise and scattegories game) and attention performance was remeasured afterwards to check the effectivity of the manipulation. The perception of the restorative value of the place and the environmental preference were also measured among conditions after treatment, by using the Italian version for children of the Perceived Restorativeness Scale Treatment consisted in a 20 minutes individually guided walk in a within-subject design and in three different sequential order (between-subject) among the three following environmental conditions: a countryside openfield for the Nature condition, a Medieval well-kept village for the historical-urban condition, a Town for standard-urban condition.

The effects of the three environments on attention and impulsivity (core ADHD components), as well as on emotions and on perceived restorativeness are discussed. Some preliminary results show better environmental perception in the Nature condition, than in

the Standard-urban condition and the Historical-urban condition. In addition, in Study 2, we argue whether in the same children (N=21) a relation exists between connectedness with Nature, frequency of contact with Nature, symptoms severity and performance tests of Study 1. Study 2 also includes a more numerous sample of children with ADHD to test the above mentioned variables. Results on both studies are integrated and discussed at the conference.

CHANGES IN FEEDING DUE TO CLIMATE MODULATED HUMAN MENTAL PROCESSES AND PREFERENCES ABOUT FOOD

Raffaella I. Rumiati
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Food is the fuel of life. Natural selection provided Homo sapiens with the adaptive attitude to virtually eat almost everything. Especially in well-to-do countries, being omnivores and the excessive availability of food generate anxiety when decisions about what to eat need to be made. Even though the different senses enrich our food experience, just looking at food allows us to extract a great deal of information about the characteristics of food.

In my presentation I will first discuss how food perception and preferences in modern humans are influenced by food-related, exogenous factors, such as the calorie content, the level of transformation of food or its colour, as well as by individual-related, endogenous factors, such as the body mass index or physiological state.

Second, I will argue that food-related processes and representations are not only biologically determined but they also are malleable and modified by the individuals' experience, as observed when food perception and recognition are compared in old adults and centenarians.

Third, I will consider the unwanted long-term effects of food choice on personal and societal well-being, as in the case of individuals affected by eating disorders and obesity and, lastly, I will describe how food recognition and preferences change in individuals suffering from neurodegenerative diseases.

Oral Session 7

Water, sanitation and climatic change

Chairs

Luca Lucentini and Oliver Schmoll

WATER SAFETY PLANNING FOR CLIMATE RESILIENCE

Rory Moses McKeown
World Health Organization, Geneva, Switzerland

Weather and climate have a profound impact on public health. Climate change and variability is expected to exacerbate existing pressures on freshwater resources. This will impact water security (i.e. access to sufficient quantities of safe and acceptable drinking-water) and the adequate provision of water supply services, and ultimately, public health. As such, there is increasing recognition of the urgent need to improve the resilience of the WASH sector to current and future climate impacts.

Water Safety Plans (WSPs) are considered to be the most effective means to ensure the supply of safe drinking-water. The WSP framework is well suited to proactively manage climate-related risks by considering the implications of climate change and variability at key steps in the water supply system. WSPs that adequately address climate impacts can support the shorter- and longer-term management of water security, despite future uncertainties with respect to a changing climate.

This presentation will describe how climate information may be integrated into the World Health Organization's WSP framework. Real-world case studies will be presented to demonstrate how the water safety planning approach may be effectively applied to assess and manage current and future climate-related risks to water security in diverse socioeconomic settings.

THE PROTOCOL ON WATER AND HEALTH TOOLS TO INCREASE RESILIENCE TO CLIMATE CHANGE AND WATER-RELATED DISASTERS

Nataliya Nikiforova
Environmental Affairs OfficerUnited Nations Economic Commission for Europe Joint UNECE - WHO/Europe Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Geneva, Switzerland

Extreme weather events, including floods and droughts, occur with increasing frequency and intensity, thereby affecting operational efficiency and sustainability of water supply, drainage, sewerage infrastructure and wastewater treatment and threatening protection of public health and the environment.

In 2011, Parties to the United Nations Economic Commission for Europe (UNECE) and World Health Organization (WHO) Regional Office for Europe Protocol on Water and Health reviewed the existing good practices in this domain in the pan-European region and produced, with support of Italy, a Guidance on water supply and sanitation in extreme weather events.

The methodology and the measures proposed by the guidance are still relevant today as it takes an integrated environment-and-health approach and addresses cross-cutting issues, such as the role of the health and environment sectors in extreme weather, the need for policy dialogue and multisectoral partnership to assess and control risks, and the challenges of different settings (such as urban and rural, small and centralized large-scale supplies).

Further work under the Protocol on Water and Health continued promoting and disseminating knowledge and expertise on the climate change resilience by strengthening national capacities regarding the sustainable management of water resources and scaling up risk-based management approaches, focusing specifically on the regulation, management and surveillance of small-scale water supply and sanitation, and building awareness, evidence and capacities in addressing the issues of water scarcity and wastewater reuse in agriculture in the broader water resource management context.

WATER AND SANITATION IN EXTREME WEATHER EVENTS: ENVIRONMENT AND HEALTH RISKS AND VULNERABILITIES

Luciana Sinisi
Istituto Superiore per la Protezione e la Ricerca Ambientale, ISPRA, Rome, Italy

Under climate change scenarios extreme weather events are increasing in frequency and intensity worldwide. The vast majority of disasters are linked to high-impact weather and hydrological events including rapid-onset hazards such as floods and slow-onset hazards such as droughts. They affect water quality and availability and may also cause direct impacts on the operation of water-supply, drainage and sewerage infrastructure, and the functioning of wastewater treatment plants. The performance of these infrastructures, which in ordinary condition are essential assets of Water-Born Disease (WBD) prevention, under climate variability may be highly impaired becoming a crucial environmental health determinant, including also transboundary implications.

Following an overview on trends and figures of extreme events, the presentation will regard a synopsis of environment and health risks, taking also into consideration vulnerabilities and key issues for risk management actions, to be considered in crucial adaptation measure.

ASSESSMENT OF CLIMATE CHANGE IMPACTS ON GROUNDWATERS OF SEMIARID REGIONS: HEALTH-RISK FOR FLOODS

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Fractured groundwaters are important water reservoirs of good quality in many arid regions of the world (Mediterranean Sea area, Mexico, USA, Australia, etc.) where surface water scarcity, such as lakes or rivers, is predominant. However, impacts due to climate change, by increasing extreme event intensity and frequency, i.e. droughts and floods, are progressively reducing aquifer volume availability and quality by producing groundwater impairments. Furthermore, groundwater overexploitation and local sea level rise increased water depletion and many wells along the coasts also in Puglia (Italy) have been abandoned due to high water salinity. Specific measures have been applied around the world and in Italy in order to contrast the groundwater impairment, such as the water reuse for irrigations via treated effluents and the artificial groundwater recharge by means of ditches, catchments or soil spreading. In this environmental framework the groundwater protection and the control of water quality pumped for irrigation and domestic uses is the priority in many countries, because there is awareness of the possible microbiological contamination of groundwater. Uejio et al. (2014) highlighted that precipitations in summer/fall were systematically correlated to increased childhood gastrointestinal illness in municipalities accessing treated/untreated water mainly derived from wells in Wisconsin (USA). In this study we focus on the Quantitative Microbiological Risk Assessment (QMRA) for contaminated drinking water derived from wells in fractured aquifers. Theoretical aspects deal with: i) fate and transport of viruses in fractured aquifers; ii) studies on the dose-response model, and iii) quantitative microbial risk assessment. The results will be useful to provide inputs for Water Safety and groundwater Monitoring Plans suitable for best practices for safe drinking water supply and for managed aquifer recharges.

Oral Session 8

Blue and Green Space

Chairs

Lora Fleming and Camilla Puccinelli

THE EFFECTS OF WEATHER AND DAYLIGHT ON CURRENT AND FUTURE NATURE-BASED RECREATIONAL PHYSICAL ACTIVITY IN ENGLAND

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Green and blue spaces can support health-enhancing physical activity, but the amount of physical activity accumulated in these environments can be particularly affected by meteorological conditions. This study aimed to investigate how energy expenditure in different green and blue spaces is affected by the weather and how these patterns might change in light of future temperature changes under different climate change emissions scenarios.

Using responses from a survey of leisure visits to natural environments in England (n=47613), visits were ascribed estimates of energy expenditure (MET-minutes) and assigned historical meteorological data. We explored relationships between MET-minutes in natural environments (in particular, parks, woodlands, inland waters, and coasts) and the hourly maxima of temperature and wind speed, levels of rainfall, and daylight hours using generalised additive models. Temperature changes informed by moderate to business-as-usual representative concentration pathways from the EURO-CORDEX initiative (RCP 4.5 and RCP 8.5, respectively) allowed us to estimate the quantities of physical activity that different green and blue spaces might support in 2040 and 2090.

Overall, we found a positive linear relationship between MET-minutes and air temperature, a negative linear relationship with wind speed, no relation with categories of rainfall, and a quartic relationship with daylight hours. These same trends were observed for park-based energy expenditure, but differed for visits to other environments: only daylight hours were related to energy expenditure at woodlands, wind speed and daylight hours affected energy expenditure at inland waters, and only air temperature was related to energy expenditure at coasts. In all environments, only small changes in energy expenditure were observed under different future climate scenarios, with some suggestion that coastal environments in England may become increasingly important in supporting higher quantities of energy expenditure. Differences with previous literature could be due to variations in setting, methodological choices, climatic differences, or the individual respondent's choice not to visit green and blue spaces in inclement weather. Implications for public health will be discussed as well as limitations with our future predictions and extensions to consider humidity.

HEALTHY PARKS HEALTHY PEOPLE: USING EUROPE'S NETWORK OF PARKS AND PROTECTED AREAS AS 'NATURAL HEALTH CENTRES'

Bridget Finton, Peter Rawcliffe, Joel Erkkonen, Nele Sober, Carles Castell
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The connections between human health and environmental health are becoming increasingly recognised as the evidence mounts that high quality environments can bring a range of public health, social and economic benefits. This in turn increases the value governments and society place on environmental assets, and aids the case for sustainable management.

"Healthy Parks Healthy People" is an approach instigated in Australia by Parks Victoria which promotes the value of the environment to human health and is providing the impetus for Health and Environment alliances at various scales in countries such the USA, South Korea, Finland and Scotland. Using examples from around Europe, this session will outline how a solid policy framework, cross-sector integration, and investing effort in promoting the value of parks and protected areas as health-promoting assets, are all key ingredients to delivering healthy parks and healthy people.

Tackling key health issues including physical inactivity, mental health problems and health inequalities is becoming increasingly recognised as the joint responsibility of a range of sectoral interests and a "Health in all policies" approach is becoming more common. Integrated policy frameworks enable more cross-sector collaborative working which aims to embed nature-based solutions into governments wider physical activity agenda and make contact with nature mainstream in health and social care systems. From the healthy parks healthy people case studies, there is a clear message for park and protected area managers to join public health *fora*, as not only do parks protect the essential systems of life and biodiversity, but they are also a fundamental setting for health promotion and the creation of wellbeing.

LABYRINTH, A WAY TO INTEGRATION

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The first middle class “A” of XII Comprehensive School Borgo Faiti (Latina, Italy), took part in the third edition of “Junior Rangers of Nature and Culture”. The project was aimed at the creation of a labyrinth, on a surface of 400 square meters, made by Mediterranean plants, especially medicinal plants. The project developed in four steps; the first concerned the collection of data about medicinal plants and their usage, and, at the same time, the class started to study the Labyrinth myth; then, each student drew a paper format Labyrinth. During the second phase, the students developed a single scaled labyrinth by using digital applications and made them by plastic materials. In the third step, we created together a 3D (three-dimensional) digital template labyrinth, using also the “augmented reality” method. Then, we turned all of it in a real laboratory by working the earth, staking out the area, measuring each side, tracing the paths according to the Pythagorean Theorem and, at last, planting plants. In the end, the students showed their work to the families and, during a celebrative event, they graduated “Junior Rangers”.

For each step, we joined a survey in the Pantanello Park aiming at gaining competencies and knowledges needed for the project implementation. Students experienced a theoretical, practical, complementary and inclusive way of working in a group. The key idea has been the “integration”, to carry out the project by studying on the field the different school subjects as math, science, Italian, information technology. It was also necessary that students could fit in with each other with their own capacity, everyone with their tasks. In particular, some students with previous difficulties in expressing themselves or in collaborating with others in nature became able to communicate their thoughts and demonstrate their competencies. Moreover, integration was possible thanks to the connection of two - apparently - conflictual aspects: nature and the digital world. This project has shown that the coexistence between nature and digital technologies is desirable. Students understood that the digital world could be integrated or included in the experiences in nature. The way to know and acquire competences turned into a discovery and in a “comprehension journey” of nature, by allowing students to understand how the conservation of nature is important.

BLUEHEALTH COMMUNITY-LEVEL INTERVENTIONS: THE CASE STUDY OF APPIA ANTICA PARK

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Current studies show that green and blue areas have positive effects on mental and physical wellbeing. In this context BlueHealth EU project, funded by Horizon 2020, has the aim to understand links between exposure to blue space and health and well-being through a large-scale systematic programme of interdisciplinary research.

Another aspect that will be investigated in the context of the project is to evaluate the effects on health and well-being using a range of case studies located in urban areas in eight European countries; they are linked by recreational activities and changes of blue infrastructure. One of these case studies has been performed in the Appia Antica Park in Rome. The latter known for its archeological heritage, is home to both natural and artificial aquatic ecosystems, including streams, springs and wetlands, representing also a biological corridor for wildlife.

This area has been chosen because is a major hub for the several recreational activities for park goers. The aim of this study was to sensitize stakeholders to the positive effects of blue spaces on human health and wellbeing.

The selection of stakeholders for this case study was based on their involvement on blue spaces management and recreational activities. A total of 62 stakeholders were engaged: blue space volunteers, park rangers and park workers, trekking associations and bike rentals.

Since May 2017 four workshops have been conducted relating to aquatic ecosystem health and environmental global changes, and the positive effects of green urban areas on human well-being.

The evaluation of the beneficial effect of workshops, before and after, was performed by administering a questionnaire, developed in the context of the project called the "Blue Health Community-Level Survey (BCLS)". The BCLS comprises 40 questions to collect information on physical and mental wellbeing, type of activities performed in the proximity of blue spaces as well as their frequencies, personal feelings about the benefit and protection of blue areas. Data analysis of the results are in progress. However, the preliminary results of this study provide useful information on the positive effects of the communication activities on the sensitivity of the stakeholders.

THE ENVIRONMENTAL CULTURAL CENTER OF THE ITALIAN NAVAL LEAGUE (LEGA NAVALE ITALIANA) FOR THE PROPAGATION OF AN ENVIRONMENTAL CULTURE

Valerio Manfrini, Nunzia Rossi, Flegra Bentivegna, Domenico Gaudioso, Adriano Madonna, Giovanni Russo, Giancarlo Sapio, Piero Vatteroni, Luigi Valerio
Technical-scientific Committee of Environmental Cultural Center, Sperlonga Lago di Fondi, Latina, Italy

The Italian Naval League (Lega Navale Italiana, LNI), founded in 1897, is a public Institution, non-economic, based on association, apolitical, and non-profit organizations. It promotes the protection of the marine environment and the fresh waters, and develops ecological events to engage citizens on environmental issues. LNI is made up of a national President and over 250 peripheral units (Sections and Delegations) located on national territory. Within this context, the Environmental Cultural Center (Centro Culturale Ambientale, CCA) of LNI was established on 3 March 2017 (Delibera n. 220) and it is made up of a technical-scientific committee with seven internationally renowned experts who offer their expertise on voluntary basis. CCA mainly deals with: climate change; sustainable transport and development; eco-tourism; biodiversity protection through educational projects aimed at all citizens; organising environmental protection and social utility events, conferences, exhibitions, research and publications; training of LNI members. Furthermore the Environmental Cultural Center, thanks to the widespread presence of LNI on the national territory, cooperates with the Institutions monitoring and reporting the Italian seas and fresh waters status. CCA can deals with training of personnel involved in protected marine species (also target species) rescue (e.g. cetaceans and sea turtles). With regards to cetaceans and sea turtles, in 2017 we celebrated the 120th anniversary of the foundation of LNI publishing the book “Procedure di Pronto Intervento – Spiaggiamento Cetacei e Tartarughe”, a practical manual containing basic guidelines for collecting data (e.g. body measurements, sex identification) from cetaceans and sea turtles. Among the conferences, we highlight “I Cetacei e i cambiamenti climatici”, a workshop about the influence of climate change on cetaceans and other animal species organized by CCA in Gaeta (LT) during the Day dedicated to biodiversity and climate change.

In 2018 we have scheduled meetings and events among which the National Sea Day, celebrated on 11 April, main theme of the day was the marine debris, and the workshop “Economia del mare, sviluppo sostenibile della risorsa costiera” about the sustainable development of the coast, the conseguences of climate change, anthropic influence, and marine litter to try to reduce the negative human impact on the wild.

Oral Session 9

Communicable Disease and Climate Change

Chairs

Giovanni Rezza and Luca Busani

CLIMATE AND OTHER DRIVERS OF INFECTIOUS DISEASE THREAT EVENTS IN EUROPE

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The emergence and spread of infectious diseases in the interconnected world of today is not only a function of biomedical factors but also of many complex societal and environmental factors. In order to disentangle the contributing factros of infectious disease emergence we analyzed the underlying drivers of Infectious Disease Threat Evens (IDTE) in Europe that were detected through epidemic intelligence, collected at the European Centre for Disease Prevention and Control (ECDC). These drivers were sorted into three main groups: globalization and environmental drivers contributed to 61% of all IDTE, public health systemdrivers contributed to 21%, and social and demographic drivers to 18%. A higher resolution analysis revealed that four of the top five drivers of IDTE were in the globalization and environment group: travel and tourism, natural environment, global trade, and climate. While climate is not the strongest driver of IDTE it is nevertheless an important contributor to IDTE. In fact, climate, and by extension climate change, has already impacted the transmission of a wide-range of vector-borne diseases in Europe, and it will continue to do so in the coming decades. Climate change has been implicated in the observed shift of ticks to elevated altitudes and latitudes, notably including the Ixodes ricinus tick species which is a vector for Lyme borreliosis and tick-borne encephalitis. Climate change is also thought to have been a factor in the expansion of other important disease vectors in Europe: Aedes albopictus (the Asian tiger mosquito), which transmits diseases such as Zika, dengue, and chikungunya, and Phlebotomus sandfly species, which transmits diseases including Leishmaniasis. In addition, highly elevated temperatures in the summer of 2010 have been associated with an epidemic of West Nile Fever in Southeast Europe and subsequent outbreaks have been linked to summer temperature anomalies.

Future climate-sensitive health impacts are challenging to project quantitatively, in part due to the intricate interplay between non-climatic and climatic drivers, weather-sensitive pathogens, and climate change adaptation. Moreover, globalisation and international air travel contribute to pathogen and vector dispersion internationally. Nevertheless, monitoring forecasts of meteorological conditions can help detect epidemic precursors of vector-borne disease outbreaks and serve as early warning systems for risk reduction.

RISKS MAPS OF *ADEDES ALBOPICTUS* IN SPAIN

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Aedes albopictus, the so-called "Asian tiger mosquito", is considered as one of the worst invasive species worldwide. It was detected for the first time in Europe in Albania in 1979, and in 2004 in Spain and it has rapidly spread across large regions both in Southern Europe and in Spain, and it is expected to continue expanding northward due to climate change. It is a known competent vector for human transmission of dengue and chikungunya viruses, and probable for Zika, among others. In spite of being imported diseases in Europe, from 2007 on, chikungunya disease and dengue outbreaks have occurred in Europe, locally transmitted by A. albopictus. Several conditions have been identified as key factors for the presence, survival and spread of mosquitoes. Climatic, eco-environmental and sociodemographic factors are among them. The aim of this study was to generate a Spanish risks map of *A. albopictus*.

Species distribution data were obtained from the Spanish Ministry of Health. Climate data were downloaded from 19 bioclimatic variables of WordClim. Data were obtain from theNational Geographic Institute. We processed the cartography at 1 km square.

Models on habitat suitability based on ecological niche models (MAXENT) with different approaches were used. The first Maxent model used annual mean temperature, mean temperature of warmest quarter, mean temperature of coldest quarter, annual precipitation and precipitation of warmest quarter.

The second model used mean temperature of January, mean temperature in summer, precipitation of warmest quarter and precipitation of wettest quarter and altitude.

We had 846 distribution point across all the country. We achieved several risks maps at 1 km square resolutions. All models showed the highest risk among the Mediterranean coast and small areas from the Atlantic and Cantabrian coasts. On the other hand, the inland showed a low risk excluding riverside areas. The better environmental predictor of risk of Aedes was mean temperature of warmest quarter in the first model and was mean temperature of January and altitude in the second model.

These risks maps with entomological surveillance should be a priority in public health plans to prevent outbreaks and emergence of imported diseases in Spain.

QUANTIFYING THE SPATIOTEMPORAL SPREAD OF MOSQUITO-BORNE INFECTIONS IN NON-ENDEMIC AREAS

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Many mosquito-borne infections are expanding their geographical range, inducing an epidemiological transition in many previously transmission-free areas, which are now prone to repeated epidemics. Understanding the spatiotemporal dynamics of transmission in such areas with virtually no pre-existing immunity in the population is crucial to design and optimize control interventions.

To this aim, we developed a robust Bayesian inference method to reconstruct likely transmission chains (i.e., who infected whom), using information on the spatial location of cases and their time of symptom onset. The method was applied to multiple dengue epidemics from 2013-2016 in Porto Alegre, Brazil, a non-endemic, subtropical metropolis comprising 1,4 million inhabitants.

We found that transmission clusters expanded by linearly increasing their diameter with time, at an average rate of about 600m / month. The majority (70.4%, 95%CI: 58.2-79.8%) of individual transmission events occurred within a distance of 500m. Cluster diameter, duration and epidemic size were proportionally smaller when control interventions were more timely and intense. A large proportion of cases were transmitted via short-distance human movement (<1km), suggesting a limited contribution of long-distance commuting within the city. Based on this information, we were able to assess the number of cases averted by the dengue control protocol implemented in the considered area, consisting of reactive Ultra-Low Volume insecticide spraying in public areas in a radius of 200m of confirmed cases. Furthermore, we evaluated potential improvements deriving from expanding the radius of the treated areas, reducing intervention delays, or including private premises in the spraying activities.

Due to the simplicity and easy availability of the type of data required, the proposed approach can be straightforwardly extended to other mosquito-borne infections, other climates (e.g. subtropical or temperate areas), and different vector species. Insights from the reconstruction of transmission chains in outbreaks of tropical diseases in non-endemic areas can be of great value for the definition of public health measures aimed to contain their spatial spread.

THE SECOND AUTOCHTHONOUS CHIKUNGUNYA OUTBREAK IN ITALY: LESSONS LEARNED AND FUTURE CHALLENGES

Flavia Riccardo (a), Giulietta Venturi (a), Marco Di Luca (a), Martina Del Manso (a), Claudia Fortuna (a), Maria Elena Remoli (a), Francesco Severini (a), Daniela Boccolini (a), Luciano Toma (a), Eleonora Benedetti (a), Antonello Amendola (a), Maria Grazia Caporali (a), Giulia Marsili (a), Cristiano Fiorentini (a), Roberto Romi (a), Xanthi Andrianou (a, b), Patrizio Pezzotti (a), Caterina Rizzo (c), Francesco Maraglino (d), Patrizia Parodi (d), Giovanni Rezza (a)

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In 2017, an autochthonous Chikungunya outbreak took place in Italy for the first time in ten years. A total of 391 cases (192 confirmed), occurred in central Italy between the 26th of June and the 5th of November 2017. Between the 13th of August and the 30th of October 2017 an additional 100 cases (74 confirmed) occurred, or were linked to, a village in southern Italy at a distance of about 600km. CHIKV East/South/Central African (ESCA) strain genome was detected in mosquito pools of *Ae. albopictus* females and in patient serum samples in both outbreaks. None of the strains carried the A226V mutation, which was present in the 2007 outbreak in Italy. Epidemiological and microbiological evidence supported the hypothesis that the outbreak in southern Italy was linked and secondary to the one in central Italy and suggests that the primary outbreak might have been triggered by a single introduction from South-East Asia.

Although not unexpected, autochthonous CHIKV transmission is very unusual in Italy and this was the first documented occurrence of a multifocal autochthonous outbreak. This, and the fact that the outbreak was caused by an ESCA strain not showing the A226V mutation, suggests a more widespread and effective transmission by *Ae. albopictus* mosquitoes, that are widely established across the country.

The outbreak was detected only on the 6 and 7 September 2017, due to the missed diagnoses of early cases. This triggered aggressive but delayed surveillance and response actions. While awareness has definitively increased among infectious disease and public health specialists following this outbreak, awareness still needs to be raised among primary health care workers to improve the timeliness of case detection and among mayors to rapidly activate vector control measures locally.

Oral Session 10

Health and Climate Change: Joint Action for Sustainable Development

Chairs

Bettina Menne and Rachel Stancliffe

HEALTH, CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

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Introduction. Climate change, either a direct effect or indirectly from human activity, is putting at risk the achievement of all Sustainable Development Goals (SDGs). Globally, it is expected to cause over 250 000 additional deaths per year between 2030 and 2050. Climate-specific actions are necessary to protect people and the planet. Action is necessary across sectors and settings to promote resilience to and mitigation of climate change.

The health impacts of climate change in the European Region are wide ranging. Direct impacts result through progressive temperature increases, heat waves, storms, forest fires, floods or droughts. Indirect impacts are mediated through the effects of climate change on ecosystems and productive sectors such as agriculture, the distribution of plant and animal species, and water and food quantity and quality. Some of the implications of climate change, such as on migration, conflicts over natural resources and political instability, also generate changes in associated economic, environmental and social determinants of health.

Climate change will affect the achievements of the following health targets: SDG target 3.3: by 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, waterborne diseases and other communicable diseases.

SDG target 3.4: by 2030, reduce by one third premature mortality from noncommunicable diseases through prevention and treatment and promote mental health and well-being.

SDG target 3.9: by 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Action to achieve the following three targets will contribute to improve health and well-being: SDG target 1.5: by 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

SDG target 13.1: strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

SDG target 13.3: improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

At the United Nations Framework Convention on Climate Change Conference of the Parties in Paris in December 2015, all WHO European Region countries adopted the Paris Climate Agreement with the aim of reducing greenhouse gas emissions to limit global warming to 2°C relative to pre-industrial levels. The Paris Climate Agreement provides a critical opportunity to advance public health as a central element not only in response to climate change but also to the overall United Nations 2030 Agenda for Sustainable Development. Countries publicly outlined their intended nationally determined contributions, which are voluntary commitments to the collective action toward a zero-carbon, climate-resilient future.

Since 1999, Member States of the WHO European Region have been committed to action towards mitigation of and adaptation to climate change. The World Health Assembly resolution WHA61.19 on climate change and health urged Member States to prepare for and manage current and projected consequences of a changing climate. In March 2010, at the Fifth Ministerial Conference on Environment and Health in Parma, Italy, all Member States in the WHO European Region and the European Commission agreed to the Declaration and Commitment to Act. The Parma Declaration led to the European Regional Framework for Action: Protecting health in an environment challenged by climate change. The framework supports Member States' action to promote health equity and security, protect health and provide healthy environments in a changing climate in the WHO European Region. In June, 2017, at the Sixth Ministerial Conference on Environment and Health, the Parma commitments were reinstated and further reinforced through the Ostrava Declaration. Annex I to the Ostrava Declaration proposed the following actions: Develop and implement a national strategy or action plan for public health adaption to climate change.

Assess climate change risks to health in relevant national policies, strategies and plans.

Include, on a voluntary basis, health considerations within Member States' commitments to the United Nations Framework Convention on Climate Change.

Consider climate change adaptation and mitigation in the development of specific environment and health policies.

Strengthen natural risk reduction policies and early-warning surveillance and preparedness systems for extreme weather events and climate-sensitive disease outbreaks.

Develop information, tools and methodologies to support authorities and the public to increase their resilience against extreme weather and climate health risks.

Include the health aspects of climate change in education curricula, non-formal education and workforce continuing professional education.

Scale up public communication and awareness-raising campaigns on climate change and health.

Conduct or update national health vulnerability, impact and adaptation assessments of climate change.

Support research on the effectiveness, cost and economic implications of climate change and health interventions.

The presentation will focus on the interlinkages and mutual benefits of advancing health, addressing climate change while advancing the sustainable development agenda

TRANSFORMING HEALTHCARE FOR A SUSTAINABLE FUTURE

Rachel Stancliffe
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Sustainability has become mainstream. Everyone - from multi-nationals to schoolchildren -are engaging with it. The latest report from the IPCC underlines the urgency of reducing carbon emissions so that we do not exceed 1.5 degrees rise in global temperature. This is achievable but it is not easy. What does it mean in healthcare? How do we transform healthcare to be sustainable? How can we use the powerful voice of doctors and nurses to advocate for a sustainable future?

The Centre for Sustainable Healthcare works to engage healthcare professionals, patients, industry, researchers and the wider community in understanding the connections between health and the environment and to reduce healthcare's carbon footprint. We have developed a range of programmes to inspire people with sustainable models of care, empowered them with resources to enable them to make changes and worked alongside them to transform practice based on our principles of sustainable healthcare:

- prevention;
- patient empowerment and patient centred care;
- lean care systems;
- low carbon alternatives.

We need everyone to work together with strong, clear messages based on facts. We are inspiring everyone in the health system to engage with sustainability so that our children inherit a planet they can live on. And we are empowering people with the knowledge about what they can do to help transformation for a healthy sustainable future.

A TEN YEAR JOURNEY IN ENGLAND'S NHS: PRACTICAL STEPS TOWARDS A SUSTAINABLE HEALTH AND CARE SYSTEM

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Although climate change is one of the most serious threats to health in the 21st century, few sectors have consulted so widely, implemented plans so strategically, and evaluated them so quantitively as the English National Health Service (NHS). For over a decade, the results of consultations (with professionals, policy makers and public) has resulted in a radical reassessment of how we health and care systems are developed sustainably: economically, socially and environmentally. The health sector has an important duty and a significant set of opportunities to act visibly, not only to create a more sustainable healthcare system, but to reinforce the wider link between health and the environments in the wider public and political discourse. Evaluation of case studies in England and elsewhere in the world suggests that better and fairer health outcomes are possible with fewer resources. Actions that secure long term health can also improve health immediately; via the health care system and more widely. This paper describes the reasons why health and care systems must act, but why such actions go beyond efficiency and anti-pollution measures into areas of prevention, models of care, and a significant re-assessment of a) the primary purposes of health and care systems and b) what it means to be a healthy individual in a healthy community on a healthy planet. The Sustainable Development Unit in England started measuring the carbon (and wider) footprint of the system regularly 10 years ago. Between 2007 and 2015, the NHS achieved an 11% reduction in greenhouse gas emissions (in line with NHS and national targets) whilst health care activity rose by 18%. By 2017, the associated financial savings associated with environmental sustainability (mainly energy, waste and water) rose to £90m annually.

THE WHO UNCCC FIRST ITALIAN COUNTRY PROFILE ON CLIMATE AND HEALTH

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Climate change (CC) is directly and indirectly impacting the social and environmental determinants of health all over the world, particularly affecting clean air, safe drinking water, sufficient food and secure shelter.

Due to its geographic and physical unique features, including position in the middle of the Mediterranean basin, longitudinal extension, heterogeneous climatic zones, natural and ecological diversity, and the critical environmental phenomena along the country, including the intrinsic hydro-geological and seismic vulnerability and the existing post-industrial pollution circumstances, Italy is a living laboratory on climate and environmental changes, which may potentially induce or exacerbate critical direct and indirect effects on health.

The Italian project "Effects of Climate changes on human health within the «Planetary Health» vision" coordinated by the Ministry of Health and the National Institute for Health, in cooperation with the World Health Organization (WHO) and the Ministry of Environment, involving over 40 Italian health and climate scientists from twelve relevant national institutions in the health, environment and climate communities, has been recently concluded. The results provided substantial scientific guidance to the 2017 G7-Health Meeting in the identification of priority environmental and climatic determinants on human health. The project also produced the first Climate and health country profile for Italy. The latter recent disseminated report is part of the global initiative started in 2015 by the United Nations Framework Convention on Climate Change (UNFCCC) and WHO, based of a direct synergic work with governments and health authorities, and aimed to determine and present country specific evidence on climate and health risks, to track national adaptation and mitigation efforts in the health sector. The WHO UNFCCC climate and health profile for Italy, summarized research and analysis on the basis of country-specific climate hazard projections, including hazards, hazardous events and risks related to heat-related mortality, air pollution (with possible adaptation by urban and peri-urban forests regulating ecosystem services), ecosystem biodiversity, infectious and vector-borne diseases, water resources, water uses and sanitation, food safety and security; focus has been also given on relationship between migration and climate changes in the Italian circumstances.

The key messages the Italian country profile intends to send include the strategies in place to protect the health of Italian citizens and how health stakeholders must continue to build resilience to CC in the health sector through education, awareness, integrated surveillance and effective early warning and response systems to achieve the objectives of the 2030 Agenda for Sustainable Development and its SDGs.

IMPROVING AGRICULTURE SUSTAINABILITY THROUGH FARM MANAGEMENT OPTIMIZATION: THE WATER-ENERGY-FOOD NEXUS TO REDUCE INPUTS REQUIREMENT IN INTENSIVE CROPPING SYSTEMS

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Water Energy Food *nexus* is a conceptual approach to better understand the interactions between the natural environment and human activities, and to work towards a more coordinated management and use of natural resources across sectors and scales. This can allow for more integrated and cost-effective planning, decision-making, implementation, monitoring and evaluation.

Such planning and territorial approach has also been implemented at farm level in H2020 project, FATIMA - FArming Tools for external nutrient Input and water Management, where, the input optimization (water and direct and indirect energy) of intensive agriculture cropping systems, can help farmers to gain savings thus improving their competiveness, while reducing environmental impacts, increasing the sustainability of the whole agricultural sector.

The trials carried out in Italian pilot area of Piana di Tarquinia, characterized by high demanding input agriculture, show how important it is for farmers, to optimize water and nutrient (but also energy) management to obtain better economic and environmental performance, assuring appropriate quality and quantitative food production, under the Water-Energy-Food *nexus* framework.

Environmental and socio-economic indicators on water and energy management have been defined using dedicated tools such as FPC - Farm Performance Calculator. The results of those experimental measurements will address a new integrated policy framework inspired to the concepts of global sustainability (both socio-economic and environmental) in water and energy management related to food production.

WATER REUSE IN THE CONTEXT OF CLIMATE CHANGES AND SUSTAINABLE DEVELOPMENT: THE EUROPEAN PROJECT FRAME

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The overexploitation of water resources can cause severe problems especially in water regions affected by water scarcity such as the Mediterranean basin, and this effect is exacerbated by climate changes. Moreover, water resources are highly affected by contamination with a wide array of emerging organic compounds (e.g., pharmaceuticals, household chemicals), pathogens and antibiotic-resistant bacteria/genes discharged by Wastewater Treatment Plants (WWTPs) and this phenomenon increases with urbanization and population density. Water reuse is considered an effective strategy to fight the problems related to water scarcity and droughts in the EU and is a key action in the context of the Sustainable Development Goals. In This context the Water JPI European Project FRAME (A novel Framework to Assess and Manage contaminants of Emerging concern in indirect potable reuse) has contributed to develop new strategies to minimize the impacts of a broad range of chemical and biological contaminants when reusing treated municipal wastewater through an environmental buffer to augment drinking water resources**.** The practice of recycling treated municipal wastewater effluents to augment drinking water supplies is defined as “indirect potable reuse” (IPR) and aims to provide sufficient quantities of safe water, while preserving ecosystems and human health. The aim of FRAME has been to develop an overall evaluation procedure enabling a comprehensive assessment of efficient indirect potable reuse (IPR) measures to minimize the risks associated with emerging chemicals and microbial contaminants. This approach has included 1) the removal efficiencies of water treatment processes for suitable and representative (indicator) contaminants, including the presence of transformation products, 2) the inactivation of microbial contaminants, the removal of antibiotic-resistant bacteria/genes 3) the use of bioassays *in vitro* and *in vivo* to detect effects caused by specific pollutants and mixtures of pollutants. The outcomes of this study has been

embedded into a decision framework that can assist stakeholders and policy makers in selecting appropriate and cost-effective IPR applications minimizing ecological and human health risk in a context of climate changes.

Oral Session 11

Everything Else on Health and Climate Change

Chairs

Emanuela Testai and Enzo Funari

GLOBAL WARMING EFFECTS ON SKELETAL ANOMALIES IN FISH

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In a scenario of global warming, the direct and indirect effects of the rising temperatures on the onset of skeletal anomalies in fish are discussed. The teleost skeleton is a plastic organ system whose anatomy, histology, mechanical properties and number of elements is influenced by environmental (in addition to genetic) factors. It is fundamental for the fish's existence as the many functions it plays, i.e. mechanical (protection, locomotion, feeding); signaling (i.e. notochord during the ontogenesis); regulatory (mineral metabolism; production of several hormones); storage (i.e., lipid, phosphorus); communication (sound production and reception); generation of secondary sexual characters.

Global warming determines abiotic changes inducing indirect biotic modifications (physiological, ecological and behavioral), each possibly interfering with pattern and sequence of skeletal processes. Some effects of the rising temperature on fish skeleton are determined by changes in water viscosity and salinity, augmented pH, oxygen levels, impairment of the functionality of certain hormones, modification of aerobic/anaerobic metabolism, accelerated metabolic (and growth) rate, reduced living space availability, changes in food items availability and location, changes in toxicant mobility and bioavailability.

Understanding the entire picture of the effects of the climate changes on fish is a complex matter, because of non-linear synergistic effects between biotic and abiotic factors and fish autoecology, ecophysiology, evolutionary history, life history and stage, still largely unexplored. This determines that the future projections of changes on water ecosystems have produced mixed results and are currently under debate.

This review will focus on the extent to which aquatic warming temperatures will affect the skeleton modelling and remodelling processes that, in turn, affects phenotypic variability, autoecology and selective pressures. Whole-organism, environment and evolutionary scales are interconnected in a framework (eco-evo-devo) where the environment scale represents the challenges that developmental mechanisms have evolved to cope. The recent experience acquired on aquaculture-reared species showed that extreme environmental conditions will elicit epigenetic changes in phenotype; even without selection, this 'artificial' phenotype may be stabilized (genetically) through genetic assimilation *sensu* Waddington.

Consequently, fundamental questions will include the effects of sublethal deformations on fish biodiversity, and if these responses will lead to permanent evolutionary change in some species.

DROUGHT EFFECTS ON FRESHWATER MACROINVERTEBRATE COMMUNITY IN THE MEDITERRANEAN: ECOLOGICAL NETWORK ANALYSIS AS AN INNOVATIVE TOOL FOR BIOASSESSMENT

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Freshwater ecosystems in the Mediterranean region are under high pressure. Predictions point to an increase in water scarcity with negative implications on the sustainability of freshwater resources. Models at the local and regional level forecast that water stress may become particularly acute in the south-west USA, the Mediterranean Basin and the Middle East. On the other hand, at the global scale, water demand has doubled over the last fifty years due to increased demography and water intensive use. It is therefore essential to develop tools able to quickly detect environmental drought effects and establish measures that minimize their associated socio-economic impacts.

From an ecological perspective, droughts are considered to be a 'ramp disturbance', whose effects on biological communities is influenced by factors such as timing, duration, intensity and the presence of refuges. As flows decrease, habitat space is generally reduced; organisms respond to these conditions by continuous colonisation–extinction processes that often lead to a reduction in their density or even extirpation. Network analysis can be a powerful tool to obtain useful information about the pattern of species incidence and/or species co-occurrence, revealing complex direct and indirect effects of stressors on biotic communities, beyond the simple loss or gain of species.

Here, we tested how drought dynamics in rivers influence the modular partitioning of macroinvertebrates co-occurrence networks using different datasets within the Mediterranean region, covering different spatial and temporal drought surveys. We postulate that under severe drought events the contraction of available habitats/resources leads to an increasing modularity. The higher modular partitioning of networks clearly indicate that the pattern of species co-occurrence is influenced in a non-trivial way by the drought period, influencing how each species aggregate or segregate in space and time. Our findings suggest that network modularity is a key tool for biomonitoring, able to discriminate the role of drought in different datasets and giving us better information than metrics from standard methods, with the advantage of requiring the same sampling efforts as current monitoring procedures. We advocate the use of such a tool to improve our capacity to quickly detect environmental drought effects and accurately assess the ecological status of Mediterranean streams under multiple stressors.

MODELLING *AEDES ALBOPICTUS* DYNAMICS AND RELATED ARBOVIRUS OUTBREAKS RISK IN CENTRAL ITALY

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The invasive species Aedes albopictus has successfully colonized large areas of the Mediterranean basin and represents an alarming public health threat due to its potential role as competent vectors for arboviruses. Moreover, infected individuals are increasingly detected in the flow of international travelers into Europe due to the expansion of the geographic range of mosquito-borne diseases and the occurrence of significant outbreaks in endemic countries. The Public Health impact of the combination of these factors has been pointed out by the recent (2017) chikungunya outbreaks in Italy.

Mathematical and statistical models can be used to interpret monitoring data and to improve our knowledge on vector and outbreak dynamics. Indeed, understanding vector population dynamics is essential to identify under which conditions the transmission risk is higher and eventually reduce the public health burden represented by mosquito-borne diseases. Estimates of vector population dynamics, autochthonous transmission risk and the impact of arbovirus transmission, both in term of number of cases or deaths, could help the planning of preventive and reactive interventions.

Therefore, we analyzed the Italian 2017 chikungunya outbreak and found that the reproduction number R0 was 2.07 (95% credible interval: 1.47-2.59) and the first case importation between 21 May and 18 June 2017 with a probability of outbreak conditional to the importation event as high as 82% during the same period. We then evaluated the potential risk of yellow fever outbreaks and found between mid-July and mid-September a probability up to 31.9% of autochthonous transmission and up to 10.3% of large outbreaks. Moreover, the average probability of observing at least one death caused by yellow fever infection ranged between 7.2 and 12.5% if autochthonous transmission takes places.

A MODELLING ANALYSIS OF WEST NILE VIRUS TRANSMISSION AND HUMAN INFECTION RISK IN VENETO (ITALY)

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West Nile Virus (WNV) is a flavivirus of emerging public health relevance in Europe, which is maintained in enzootic cycles between avian reservoir hosts and mosquitoes. Humans are dead-end hosts in which infection can induce symptoms from mild flu-like fever to severe neurological syndromes such as meningitis, encephalitis, and acute flaccid paralysis. An intensified and continuous WNV spread across Northern Italy has been observed since 2008, which caused more than a hundred reported human infections up until 2016. Veneto is one of the Italian regions where WNV is considered endemic, and the greatest circulation was observed during 2013 and 2016.

By using entomological data collected across the region in those years, we calibrated a mathematical model through a Bayesian approach that simulates the WNV infection in an avian population with seasonal demography, taking also into account the effect of temperature on the virus dynamics. We considered two alternative routes of life cycle re-activation of the virus at the beginning of each vector breeding season: in one the virus is introduced by infected birds, in the other by diapausing mosquitoes which were infected in the previous year. We estimated biting rate and host-vector ratio by fitting model prediction to the observed WNV infection in the vector. Afterwards, we computed seasonal risk curves, indicating the likelihood for a human to be infected during the year, and quantified how they translate into reported symptomatic cases, also allowing for a shift in vector feeding preference according to actual observation.

According to our results, WNV is likely to be re-activated each year via already infected mosquitoes, thus it seems probable that the virus survives through winter in the area and it is not reintroduced every season from other regions. The highest probability of human infection is expected to occur in August, consistently with observations.

Our findings might provide new insights on the ecology of WNV in Southern Europe, in particular regarding its endemism and seasonality. Estimated human infection risk during the season can be of particular interest for public health authorities, helping them to design efficient surveillance and prevention strategies.

SPATIAL CORRELATIONS OF CLIMATIC AND ECO-ENVIRONMENTAL FACTORS WITH INCIDENCE OF HUMAN LEISHMANIASIS IN SPAIN

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Introduction. Leishmaniasis is an endemic parasitic disease in Spain. Main pathogen causing disease in that context is protozoon Leishmania infantum with sandflies of genus Phlebotomus (mainly P. perniciosus) as intermediate vectors. Role of humans and others mammals as hosts has been proven. Emergence of the weightest leishmaniasis outbreak in Mediterranean region, occurring in a locality close to nation's capital city, and recent inclusion as a compulsory notifiable disease are proofs of the rising importance as a Public Health issue. Impact of climatic, ecological, geomorphological and sociodemographic factors over changing distribution patterns has been analyzed in some neighboring countries, resulting in a huge amount of complex relationships between these factors and disease occurrence.

Objective. This study aims to explore relation between eco-environmental factors and leishmaniasis incidence (both visceral and cutaneous disease) in Spain.

Materials and methods. Information about cases was provided by the National Network for Epidemiological Surveillance (RENAVE), which compiles case-based data from reporting regions. Cases from 2006 to 2016 were included. Data on annual precipitation, temperature and humidity were obtained from WorldClim database. Topographic factors (elevation, slope, soil taxonomy), vegetation coverage and land use coverage were included, as well as population density (data from National Geographic Institute and National Institute of Statistics). An ordinary least square (OLS) regression model was applied and spatial autocorrelation of residuals was tested (Moran's Index). A geographic weighted regression (GWR) model was used to analyze the data and compare with OLS regression results. Principal component analysis method was performed and goodness of fit was evaluated.

Results. In Spain, distribution of leishmaniasis doesn't show a homogenous spatial pattern. Although data are provisional, geomorphological (such as altitude) and some meteorological factors (temperature and precipitations) show significant relationships with disease incidence.

Conclusion. Human leishmaniasis could be a defiant challenge for Public Health in next decades, especially under climate change scenarios. A better implementation and maintenance of surveillance systems are needed. Entomological approach is crucial to clarify some epidemiological aspects.

THE MEDITERRANEAN BASIN LIKE A PATHOGEN'S SOUP: A CONCERN FOR CETACEAN SPECIES INHABITING THE PELAGOS SANCTUARY AND THE ZOONOTIC SIGNIFICANCE OF SOME PATHOGENS INVOLVED

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The detection of disease agents affecting stranded cetaceans provides effective information about the health status of the marine mammal populations and the marine environment in general and may increase public awareness of deteriorating marine ecosystems health.

Between 2015 and the beginning of 2018 (January-March), 27 cetaceans, of which 22 striped dolphins (*Stenella coeruleoalba*), 2 bottlenose dolphins (*Tursiops truncatus*), 1 sperm whale (*Physeter microcephalus*) and 2 undetermined, were found stranded along the Ligurian coast of Italy, included within the Pelagos Sanctuary, a marine protected area for marine mammals in the North Western Mediterranean Sea.

Thanks to the surveillance activity of the National Reference Centre for diagnostic activities on dead stranded cetaceans (C.Re.Di.Ma.), a total of 22 necropsies were performed (22/27, 81%) and a cause of death was determined with confidence in 21 cases (21/22, 95%). Infectious disease was the most common cause of death, involving 20 cetaceans (20/21, 95%).

Interestingly, 10 of these cases (10/20, 50%) were characterized by severe coinfections involving cetacean-specific viruses and pathogens with zoonotic significance (e.g. monophasic variant of *Salmonella* Typhimurium 1,4 [5],12:i:-, *Listeria monocytogenes*,

Brucella ceti ST26) and/or indicative of environmental contamination (e.g. protozoal pathogens like *Toxoplasma gondii* and fungal pathogens like *Aspergillus fumigatus*).

The interaction of multiple pathogens, as represented in these cases, associated in some cases to hazardous levels of organochlorine pollutants at tissue level, may have significantly impacted the course and severity of the disease condition, thereby leading to the dolphins' stranding and death.

To our knowledge, published reports on some of the aforementioned pathogens in marine mammals are rare, and little is known regarding the environmental factors affecting their persistence in the marine environment as well as the infection of marine organisms.

Coinfections involving pathogens with zoonotic significance were analysed in detail, focusing on the pathogenic role of the agents identified, the association with the pathological findings (specific or not) in the central nervous system and/or in other organs and tissues, and the most likely source of exposure, considering the characteristics of the concerned coastline.

These results highlight the role of cetaceans as sentinel species for zoonotic and terrestrial pathogens in the marine environment, suggest a high level of seawater contamination by pathogens of anthropogenic and/or terrestrial animal origin along the coasts of North Western Italian coastline and underline the potential risk for cetacean species and public health.

RISK EVALUATION OF MALARIA REEMERGING IN NON-ENDEMIC AREAS WITH A TEMPERATE CLIMATE

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Plasmodium vivax is the most prevalent human Plasmodium species outside Africa, because of the capability of this parasite to complete its biological cycle also in areas characterized by temperate climate. So far, in the European Region of World Health Organization (WHO), most of the observed malaria endemicity was due to P. vivax. In the year 2015, this WHO Region achieved the interruption of malaria transmission. The number of indigenous malaria cases dropped from 90.712 in 1995 to zero cases in 2015. Malaria elimination in the European Region has been achieved thanks to the implementation of a series of specific activities, as an accurate detection and surveillance of malaria cases, a deployment of integrated strategies in malaria control programs, a tight collaboration with neighboring countries and a capillary activity of information among at risk people. These achievements are impressive but fragile since the continuous importation of cases from endemic regions and possible changes in the eco-epidemiological situation, including changes in climate condition, could lead to a re-establishment of malaria transmission. Other Regions in the world are prone to a possible remerging of malaria transmission, as for example some areas of China bordering North Korea, this latter the only temperate country where P. vivax is still endemic today. The massive movement of refugees that are entering in China and South Korea from North Korea constitutes a serious risk of malaria reintroduction in those areas. The risk evaluation of possible malaria re-emerging in a given area can be estimated by the assessment of the malariogenic potential, that is determined by three factors: receptivity, infectivity and vulnerability. Receptivity is the capability of a given vector to spread the disease, infectivity is the susceptibility of the vector to different Plasmodium species and the vulnerability is the presence of gametocyte (the parasite blood stages transmittable to Anopheles vectors) carriers in the area. Recent outcomes of evaluation risk studies carried out in some temperate areas of the world, such as the Mediterranean basin, some countries located in Central Asia belonging to the NIS confederation and the above mentioned Asian countries, will be presented and discussed. Even if in the majority of temperate regions the risk of malaria reintroduction is low, outbreak events due mainly to P. vivax cannot be excluded, as demonstrated by the P. vivax epidemic recently occurred in Greece.

Oral session 12

Air Quality, Low Carbon Policy Health and Climate Change

Chairs

Maria P. Neira and Andrew P. Haines

ADRESSING CLIMATE CHANGE, A MAJOR OPPORTUNITY FOR HUMAN HEALTH

Maria P. Neira
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Avoidable climate and environmental risks cause almost 13 million deaths every year, and approximately a quarter of the global burden of disease. Half of this total, over 7 million deaths a year, are attributable to air pollution - a constant public health emergency, requiring an immediate and strong response. Taken together, this is an unbearable cost in lives, health, and human development, particularly for the poor.

We have more evidence and understanding than ever before about the direct and indirect paths through which a stable and protected environment maintains human health; and conversely, how failure to manage climate and environmental risk factors are contributing to both communicable and non-communicable diseases from the poorest to the richest populations. We also have a wealth of evidence on effective interventions to address many of the root cause drivers of the environmental determinants of health, including through local level actions.

There are ongoing community based climate change resilience initiatives, local and national operational interventions and a huge mobilisation of global actors who are interacting in new partnership models bringing together governments, civil society and the private sector.

Opportunities for action on health, climate and the environment are rapidly opening up. Promoting sustainable transport, clean energy, waste management, sustainable food production, and urban planning together with promoting universal access to clean energy at the household level will critically improve health.

Policies that reduce climate change and improve environmental conditions have huge health co-benefits potentials. For example, an increase of 7 per cent in total clean energy investment for the period 2012-2040 could prevent 1.7 million premature deaths from outdoor air pollution and 1.6 million deaths from household pollution in 2040.

Let’s work together and to make sure we don't miss this opportunity.

HEALTH IN THE LOW-CARBON ECONOMY

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Urgent action is required to keep to the commitments of the Paris Treaty which aims to limit a global temperature rise this century well below 2°C above pre-industrial levels and 'to pursue efforts to limit the temperature increase even further to 1.5 ° C'. Currently we are on a trajectory which would result in a rise of about 3.2 ° C by the end of the century in the absence of more effective policies to cut emissions of carbon dioxide and short-lived climate pollutants, such as methane and black carbon. Many such policies can yield major co-benefits for health and development more widely, through reduced exposure to particulate and ozone air pollution and through other pathways such as healthy sustainable diets and increased physical activity. Greater recognition of these multiple near-term benefits can help overcome barriers to urgent action. However such policies need to be designed carefully in order to avoid unintended harms, examples include the promotion of diesel vehicles as a 'low-carbon ' alternative to petrol or increasing inequalities from poorly designed carbon pricing policies. This presentation will give an overview of recent developments in quantifying the health and related (co)-benefits of different policy options to cut emissions in the energy, transport, built environment and food and agriculture sectors. It will also discuss how to minimise the risks of unintended adverse consequences.

SHORT-TERM EFFECTS OF TEMPERATURE ON MORTALITY AND HOSPITAL ADMISSIONS IN ITALY DURING 2000-2010. RESULTS FROM THE BEEP PROJECT

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Introduction. Health effects of heat and cold in large urban areas are well known, while evidence in suburban and rural areas is scarce. One of the objectives of the BEEP project: "Big Data in Environmental and Occupational Epidemiology" is to evaluate the effects of extreme temperatures on health outcomes at the municipal level in Italy. The aim of the study is to estimate the short-term effect of heat and cold on mortality (in 5 Italian regions: Puglia, Sicily, Piedmont, Lazio and Emilia Romagna, 2006-2010) and hospital admissions nationwide (all municipalities, 2001-2010), and to evaluate possible changes in the effects by sex, age (<64; 65-74;> 75 years) and level of urbanization.

Methods. Through the use of Land Surface Temperature (LST) and NDVI satellite data, observed temperature data from meteorological stations and "land use" data, daily mean air temperature with a spatial resolution of 1x1km was derived. To account for the non-linear relationship of the association, non-linear distributed lag (DLNM) models were used. The association between temperature and mortality/hospitalizations was assessed by means of region-specific Poisson time-series models adjusted for temporal trends, particulate matter and influenza epidemics. Results are given as percent increases in risk (IR%), and 95% CI, for temperature increases between the 75^{th} and 99^{th} percentile (heat) and decreases from the 25^{th} to the 1^{st} percentile (cold). Risk estimates by age, sex and urbanization levels (high, medium, low) were also calculated.

Results. The analysis on mortality showed a non-linear relationship, with an increase in risk for both high and low temperatures. The pooled effect estimates for heat and cold on natural mortality were 1.33% (95% CI: 1.21-1.47%) and 1.18% (1.12-1.25%) respectively. Greatest effects were observed on respiratory causes (IR%=1.54, 95% CI=1.36-1.72, and IR%=1.43, 95%=CI 1.24-1.65, respectively for heat and cold), among the very elderly (75+

years), for heat in women and for cold in men. Similar mortality effects were found by level of urbanization. Concerning hospitalizations, high temperatures were significantly associated only with respiratory admissions, while low temperatures with both cardiovascular and respiratory admissions. Higher effects of heat and cold were estimated in the elderly and in municipalities with a higher level of urbanization.

Conclusions. The results of the BEEP project show a risk in mortality and admissions for heat and cold in urban, sub-urban and rural Italian cities. In particular, effects were highest for respiratory outcomes and among the elderly.

**On behalf of the BEEP Collaborative Group.*

LOW CARBON FOOTPRINT TECHNOLOGIES TO RECOVER AND REUSE SAFE RESOURCES WITHIN THE URBAN WATER CYCLE

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The road to urban bioeconomy can go through the urban water cycle and valorize the safe resources that can be recovered and reused from wastewater. The key enabling technologies to recover water and valuable materials, such as phosphorus and other nutrients, biopolymers and/or cellulose, are under validation and demonstration in existing plants in a number of large Horizon2020 Innovation Actions such as SMART-Plant (www.smart-plant.eu). SMART-Plant is proving the technical and economic feasibility and the environmental sustainability of circular management of urban wastewater even through Life Cycle Assessment and Life Cycle Costing approaches. However, several barriers have to be broken in order to deliver circular economy: product standardization and health & safety of end-users are major issues to be addressed for a proper and sustainable market uptake. The water-related value chains under validation within SMART-Plant will be presented with major focus about technical performances, eco-efficiency and barriers to be addressed and broken.

THE INTERACTIVE EFFECT OF TEMPERATURE AND AIR POLLUTION ON MORTALITY: A TIME SERIES ANALYSIS IN 25 CITIES

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Background and Aim. Climate change scenarios for Italy predict an increase in frequency and intensity of extreme weather events, such as heat waves, heavy rainfall and droughts. Heat waves are often related to stagnant weather conditions favouring the local build-up of pollutants above the air quality standards in larger urban areas. There is still uncertainty regarding the potential interaction between temperature and air pollutants apart from their independent health effects. The aim of this study is to evaluate daily PM10 as a potential effect modifier of the relationship between temperature and natural mortality in 25 Italian cities during 2006-2010.

Methods. Daily time-series analysis between mean temperature and mortality for all natural causes using a generalized additive mixed model, with a random intercept for each city was used to estimate heat (75th-99th percentile increase in temperature, lag 0-3 days) and cold (25th-1st percentile temperature decreases, lag 0-14 days) effects expressed as % changes. A bivariate tensor product between mean temperature and PM10 was defined to evaluate their interaction. Temperature effect estimates were extrapolated from the tensor at low, medium and high levels of PM10, defined at 5th, 50th and 95th percentiles. Data were stratified by season (summer, winter) and geographic area (North, Centre, South).

Results. We found increasing effects of heat by increasing levels of PM10: % changes from +3.9% for low PM10 to +14.1% for high PM10 days in the North, from +3.6% to 24.4% in the Centre and from +7.5% to 21.6% for the South. No effect modification by PM10 was observed for the effects of low temperatures.

Conclusions. This study outlined the importance of taking into account air pollution in policies for mitigation of heat effects. Considering that both environmental exposures especially affect the most vulnerable subgroups, such as the elderly and those with pre-existing cardio-respiratory conditions, heat response plans should address the combined effects of the two exposures both in warning systems and in prevention measures for vulnerable subgroups.

RESPIRATORY INFECTIOUS MORTALITY RATES IN ITALY: THE CLIMATIC INDEXES AS LONG TERM PREDICTION INSTRUMENTS

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Climate change refers to long-term statistical shifts of the weather, including changes in the average weather condition or in the distribution of weather conditions around the average. Despite many discussions on the causes for climate change, there is a general recognition of an on-going global climate change and the non-minor role of human activities during this process. Climate changes include alternations in one or more external (sun activity) and/or internal (temperature, precipitation, wind) climate variables.

Three components are essential for most infectious diseases: an agent/pathogen, a host/vector, and the transmission environment. Appropriate climate and weather conditions are necessary for the survival, reproduction/evolution, distribution and transmission of disease pathogens, vectors, and hosts. Therefore, changes in climate conditions may impact infectious diseases through affecting the pathogens, vectors, hosts and their living environment. As a result, not only the quantity but also the geographic and time distributions of pathogens may change. As consequences, the health effects of such impacts tend to reveal as shifts in the geographic patterns of human infectious diseases, and as cyclical changes in their outbreak frequency and severity.

Studies have found that long-term climate oscillations tend to favour the geographic expansion of several infectious diseases, and that extreme weather events may help create the opportunities for more clustered disease outbreaks or outbreaks at non-traditional places and time. In particular, the striking seasonal pattern that characterizes influenza in temperate populations has long suggested a causal link between seasonal fluctuations in climatic and social factors and influenza transmission.

Recently (American Thoracic Society, 2018), following a multidisciplinary approach focused on a non communicable disease such as asthma, we have found that drought and asthma mortality show similar periodicity in the contiguous US. In particularly, the interaction between the Atlantic Multidecadal Oscillation and the Pacific Decadal Oscillation indexes, and consequent drought events, show a similar periodicity to asthma mortality in the contiguous US.

Accordingly, we have started a study to examine evidence from the recent past (last ~60 years) of associations between the climatic indexes variability (e.g., North Atlantic

Oscillation, Atlantic Multidecadal Oscillation, Total Solar Irradiance), the infectious disease evolution and related death rate in Italy, and we use the above evidence to create predictive models to estimate the future burden of infectious disease under projected climate change scenarios.

Oral session 13

Ecosystem and Health

Chairs

Laura Mancini and Damia Barceló Cullerès

THE EU GLOBAQUA PROJECT ON MULTIPLE STRESSORS IN RIVERS UNDER WATER SCARCITY AND GLOBAL CHANGE. A RECONNAISSANCE STUDY IN SELECTED EUROPEAN RIVER BASINS AND THE WATER-ENERGY-FOOD NEXUS

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Most ecosystems are exposed simultaneously to several stressors, in the so-called multiple-stress situations. Some stressors such as water scarcity can limit biodiversity and economic activities in entire regions. In addition of being a stressor on its own, water scarcity can drive the effects of other stressors acting upon river ecosystems. It leads to intermittency in water flow, and therefore has implications for hydrologic connectivity, negative side-effects on biodiversity, water quality, and river ecosystem functioning. Water scarcity can amplify the effects of water pollution by reducing the natural diluting capacity of rivers. Interactions between stressors may be exacerbated by climate change. For instance, warmer temperatures and reduced river flows will likely increase the physiological burden of pollution on the aquatic biota, and biological feedback between stressors (e.g. climate change and nutrient pollution) may produce unexpected outcomes. Degradation of drainage basins, destruction of natural habitats, over-exploitation of fish populations and other natural resources, or the establishment of invasive species, are factors whose impacts combine and may give rise to synergistic effects, especially during periods of water shortage. The effects of these stressors are very relevant for the chemical and ecological status of water bodies as well as for the sustainability of ecosystem services they provide.

Water scarcity is a key stressor with direct and indirect effects. The relevance of water scarcity as a stressor is most important in semi-arid regions such as the Mediterranean basin, characterized by highly variable river flows and the periodic occurrence of low flows and even no-flows. Climate change previsions forecast an increase in the frequency and magnitude of extreme events. Although extremes are part of the normal hydrologic behavior in Mediterranean-type rivers, many already show a consistent trend towards decreased discharge.

This presentation will show different examples on the risk of emerging contaminants and nanomaterials in Mediterranean river catchments affected by water scarcity. For example, the relevance of environmental factors (light, temperature, water flow) and chemical stressors (nutrients, pharmaceuticals, endocrine disruptors, pesticides, perfluorinated compounds and heavy metals) in the structure and functioning of epilithic biofilms in the following Mediterranean watersheds, Ebro, Gualdalquivir, Jucar, Llobregat and Evrotas will be shown. Relevant data en Emerging Contaminants and Nanomaterials on three other European river catchments; Adige, Sava and Evrotas will be reported too. Stressors co-occur and interact in specific manners, and the respective relevance of one or another in the response of the biota may be altered also by the flow regime.

Finally, new tools like MALDI-TOF MS were used to better understand the river functioning. The experiments start using standard polymeric materials exposed to natural aquatic environments. Afterwards structural changes related to degradation process of the polymeric surface are monitored by MALDI TOF IMAGING.

ADDRESSING KEY CHALLENGES OF WATER SCARCITY AFFECTING WARM MEDITERRANEAN RESERVOIRS

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Freshwater resources are constantly under pressure from climate change, urbanization, pollution, overexploitation, and increasing competition between various user groups. At European and EU Member State level, freshwater policy derives mainly from the Water Framework Directive - WFD (2000/60/EC) and calls for "good ecological status/potential" for all surface waters.

Eutrophication, which is one of the most frequently problems that surface waters experience and it is also linked with climate change and raising temperatures, can lead to the formation of cyanobacteria harmful algal blooms (Cyano-HABs) that directly affect water quality by producing undesirable color, taste, odor and by releasing harmful cyanotoxins into the water. Worldwide increase on cyano-HABs formation calls for taking both action and preventative measures to insure the wellness of people coming in contact with the cyanobacterial contaminated water either through recreational activities, inadequately treated potable water, and contaminated with cyanotoxins food (crops and fish).

Herein, we will discuss two case studies concerning Mediterranean reservoirs located in Greece and Cyprus which frequently exhibit persistent cyano-HABs. Specifically, this study focused on the newly recreated artificial Lake Karla in Greece, which is a very shallow and heavily modified waterbody, exposed to point and diffuse pollution sources due to intensive agricultural and livestock activities. Polemidia reservoir in Cyprus is one of the oldest artificial dams in Cyprus and it is solely used for crop irrigation. It is constantly enriched with tertiary treated water from the Sewerage Board of Limassol Amathus (SBLA) while until recently (2016) untreated urban and industrial wastewater was leaking into the dam from a nearby landfill of Vati, leading to enhanced eutrophication.

The goal of this study was to correlate key-water quality parameters with the formation of cyanobacteria harmful blooms (Cyano-HABs) and their cyanotoxicity. By doing so, the components that mostly disturb the proper function of each hydro ecosystem are identified in order to provide suitable management tools. Though multiple linear regression analysis, we were able to correlate characteristics of the blooms with nutrients (N, P) and water temperature. In brief, data collected from the past decade on the annual temperature (T) range of water, indicated that T is not a limiting factor for bloom formation for both waterbodies. The concentration of phosphorus was found to be key for the development of cyano-HABs in Lake Karla, while a significant reduction in the TP concentration of the recycled water used to enrich Polemidia reservoir following year 2010 changed the trends of cyano-HABs formation and their characteristics.

AN ITALIAN NETWORK FOR THE DETECTION OF ECO-GENOTOXICOLOGICAL EFFECTS IN A RIVER BASIN CHARACTERIZED BY FLOODING AND WATER SCARCITY

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The use of effect-based methods for the assessment of the quality status of surface waterbodies such as rivers, lakes, marine-coastal waters is highly recommended both by the scientists and the policy makers for example in the context of the common implementation strategy of the European water framework directive. The presence of thousands of chemical contaminants in the environment cannot be monitored and evaluated only through the chemical analysis considering the presence of complex mixtures and the emerging chemical contaminants not included in the legislation. Furthermore the effects of climate changes (e.g. water scarcity, flooding) can vary in an unpredictable way the environmental fate of the contaminants in the ecosystems and the use of innovative alternative monitoring methods is recommended.

In this context the Italian Institute of Health, in collaboration with several Italian Universities, has developed a project for the application of eco-genotoxicological assays to evaluate the quality status of the urban trait of the Tiber river basin through the detection of biological effects in the ecosystems (genotoxicity, mutagenicity, embryotoxicity, teratogenicity, neurotoxicity, cardiotoxicity, lethality) that are also related to the protection of human health. This part of the Tiber river basin is characterized by the presence of point and diffuse sources of pollution typical of a big urban city (e.g. urban wastewater effluents, small enterprises discharges) and the effects of this pollution could be exacerbated by the presence of extreme weather events such as flash-floodings and water scarcity typical of this geographical area.

The bioassays toolbox has included, *inter alia*, the genotoxicity tests Comet and Micronucleus assays, the Fish Embryo Toxicity Test (FET), the Hydra teratogenicity test, the Daphnia magna assay, Vibrio fischeri and algae test. The monitoring campaigns have been conducted in different seasons of the year in 3 sampling stations including a potential background area.

The results of this study, based on an ecosystem approach, will contribute: 1) to improve the knowledge of the quality status of the urban part of the Tiber River basin 2) to define a set of eco-genotoxicological indicators needed in scenarios characterized by the effects of climate changes such as floodings or water scarcity 3) to support the implementation of the national and European legislation for the protection of surface water bodies.

“SUMMER RAIN” - INCREASED RISK OF GASTROINTESTINAL AND RESPIRATORY INFECTIONS AFTER URBAN PLUVIAL FLOODING IN THE NETHERLANDS

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Climate change leads to an increasing risk of extreme rainfall events in the Northern Hemisphere and herewith urban pluvial flooding. Urban pluvial flooding often consists of street flooding and/or flooding of combined sewerage systems, leading to contamination of the floodwater with several gastrointestinal and/or respiratory pathogens. An increase in flooding events may therefore pose a health risk to those exposed to urban floodwater. We studied the association between exposure to pluvial floodwater and Acute Gastroenteritis (AGE) and Acute Respiratory Infection (ARI).

We performed a retrospective, cross-sectional survey during the summer of 2015 at 60 locations in the Netherlands with reported flooding. Two weeks after the flooding, questionnaires were sent to households in these locations, collecting data on self-reported AGE and ARI, as well as detailed information on floodwater exposure in the previous two weeks. Multivariable Generalized Estimating Equations (GEE) regression models, accounting for the clustered data structure, were used to assess risk factors for AGE and ARI.

In total, 699 households (1656 participants) returned the questionnaire corresponding to a response rate of 21%. Contact with floodwater was significantly associated with AGE (OR 4.2, 95%CI:2.1-8.4) and ARI (OR 3.3, 95%CI:2.0-5.4). The risk factors for AGE are skin contact (OR 4.0, 95%CI: 1.8-9.0), performing post-flooding cleaning activities (OR 8.6, 95%CI: 3.5-20.9) and cycling through floodwater (OR 2.3, 95%CI: 1.0-5.0). The risk factors for ARI are skin contact (OR 3.6, 95%CI:1.9-6.9) and performing post-flooding cleaning activities (OR 5.5, 95%CI:3.0-10.3).

The results demonstrate that direct exposure to pluvial floodwater significantly increased the risk of AGE and ARI. Since it is predicted that pluvial flooding will increase in the future, there is a need for flood-proof solutions in urban development and increased awareness among stakeholders and the public about the associated health risks.

EVALUATION OF THE ECOTOXICOLOGYCAL IMPACT OF MUNICIPAL WASTEWATERS ON WILDLIFE

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As effect of human activities, persistent organic pollutants are discharged in the environment and can be found in surface waters. They could ultimately accumulate in Wastewaters Treatment Plants (WWTPs) which unfortunately are rarely designed to face this problem.

The aim of this study was to evaluate the quality of waters collected from real wastewater treatment plants in the north of Italy, in terms of pharmaceutical active compounds (PhAC) concentration and environmental risk assessment. The process efficiency was studied, evaluating also the effect of seasonal variability: samples were collected from both the influents and the effluents during a four season sampling campaign. The chemical characterization revealed the presence of nine PhAC including three non-steroidal anti-inflammatory drugs (diclofenac, ketoprofen, paracetamol), three antibiotics (amoxicillin, clarithromycin, doxycycline), one β-blocker (atenolol), one antiepileptic drug (carbamazepine) and one hormone (β-estradiol). As expected, their concentration was strongly affected by the season, with high antibiotics concentration detected during cold periods. As regards the wastewaters ecotoxicity, several bioassays were performed based on three seeds (watercress, sorghum and cucumber), algae, crustaceous and luminescent bacteria. *Raphidocelis subcapitata* was often the most sensitive organism, but data confirmed the importance of a battery of tests with model organisms representative of different trophic levels of the aquatic ecosystem. The WWTPs did not always reduce the toxicity indicating that the waters discharged in the receiving basin still had relevant effects on the ecosystem.

Ecotoxicologycal synthetic index were also performed to better define the actual environmental risk. The set-up of the toxicological scale allowed to provide a single number that indicates the environmental risk associated to the sample, merging all the results (potentially even contrasting ones) of the bioassays including statistical evaluation of the data. The sampling campaign is still in due course and it will be useful to evaluate the major chemicals responsible for the environmental stress posed by the wastewaters and to set up an ecotoxicological battery fruitful for the evaluation of the acute and chronic toxicity of a water sample.

SOIL SEALING AND URBAN GROWTH IN ITALY

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Land take is increasing at global and national level, mainly because of new buildings and low-density urban areas. However, other factors, like expanding transport network, urban densification process and, in general, soil sealing growth, are contributing to this process as well. Many negative effects on the environment are evident: hydrogeological risk growth, agricultural productivity reduction, soil and landscape degradation, biodiversity loss and a lack of those ecosystem services that are the basis of our existence and well-being.

Thus, the soil protection and the acknowledgment of the natural capital are tasks that Europe and United Nation (UN) are asking to all the European governments. The goal for EU is to reach zero net land take within 2050, while UN aim to achieve a land degradation neutrality within 2030.

The most recent data of the Italian System for Environmental Protection and ISPRA state that land take due to urban growth and soil sealing in Italy are still rising, even though both the processes are slightly decreasing in the last years. These data show phenomena like diffusion, dispersion (urban sprawl), urban decentralization on one side and urban densification on the other.

The above-mentioned processes concern the coastal and plain areas mostly. However, in the marginal areas appear also phenomena of land misuse and fragmentation of natural areas. An emerging issue is the increment of urban densification mainly caused by new buildings located either close to or inside the cities. The progressive densification of urban areas will lead to the saturation (loss) of green infrastructures and the reduction of open spaces inside the city. Unfortunately, these spaces are essential for the citizen quality of life, for the environment, and for climate change adaptation.

Oral session 14

Global Health and Climate Change

Chairs

Stefano Vella and Maurizio Marceca

CLIMATE CHANGE IMPACT ON CHRONIC DISEASES

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Climate change represents one of the major challenges to sustainable human development. Among the different causes of climate change, household and ambient air pollution, mainly driven by emissions of power generation, transportation agriculture, also have a definite impact on chronic Non Communicable Diseases (NCDs).

It has been estimated that over 3 million of NCDs morbidity and deaths are linked to air pollution: in the short term cardiovascular and respiratory hospital admissions, exacerbated asthma symptoms, and reduced lung function, in the long term impacts include reduced life expectancy, death from stroke or coronary heart disease, lung cancer, bronchitis in children, chronic bronchitis in adults, heart attacks, heart arrhythmia, and chronic obstructive pulmonary disease.

The close link between both climate and NCDs points towards the urgent necessity of a common action, under the umbrella of the Sustainable Development Goals, which are all interlinked and needs to be addressed synergistically.

As beautifully stated by the 2015 Lancet Commission on Health and Climate Change, “Given the potential of climate change to reverse the health gains from economic development, and the health co-benefits that accrue from actions for a sustainable economy, tackling climate change could be the greatest global health opportunity of this century. A public health perspective has the potential to unite all actors behind a common cause - the health and wellbeing of our families, communities, and countries”.

ONE HEALTH: THE MEDILABSECURE EFFORT TOWARDS INTEGRATED SURVEILLANCE OF ARBOVIRUS INFECTIONS IN THE CONTEXT OF ENVIRONMENTAL CHANGES

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Despite all efforts of cooperation between human and animal health, isolated silo thinking persists, particularly in the public health sector that struggles to perceive advantages of using a One Health approach. MediLabSecure network (http://www.medilabsecure.com/project.html), established in 2014 following the EpiSouth Projects (http://www.episouthnetwork.org/), comprises 55 laboratories and 19 public health institutions in 19 non-EU countries in the Mediterranean and Black Sea regions (Albania, Algeria, Armenia, Bosnia and Herzegovina, Egypt, Georgia, Jordan, Kosovo, Lebanon, Libya, Moldova, Montenegro, Morocco, Palestine, Former Yugoslavic Republic of Macedonia, Serbia, Tunisia, Turkey, Ukraine). This One Health project develops through the transdisciplinary interaction of four sectors: human health, animal health, medical entomology and public health, to enhance preparedness and response to emerging arboviroses. In line with this approach, in four years of the MLS Project (2014-2018), the studies and activities implemented have provided relevant results and lessons learned that contribute to the strategies for the prevention and control of arbovirus infections with a One Health approach, by focusing on integrated surveillance and multisectoral risk assessment.

To enhance further the approach described, additional aspects related to global environmental and climatic changes will be addressed by new studies and activities: by MediLabSecure network. In fact, the above changes and trends seem to have a critical role in the ecology of numerous pathogens and vectors and related impact on diseases transmission and human and animal health. It is therefore a priority to identify appropriate “One Health” indicators which can easily and promptly provide information from multiple sectors (human, animal, vector, environment) for surveillance and preparedness of vector borne diseases. This will allow the development of an integrated early warning tool, which will finally contribute to describe the phenomenon and to focus on at risk geographical areas. The MediLabSecure Project is supported by the European Commission (DEVCO: IFS/21010/23/_194).

PERCEPTION OF CHANGE, LOSS OF SOCIAL CAPITAL AND MENTAL HEALTH IN MIGRANTS FROM AFRICAN COUNTRIES DIVIDED BY INDEX OF VULNERABILITY TO CLIMATE CHANGE

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The relationship between climate change and mental health is still largely understudied. The impact on individuals and communities is assumed to occur through direct and indirect mechanisms as a result of a variety of weather events: acute natural disasters (e.g. hurricanes, floods), subacute events (e.g. heat waves, droughts) and long-term environmental changes (e.g. desertification, biodiversity loss). Direct impacts can arise through more frequent exposure to trauma resulting from increased severity and incidence of disaster and subacute events. As regards indirect impacts, climate changes may erode natural resources on which economic and community wellbeing is based on; this effect undermines social capital (a combination of community participation and social cohesion) which is causally related to mental health. Few evidences on the relationship between climate change, loss of social capital and mental health have been collected from studies on Australia and Northern Canada rural populations. Many migrants arriving in Italy come from African countries, with high or very high vulnerability to climate change. The majority are culturally and economically disadvantaged even in their countries of origin. Climatic events are likely to be experienced differentially along socio-economic disparities, with people like African migrants disproportionately exposed to the most negative impacts. This exploratory research compares the knowledge and perception of climate change, the reduction of social capital and mental health in two groups of migrants. These migrants are currently hosted in three First reception centers in Northern Italy. The two groups were divided according to the ND-GAIN Vulnerability index of the University of Notre Dame Global Adaptation Index. The first group is composed of people from countries with the highest vulnerability to climate change (ND-GAIN> 0.60: Burkina Faso, Mali, Niger, Sierra Leone) and the second group of people coming from countries with high-medium vulnerability (ND-GAIN <0.50; Cameroon, Ghana, Nigeria). The two groups, each composed of 50 subjects, were matched in gender, age and level of education. The knowledge / perception of climate change and the degree of social capital in the country of origin were assessed with a semi-structured interview. The psychological condition and the psychopathology were investigated through the clinical psychological interview and the PHQ-9 and GAD-7 tests. The interviews were conducted by psychologists with the help of the cultural mediator. The data collected allowed to explore the relationships between the

index of vulnerability to climate change, perception of change, loss of social capital and mental health in African migrants and to assess the differences between the two groups regarding the loss of social capital, psychological distress and psychopathology.

EFFECT OF GLOBAL CHANGES IN GENE POLYMORPHISMS ON HEALTH PROTECTION AT WORKPLACE

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The migration of populations of various ethnicity in host Countries affects not only social life and behavior but also human health. In particular, it is widely known that individual response to environmental and occupational exposures is strictly dependent on the genetic background characterizing different population subgroups. Besides the genetic contribution, other factors including life style, diet, habits and susceptibility to climate and temperature changes underline the importance of creating health risk assessment programs tailored to the actual scenario.

Gene polymorphisms, in particular single nucleotide substitution (SNPs) are the most common type of genetic variations in humans. These last are known as indicators of susceptibility in the exposure to xenobiotics and are of great relevance in public health. In the occupational setting, the association between exposure to xenobiotics and variable functionality of SNPs, involved in a specific metabolism, is extremely important to identify individual susceptibilities and improve health protection of workers. Here we used public databases to extract genotypic and allele frequencies of the most significant SNPs involved in oxidative stress metabolism and compared the results among three main ethnic populations (African, Asian, Europeans) to assess different levels of health risk within population subgroups. This work might represent a basis to design a predictive model useful in the identification of susceptible categories of workers without infringing the ethical, legal and social issue surrounding the use of genetic information.

CLIMATE CHANGE, MIGRATION AND CONSEQUENCES FOR HOST COUNTRIES

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Migration is a complex process where multiple causes intervene. Climate change events tend to create migratory movements towards different areas of the same country or towards neighbouring countries.

Models developed at regional and global level estimate tens of millions of people forced to move either for extreme climatic events or for "slower" processes, such as desertification, salinization of agricultural land and elevation of the sea level, even in the Mediterranean region. It is certainly possible that the effects of climate change on Sub-Saharan Africa subsistence economies will push an increasing number of people, not only to move beyond borders, but also to cross the sea to reach Europe. However, with the currently available data, it would be impossible to attribute exact numbers of migrants to climate change, intended as a driver for intercontinental migration. Beyond the forecasting exercise, however, it is clear that Italy has made an enormous effort in recent years to rescue, welcome and integrate migrants arriving on its shores into the national health system, facing huge public health challenges.

The constant influx of migrants requires strengthening of key areas, such as emergency preparedness and response, inter-ministerial coordination and implementation of the health information system. In this context, the recent migrant health guidelines issued by INMP, ISS, SIMM to be implemented at entry points and reception centres (hot-spots) are an important achievement. They provide health workers with useful tools for managing the health of migrants and their inclusion in the national health system, thus avoiding a waste of resources caused by the duplication of tests and unnecessary examinations, with an aggravation of migrants' suffering, besides offering an indirect protection of residents through the timely identification of infection outbreaks of particularly contagious diseases.

Further recommendations concern the planning of migratory flows, a greater investment in the reception system at a European level, a better management of health checks and increased scheduling capacity. Challenges lie in the need of national and international cooperation between different countries and of data availability or collection from scratch. However, in the perspective of a constant migratory phenomenon, it is imperative to provide us with increasingly refined tools to predict and be able to act in advance on events that otherwise may find us unprepared, hence contributing to a real or perceived sense of security risk. The WHO UNCC first Italian country profile on Climate and Health gave us the opportunity to research this topic.

Oral Session 15

Tools and Needs

Chairs

Denis Sarigiannis and Mark Scrimshaw

THE CLIMATE EXPOSOME: A NEW TOOL FOR ADDRESSING THE HEALTH IMPACTS OF CLIMATE CHANGE

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The current state of play in the climate policy debate internationally focuses on two key aspects: the relevance and proper extent of mitigation measures in order to avoid crossing the point of no return; and the necessity for adaptation measures considering the very different socio-economic state and dynamics across the globe. For this, assessing properly the health benefits of policy measures geared towards adapting to the incumbent climate change is a key requirement for accurate impact assessment of the measures envisaged. In this context, reliable quantification of direct and indirect impacts related to both climate change and to climate mitigation policies and measures is a sine qua non for further climate action. Lack of reliable data and comprehensive integrated assessment models hampers decision-making in government, industry and the financial sector.

The exposome concept accounts for the totality of exposures over an individual's life course, focusing inevitably on age windows of increased susceptibility. Rendering it operational requires development and adaptation of novel tools for exposure assessment (both external and internal). Making use of the exposome for comprehensive health risk assessment on the population scale requires development of advanced statistical and biochemical/pathology models based on a combination of environmental and high dimensional biological data, enhanced by machine learning and big data analytics. In addition, agent-based models help capture the changing socioeconomic dynamics that influence societal vulnerability to climate-induced health stress. Considering the change in environmental pressure and human exposure to health stressors linked to climate change would allow us to construct the climate exposome: namely, the exposome of human population subgroups considering the climate change aspects relevant to the ca. 80 years of the human life course.

In this talk, the methodological framework for unraveling the climate exposome is presented and examples demonstrating its applicability and usefulness in climate decision-making are given. The ultimate objective at this point is to start the scientific discussion on the new generation of integrated assessment models. This entails a model scheme based on enhanced data fusion and on the concept of ensemble modelling, supported by big data analytics for filling data gaps. This methodological framework and toolbox should support science-based decision-making in the climate action arena, a much-needed prerogative given the uncertainties that characterize the field.

HEAVY METALS DETECTION USING SCREEN PRINTED CARBON ELECTRODES

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Heavy metals are usually present in the environment and they can be of natural or anthropogenic origin. Most heavy metal compounds show ecotoxic and/or human toxic effects, depending on their availability, which is basically influenced by their binding form and the pH value. These toxic compounds can influence the functioning of cellular components in the living organisms by binding to specific sites and interfering with the natural biochemical processes [1-3]. Their toxic effects on organisms can be very different, for example copper has relatively low toxicity for humans, while it is highly toxic to algae and fish. Considering the severity of their effects on humans and other living organisms, the European project INCATCH H2020 aims to create innovative and cost effective tools to detect these metals in surface waters [4]. The study is focused on detection of dissolved heavy metals Cd, Cu and Pb, as they are known to possess higher mobility and bioavailability, having a stronger toxic impact on the water body and its biota [5,6].

The goal of this work is the development of a methodology for *in-situ* and simultaneous heavy metal detection in surface water, using Square Wave Anodic Stripping Voltammetry (SW-ASV) technique. A continuously flow system composed of filter, peristaltic pump, degasing system, mixing system, electrochemical cell and homemade screen-printed carbon sensors ha been developed for later integration into boat systems, allowing real time tracking of selected heavy metals. Disposable sensors are developed to withstand multiple SW-ASV measurements showing good stability. Electrolyte and SW-ASV parameters are optimized for the above mentioned heavy metals.

HOW CAN SMART TECHNOLOGIES ADDRESS MEASURES FOR HUMAN HEALTH PROTECTION WHEN EXTREME EVENTS HAPPEN? THE CHALLENGES OF INTCATCH PROJECT

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Global environmental change can cause negative effects on aquatic ecosystems that might affect human health. The spread of microbiological and chemical contaminants is one of the effects that extreme weather events could induce due to run-off from agricultural and zootechnical areas, the sewage and industrial discharges. This contamination can represent a serious risk to human health. European Directives define microbiological parameters, limit values and methods for the assessment of water quality to be used in the monitoring programmers, while no criteria or methodologies are available for monitoring in case of emergency. In recent years, several researches have been focused on the exploration of the potential of smart technologies to characterize the microbiological contaminants with the purpose to prevent human health risks.

Development and application of Novel, Integrated Tools for monitoring and managing Catchments (INTCATCH) is a HORIZON2020 project funded by the European Union, which aims to deliver new innovative tools for monitoring and managing of surface waterbodies in Europe. One of the goals of the project is to develop innovative smart technologies able to provide in real time some information about the microbiome of surface waters. The autonomous boats were equipped with a filtration system and connected with the portable genomic laboratory the latter developed by Personal Genomics[(i)]. The filtration system allows the concentration of water samples necessary for the metagenomics analysis, the microbiome study and further detection of both microbiological indicators and pathogens in different surface waterbodies. The validation of the mobile metagenomic laboratory will be performed using traditional microbiological analysis of raw water. A preliminary experiment to evaluate the performance of filtration system was conducted “in house” using raw water from the Tiber river. The molecular and microbiological results demonstrated that the proposed system allows an effective microorganisms detection. The use of smart technologies developed by the

project will help to promptly identify pollution sources and detect pathogens relevant for human health, providing rapid responses in the case of extreme weather events, such as flooding. In addition, the proposed methodology, which is able to link microbiome changes to the effects of chemical contaminants or other stressors, could provide an effective support for the investigative monitoring under the Water framework directive.

SUMMER WORK: PREVENTION OF THE EFFECTS OF HEAT WAVES (HW) ON THE HEALTH OF WORKERS

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The heat risk for the worker is a summer emergency, but it is not unpredictable. Information on possible health problems caused by heat is essential to prevent, to recognize and provide defence against them, without underestimating the risk. Some categories of workers are more exposed to high temperatures during the summer and its effects in relation to age, health and work conditions.

The increase in the average summer temperatures determines the meteorological conditions with very high temperatures above the normal values of the duration of days or weeks. This phenomenon is called "heat wave".

National Operating Plan Italy was one of the first European countries to activate from 2004, a program of interventions for the prediction and prevention of the effects of Health Heat Waves.

The EU is increasingly sensitive to the protection of workers' health from the risks associated with climate change and the Horizon 2020 Project "Integrated inter-sector framework to increase the thermal resilience of European workers in the context of global warming" (HEAT-SHIELD) aims at identifying innovative technological solutions, preventive measures and specific behavioral guidelines for workers and at protecting their health from risks associated with high temperatures.

The Consolidated Law on Health and Safety of Workers, D.Lgs. n. 81/2008, provides for the assessment of risks including those concerning "groups of workers exposed to particular risks" and therefore also the risk of damage from heat, with particular reference to the susceptible working population and in work sectors at risk.

The prevention measures for workers are specific and include organizational and structural measures (management of job and breaks alternation during the working day), training and information measures in order to prevent risks and manage stress-related emergencies associated with behavioral and feeding guidelines, according to the intensity of the work task, and the individual protection devices (DPI) used.

It is also important to inform, and empower not only healthcare providers, but also the workers about the health impacts of climate change. Furthermore, effective health communication concerning climate change between healthcare networking is needed.

The findings of this work, would be helpful in trying to introduce measures in public health prevention and propose health surveillance to workers to act locally on heat stress and occupational risk for those exposed to high temperatures.

Oral session 16

From the Environment Friendly Green to the Healthy Hospital

Chairs

Giovanni Capobianco and Luigi Bertinato

HOSPITALS AND HEALTHCARE SYSTEM AT DISASTER SITUATIONS; CHARACTERISTICS AND FUTURE SUGGESTIONS

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Nature disasters are expanding due to global warming, population explosion and overcrowding of cities. The basic assumption is that thousands of people will be harmed, injured, suffer from health disorders, remain homeless, infrastructure will be damaged or paralyzed, roads blocked for extended periods and more,

National and international organizations such as the UN and Red Cross; non-governmental, military and commercial organizations; and even private donors enlist to provide humanitarian and medical support, and to send supplies, shelters and temporary healthcare facilities to disaster zones. Yet, their mission is short and the major medical hazard that follows the natural disasters is a disruption of medical services and no ‘continuity of care’, including inability to get medications, to use respiratory equipment or dialysis, unavailability of healthcare facilities and doctors, and no medical response for "Day Two", especially for chronic disease patients, thus having prolonged deleterious effects on health and on population resilience .

The main aims of the presentation will be:

1. to review types and structures of healthcare facilities currently available for rescue and salvage sites, to compare their relative strengths and weakness, to suggest future directions based on innovative technologies, smart and automated solutions;
2. to present a framework for a healthcare system and urban preparedness for a healthcare moving from centralized to decentralized system, at the Point Of Care (POC), merged into city surroundings, to be activated upon disaster onset for the immediate welfares of city residents, with focus on special populations needs (elderly, special needs, chronic disease, children, pregnant women and lonely people).

COMMUNICATING THE RISK OF ADVERSE HEALTH OUTCOMES RELATED TO A CHANGING CLIMATE TO POLICY MAKERS AND THE PUBLIC IN MARYLAND, USA

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Introduction.An ever-increasing body of literature suggests frequency, duration, and intensity of extreme weather events are rising and will increase in response to a changing climate. The Maryland Department of Health (MDH) in collaboration with the University of Maryland (UMD) has created a series of risk profile assessments examining how extreme weather events are affecting the risk of a variety of health outcomes at a localized level in the State of Maryland. This work is critical to informing local climate adaptation policy and is a part of the U.S. Centers for Disease Control and Prevention (CDC) program termed the Climate Ready States and Cities Initiative (CRSCI) which implements the Building Resilience Against Climate Effects (BRACE) Framework.

Methods. For the risk profile assessements, we obtained records for all asthma and myocardial infarction hospititlizations, traffic related injuries, and laboratory culture-confirmed cases of *campylobacter and salmonella* infections for the State of Maryland from 2000 to 2012. We then linked these records with extreme heat and precipittion events in Maryland during that period, where extreme events were identified based on local climatology specific to each county derived from a 30-year baseline. Our epidemiogical analysis included a time-stratified case-crossover design to examine associations between exposure to extreme events and chronic health and injury outcomes, while bacterial infection risk was assessed using multivariate negative binomial regression.

Discussion. Our results indicate that extreme heat and precipitation events affected the risk of all health outcomes and that risk varied across geographic areas and demographic characteristics. UMD and MDH summarized the extensive amount of peer review literature we generated to be more digestible by the public in what was termed a Climate and Health Profile Report (CHPR), published in 2016. The Maryland Department of Health has been periodically asked by local (county-level) governments within the State of Maryland for technical assistance and support on how individuals could integrate climate and health considerations into their Hazard Mitigation Plans, which are local planning documents reviewed and approved by FEMA. In order to create information that could be utilized to engage with these local governments, a Climate and Health Fact Sheet was created for distribution to interested stakeholders that was based on the CHPR.

Our presentation will provide an overview of the BRACE program, risk profile assessments, and how ongoing engagement with local givernemtns is contributing towards climate adaptation policy.

SUSTAINABLE AND CLIMATE CHANGE RESILIENT HEALTH FACILITIES IN EUROPE: THE CHALLENGE

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This study has been carried out by a group of members of the Italian Society of Architecture and Engineering for Healthcare, SIAIS and has been originated by a request of the European part of the International Association of Hospital Engineering, IFHE, IFHE-EU to its members for scientific contributions on topics of relevant importance and actuality.

It aims to provide evidence-based support in the development of guidance and toolkits to hospital management, and in general to hospital staff, regarding the resilience to climate change-related risks and disasters faced by the health system, mostly hospitals and health facilities.

After an introduction defining the climate change –related natural disasters, that have been considered in the research, section 2. is dedicated to an overview of the recent major catastrophes of such a type, that have hit Europe, to recall the presence also in this continent of such events, with an increasing risk of their repetition and the forecast of their even greater intensity.

A worldwide research and analysis of methods and tools development for mitigation and disaster risk reduction, to which section 3 is dedicated, has brought in evidence the major contributions, which come from North America, with the work produced by The National Oceanic Atmospheric Administration and by the Department of Health and Human Services, DHHS of the United States, from Canada by a groups of scholars and by the "Canadian Coalition for Green Health Care". The documents analysed are different in their approach and goals. Their common characteristic is to give important guidelines, more than the technical toolkits, needed in operative interventions.

The research examines another relevant contribution: the comprehensive work done by the World Health Organisation, WHO, that has developed, during more than 20 years of activity, its own programme called "Safe Hospitals Initiative". WHO has produced a guidance for experts evaluators of hospitals conditions, which is, in effect, the most detailed list of what to check regarding the safety conditions of each hospital, wherever it is located in the world. This constitutes a relevant step toward a toolkit. Another contribution by WHO is the "Operational framework for building climate resilient health systems", relevant for its systemic approach to the issues health systems resilience.

The section 4 of the research examines the awareness and preparedness of EU institutions to face climate change disastrous effects, both in terms of adaptation measures and risk reduction, which require also a better understanding of the health system strategic role, of hospitals in first place.

In its conclusions the study stresses how much more work is needed in order to produce the necessary "metrics" for measuring resilience of healthcare infrastructures and indicators

for its improvement. Initiatives are suggested to obtain an effective strategic role of the hospitals and health systems in facing some of the challenges we have to face in our historic period: climate change.

REDUCTION OF INFLAMMATORY PARAMETERS IN ASTHMATIC CHILDREN IN AN ALPINE HOSPITAL FREE FROM ALLERGENS AND POLLUTANT.

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Asthma is a chronic inflammatory disease defined by clinical and functional characteristics. The main characteristics of asthma are reversible episodes of bronchial obstruction accompanied by symptoms such as dyspnea, coughing and wheezing. It is estimated that around 300 million people worldwide suffer from this disease and some epidemiological studies have shown an inverse relationship between prevalence and morbidity for asthma and altitude. The mountain climate is characterized by the reduction of aerosol allergens and pollutants, as well as by changes, such as the progressive reduction of barometric pressure and the parallel reduction of the inspiratory oxygen pressure, the reduction of air density, humidity and temperature, can influence respiratory function and bronchial reactivity in a variable way. Reducing air density helps to reduce respiratory resistance by increasing inspiratory and expiratory flows, and explains the improvement of some parameters of the forced expiration curve. Already at moderate altitudes, the asthmatic subjects find a favorable and "rehabilitative" environment able to condition the reduction of the airway inflammation, in particular in the allergic asthma to house dust mites. In respiratory rehabilitation programs at moderate levels, between 1,500 and 1,900 m. (asl), used at the Pio XII Institute of Misurina, which is the highest rehabilitation institute in Europe at 1,756 m. (asl), we try to reduce the inflammation of the airways in children with asthma, taking advantage of the environment without allergens and pollutants, and then improve the respiratory function with physical activity and rehabilitation programs that also use the other conditions, which influence breathing in altitude. In 39 children and adolescents, aged between 6 to 17 (29 M and 10 F) with asthma, who were at the Pio XII Institute of Misurina at 1756 m. asl. for a rehabilitation period more then 15 days, we have collected at the entrance (T0) and at the 15th day (T1), the measure of fractionated exhaled nitric oxide (FeNO), nasal cytological samples obtained with the nasal scrapping technique and induced sputum cytology used for the evaluation of the nasal and bronchial eosinophils, as inflammatory markers of the airways. This study shows a significant reduction in airway inflammation, expressed as the value of FeNo exhaled in ppb, and as a count of eosinophils both in the nasal cytological examination and in the induced sputum, after a 15-day rehabilitation period, at the Pio XII Institute of Misurina in an environment free of allergens and pollutants.

THE SHORT-TERM EFFECT OF POLLEN ON EMERGENCY ROOM VISITS IN ROME

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Introduction. Outdoor pollen grains have been associated with several adverse health outcomes Still, the effect of the different pollen families needs to be better characterized, and it is crucial to identify susceptible subgroups of population. The aim of this study is to investigate the short-term relationship between daily concentrations of pollen and emergency room (ER) visits in the municipality of Rome.

Methods. a daily time series analysis with Poisson regression was performed. Daily mean concentrations (grains/m^3) were calculated from three monitors for five different pollen families (Betulaceae, Graminaceae, Urticaceae, Cupressaceae/Taxaceae, Oleaceae) and daily counts of ER visits for respiratory causes were considered as the outcome of interest for the period 2006-2016. The DLNM approach was used in order to account for a delayed effect up to 4 days and to define the relationship with a non parametric approach. The effect was expressed as Relative Risk (RR) of ER visits for one standard deviation increase in the exposure. Age category (0-6, 7-19, 20-64, 65+) was considered as a potential effect modifier.

Results. 79,985 ER visits were observed during the study period. A positive effect of pollen was observed, with a RR=1.19 (CI95%: 1.13-1.25) per 162 grains/m^3 increase. The highest effect was observed in the youngest (especially in the age category 7-19, with a RR=1.28), while no significant effect was estimated in the elderly. When analysing pollen families separately, a positive relationship between exposure to all pollen families was observed, with the exception of Urticaceae. The highest effect was observed for Graminaceae, with a RR=1.32 (CI95%: 1.23-1.42) per 41 grains/m^3 increase. The same trend by age category was observed across different families.

Conclusions. Overall, these findings confirm adverse short-term health effects of pollen on ER admissions, especially in the youngest, and encourage an adequate monitoring of specific families of pollen, together with a careful management of the urban environment.

Oral session 17

Food security-Food Safety and Climate Change

Chairs

Tobin Robinson and Renata Clarke

CLIMATE CHANGE AND EMERGING RISKS FOR FOOD SAFETY

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According to the EFSA's Founding Regulation (EC) No 178/2002 (Article 34), EFSA is required to establish procedures for the screening and analysis of information with a view of identifying emerging risks in the fields within its mission. The aim is to anticipate or even prevent future food safety challenges and risk assessment needs (data, knowledge, methodologies) thus contributing to preparedness. The achievement of this aim in the long-term may be based on the identification of drivers.

They are natural or anthropogenic factors causing complex and interlinked changes that could put the European food system under severe stress. Because of them, food safety cannot be taken as granted in the future.

Climate change is one of the most relevant drivers of emerging risks. While a broad range of forward-looking studies focus on the impact of climate change on food security, future challenges for food safety and nutritional quality are usually not particularly studied.

The CLEFSA project (Climate Change and Emerging Risks for Food Safety) aims at developing, testing and piloting new methodologies for emerging risks identification and to produce a prioritised list of emerging issues/risks potentially affected by climate change.

In particular, it explores the possibility of a) using the specific driver, climate change, for long term anticipation of emerging risks, b) using horizon scanning and crowdsourcing to collect a broad range of signals, c) enlarging the knowledge network to experts for the specific driver from international EU and UN agencies, d) designing Multi-Criteria Decision Analysis tools for prioritisation purposes. A transparent and reproducible 5-step procedure has been designed. It consists of the following steps: definition of the identification criteria, identification of emerging issues, definition of the prioritisation criteria, design of the ranking system, ranking of the identified issues.

A survey has been launched to collect a broad range of issues, including weak signals, potentially affected by climate change. The scope of the survey has covered all EFSA's areas. More than 600 people responded, providing over 240 issues.

A CLEFSA discussion group has been created constituted by experts from international EU and UN institutions and coordinators of large EU projects involved with climate change. The task of this group is to design the Multi-Criteria Decision Analysis tool for prioritization purposes and to rank the identified issues.

A report will be produced and published at the end of the project (2020).

CLIMATE CHANGES AND "ONE HEALTH": EXAMPLES FROM THE SAFETY ASSESSMENT OF PRIMARY PRODUCTION

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"One Health" (OH) is the conceptual and operational framework linking the environment and ecosystems, the food-producing organisms and human health. It is apparent that climate changes should be considered in OH, whereas it may be more difficult to characterize its impact. Indeed, climate changes may influence plant protection and animal feeds as major components supporting the safe primary production of foods. Some interesting insights can be derived from the activities of the European Food Safety Authority (EFSA), namely the Panels dealing with pesticides (PPR) or with animal feeds (FEEDAP).

Climate changes may have a broad impact on the risk assessment of pesticides, including the possible secondary exposure of livestock and food chains. Indeed, the climate components influence the whole combination of abiotic, biotic and agronomic parameters that, together with toxicological characteristics of the pesticides, allow building-up realistic worst-case scenarios. Climate modulates the abiotic factors involved in the formation of pesticide metabolites present as residues in edible plants: the characterization of toxicologically relevant residues, indeed, is a major issue in the dietary risk assessment of pesticides. Accordingly, the determination of the metabolites of specific pesticides in the target vegetables should take into account changes in the relevant abiotic factors.

Coming to animal feeds, mycotoxins are well-known contaminants related to climate changes; in some cases (Aflatoxin M1) they may pose serious concerns for consumer safety. Mycotoxin binders in feedstuffs are one strategy to minimize the exposure of food-producing animals; however, the assessments of such additives by EFSA highlighted several problems, including limited proofs of efficacy. Feeds are also a source of substances, (metals, coccidiostats) that may present risks for the ecosystems, due to their toxicity and presence in animal excreta, and even lead to secondary contamination of food chains,. By influencing, e.g., the dynamics of run-off waters, climate changes may increase such environmental risks. For instance, with a OH approach EFSA assessed the possibility to reduce the zinc and copper output from feeds without affecting the health of farm animals. More generally , climate changes may cause a shortage of conventional feed materials and call for new and more sustainable ingredients, such as insects: in the meanwhile, hazards that may be introduced by novel feeds, and their processing, should be characterized. By stimulating the capacity to foresee and cope with new scenarios, climate changes highlight the importance of resilience in the assessment and management of risks for food chains.

PRESENCE OF HARMFUL DINOPHYSIS SPECIES AND OKADAIC ACID TOXICITY IN SHELLFISH BREEDED IN SARDINIA (ITALY)

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The focus of our paper was to provide information about the occurrence and abundance of several microalgae of the Dinophysis genus (including D. acuminata, D. acuta, D. sacculus, D. rotundata). They can produce biotoxins, belonging to Okadaic acid group (OA), that can be accumulated in the bivalve molluscs edible tissue making them hazardous to consumer health. They are responsible for Diarrheic shellfish poisoning (DSP).

From 2015 to 2017, water and shellfish samples were collected in Sardinia (Italy). Dinophisis cell were counted according to Utermohl's technique (UNI EN 15204:2006) from water samples, while mass spectrometry (AESAN 2015) was used to identify lipophilic toxins in molluscs. During the three year study, a total of 3586 water samples (1715 in 2015, 1040 in 2016 and 831 in 2017) and 3686 shellfish samples (1365 in 2015, 1196 in 2016 and 1125 in 2017) were examinated.

A total of 50 non compliant samples (23both in 2015 and 2016 and 4 in 2017) of edible molluscs were detected. The non compliance concerned their OA levels above legal limit (160 µg OA eq/kg in part edible). Among toxic dinoflagellates, D. acuminata and D. sacculus were the species mostly found during DSP events. Toxicity has been mainly observed in the Mytulus galloprovincialis. The OA toxin group was present only between February to April in 2015, it was recurrent in 2016 from January to July and only between February and March in 2017.

As reported in literature, the most dangerous periods for toxic events are spring and early summer. In Sardinia, the mollusc data analysis showed toxin presence also in the winter season (December, January and February). The interaction between toxic microalgae and biotoxin accumulation in bivalve molluscs is extremely variable, depending on different parameters that must be evaluated simultaneously, such as environmental parameters, seasonality, different species of bivalve breeded molluscs that may have different filter ability, and the presence and abundance of microalgae placed in different geographic areas. Statistical analysis considering three years data are required to better understand eventually trend of interaction microalgae - biotoxin accumulation in mollusc tissues. The knowledge of this interaction is essential to have an "early warning" as a prevention tool to protect human health.

IDENTIFYING AND PREVENTING CLIMATE CHANGE THREATS ADVERSELY AFFECTING SEAFOOD PRODUCTION, NUTRITIONAL VALUE AND SAFETY

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Several hundred million people depend on seafood as the main source of protein, income or family stability. The oceans and estuaries supporting fisheries and aquaculture are projected to be significantly impacted as a result of climate change (CC), which may have severe consequences encompassing both food security and food safety. Warming of the upper ocean, acceleration of the water cycle, increased stratification of the ocean, frequency of extreme events (e.g. hurricanes), sea-level rise, and ocean acidification are some of the processes that are of growing concern.

Besides being a source of energy and proteins with high biological value, seafood contributes importantly to the intake of essential nutrients - such as iodine, selenium, calcium, and vitamins A, D and B12 - and provides n-3 LCPUFA with well-established health benefits on children's neurodevelopment as well as on cardiovascular diseases in adults. In order to achieve such benefits of seafood consumption, up to 4 fish servings per week are recommended by EFSA. On the other hand, depending on the type of fish consumed, the geographical origin and other factors, seafood may be a source of exposure to methylmercury, dioxins and DL-PCBs, and other persistent organic pollutants.

Risk-to-benefit assessment has been extensively applied to seafood consumption in order to envisage actions ensuring that the health benefits are achieved whereas the health risks are minimized, e.g., use of aquaculture feeds with vegetable ingredients reducing the burden of bioaccumulating pollutants or risk communication on the consumption of fish species with a high mercury content during pregnancy.

Seafood biology, including the composition of fish and shellfish tissues and the accumulation of pollutants, is strongly influenced by the quality of aquatic environments. As a consequence, the delicate balance of benefits and risks associated to seafood consumption may be disrupted by the projected adverse effects of CC on fisheries and aquaculture. Increased frequency of harmful algal blooms events, new biological hazards (including zoonotic agents) and changes in the nutrient profile and burden of toxic pollutants may result as a consequence of CC. Increasing attention is being given to these issues in the EU long term strategy to support sustainable growth in the marine and maritime sectors, and worldwide. The ongoing SEAFOODTOMORROW EU project, aiming at validating and optimizing eco-innovative, sustainable solutions for nutritious and safe marine and aquaculture-derived food products, provides a pertinent example. Predictive scenarios, definition of protection goals and effective risk reduction approaches are required to cope with the CC prospective threats to the world’s seafood supply in the next decades.

CYANOTOXINS AND CLIMATE CHANGE: ANY CONSEQUENCES FOR FOOD SAFETY?

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Cyanobacteria (CB), mostly aquatic photosynthetic prokaryotes, can produce potent toxins (CTX) and their abundance and diffusion is increasing, due to a combination of eutrophication and climate change. Since humans can be exposed to CTX via ingestion of contaminated water, consumption of contaminated food and food supplements, as well as inhalation and contact, EFSA (European Food Safety Agency) launched a project to assess whether CB represent really an emergent risk. The project, based on an extensive literature search on the occurrence of different cyanotoxins in food matrices, the analytical methods for their detection and their toxicological profile, was conducted in 2016. Out of more than 7,000 publications, only about 2% has been considered scientifically sound and screened for inclusion in a database, for occurrence, methods, toxicity, environmental factors and mixture of toxins. The data-base was not considered robust enough to either confirm or reject the hypothesis of an emerging risk from cyanobacteria, even if the few data on the combination between occurrence and consumption suggest that when present, CTX in some seafood can represent a risk for consumers, considering the health based values derived with a high degree of uncertainty, due to the scant availability of appropriate toxicity studies.

The most important research gaps were a) the lack of validated analytical methods in complex matrices other than water, b) very scant data on occurrence in the food matrices (included food supplements), c) toxicological studies on CTX different from microcystin-LR (one of hundreds CTX) and d) toxicological studies addressing a chronic exposure to toxins (and not to uncharacterized extracts), through the adequate exposure route (oral and not i.p.).

At present, those gaps have not been filled: a recent update of the literature search for cyanotoxins in food and/or fish resulted in only 10 papers reporting data on occurrence in different organisms, with different and hardly comparable analytical methods. However, the expanding geographical distribution of CTX, highlighted also by the continuously growing number of studies, and their occurrence in animals of the higher trophic level like riparian birds, suggest that the exposure of humans to CTX is expected to increase and that site specific risk assessments need to be carried out.

ARE CIGUATOXIN-LIKE PRODUCERS GAMBIERDISCUS SPP. AND FUKUYOA SPP. SPREADING IN THE MEDITERRANEAN?

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Ciguatera is a seafood poisoning that results from the ingestion of toxic fish containing ciguatoxins, which are produced by marine microalgae of the genera Gambierdiscus and Fukuyoa. Although ciguatera has not been reported in the Mediterranean, Gambierdiscus spp. have been described in the eastern and the western Mediterranean (Crete, Cyprus, Majorca and Minorca). We provide herein new results on the identification and distribution of these genera in the Mediterranean within the frame of the EUROCIGUA project. G. australes was recently reported in the Mediterreanean Sea (Tudó et al. HAN59) after analysis of 17 strains of Gambierdiscus. Here we complete the evaluation of Gambierdiscus spp. with 30 additional strains of Majorca and Minorca Islands. Gambierdiscus spp. were present in 8 out of 10 sampling stations located in Majorca, and 8 out of 9 stations in Menorca. Gambierdiscus spp. were not found in Formentera. In all of sampling points where Gambierdiscus were recorded, these genera were more abundant in macroalgal samples than in scratches of substrates.The presence of Gambierdiscus silvae and G. cf. belizeanus was confirmed in Crete, while a third taxon, morphologically and genetically identical to Gambierdiscus sp. (under description) initially identified in Crete was again detected. This is the first time that Gambierdiscus silvae and G. cf. belizeanus are found in the Mediterranean Sea. The detection of the above 3 taxa along with G. carolinianus increases the number of Gambierdiscus species in Crete island to four. The genus Fukuyoa was detected in Cyprus in samplings carried out in 2016 and also in 2017.We contribute here to a better understanding of the spatial and temporal distribution of Gambierdiscus and Fukuyoa in the Mediterranean, two genera that may be spreading and potentially representing a risk for seafood safety. Identification of Fukuyoa in the Eastern Mediterranean expands the spatial area of the genus in the Mediterranean, as Fukuyoa was previously restricted to the island of Formentera (Western Mediterranean). The single-cell DNA approach seems to be a good strategy for species identification of the genus Gambierdiscus. Evaluation of the toxicity of these strains will be required to assess the potential risk of ciguatera in the Mediterranean. The warming trends observed in the NW Mediterranean Sea may indicate that climate change may influence the distribution of Gambierdiscus and Fukuyoa species in the Mediterranean in the future.

Oral session 18

Stakeholders Round Table

Chairs

Rosaria Iardino and Aldo di Benedetto

HEALTH AND AND CLIMATE CHANGE - STAKEHOLDERS POINT OF VIEW, POTENTIAL SYNERGIES

Rosaria Iardino (a), Aldo Di Benedetto(b), Tonino Sofia(c), Luisa Brogonzoli(a), Umberto Di Maria (a), Beatrice Nicotera (a), Gianna Chiocchio (a), Laura Mancini (d)
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On October 9th 2018 on the initiative of Professor Walter Ricciardi, President of the Istituto Superiore di Sanità (Italian National Institute of Health), the Workshop: Salute e cambiamenti climatici - Stakeholder a confronto, was held. The Workshop was organized by the Istituto Superiore di Sanità together with the Italian Ministry of Health and the Bridge Foundation as a sort of pre-meeting/debate among stakeholders to share ideas/vision/policies/planning on the subject of Health and Climate Change in preparation for the First International Scientific Symposium which will take place at the Institute's premises in Rome on December 3rd to 5th, 2018. Results and outputs of the Workshop will be presented at the Symposium in the session devoted to Stakeholders.

The discussion among participants focussed on how to tackle potential climate change related health risks and prioritised issues will be dealt with in the round table on December 5th. The October Workshop featured plenary sessions and working groups and hosted 32 participants who all took the opportunity to speak.

Overall 20 institutions were represented. These institutions/associations are involved in different sectors and are located across the country. The following guideline-question was proposed for discussion:

How can stakeholders synergically contribute to the mitigation and prevention of the effects of climate change on health? and specifically:

Which synergy?

Which priority actions need to be taken to raise collective awareness?

Are there any best practices (training/ awareness raising/ comunication).

to be shared?

policy development/support.

The following actions were suggested.

Supporting the development and spread of policies.

Improving stakeholders' understanding of the problems and challenges related to adaptation Supporting the establishment of networks and the provision of information for specific areas and problems of adaptation.

Empowering and supporting operators in implementing adaptation processes.

The priority topic to be discussed at the round table is: stakeholders recommendations to bridge the gap between scientific research/data, the public and policy makers.

This step will end with the symposium and the drafting of the Rome Charter on Health and Climate Change. The idea, however, is to follow up the results of the Stakeholder session by working to establish a permanent stakeholder network which shall meet once a year (October 9th) to share objectives and information. A sort of “white book” will be drafted of national stakeholders, a flexible tool able to include further contributions as the network strengthens and grows. The network as a strong asset, wealthy in ideas and actions, to face climate change and to protect health.

Plenary Session

Chair
Luca Rosi

THINKING OUTSIDE THE BOX: TRANSLATING SCIENCE INTO INNOVATION FOR POLICY, ADVOCACY, AND BUSINESS

Timothy Bouley
Former World Bank, Washinghton DC, USA

This session will touch upon many of the themes discussed throughout the conference, highlighting diverse solutions across area of impact. Innovation is possible at any level or scale. Scientists, policy makers, philanthropists, entrepreneurs, and civil society advocates each have roles to play in this emerging landscape. Examples of innovation, success, and failure will be presented toward illuminating new pathways for engagement on climate change and health.

COMMUNICATION OF ENVIRONMENTAL RISKS

Alberto Contri
Fondazione Pubblicità Progresso, Milan Italy

There is still a debate over climate change although evidence is becoming increasingly visible and tragic.

For many years, mainly thanks to environmental associations and governmental organizations, awareness campaigns have been organized, sometimes with a view to educating the public, sometimes even with terroristic connotations.

Gradually, there has been a shift in public opinion towards environmentally friendly and energy saving behaviours.

This new consumer attitude towards environmental issues has prompted many companies to focus on and include them in their commercial advertisements. This has led to a new kind of Corporate Social Responsibility that, also in consumption, promotes behaviours that are less harmful to the environment and thus able to slow the pace of climate change.

MIGRATION AND CLIMATE CHANGE

Isabella Annesi-Maesano
Epidemiology of Allergic and Respiratory Diseases Department, IPLESP, INSERM and Sorbonne Université, Paris, France

Migrants represent a heterogeneous population comprising workers, students, undocumented individuals, and refugees. Migration is fuelled by seeking better opportunities in wealthier countries or escaping conflict, persecution, or the consequences of climate change (desertification, famine, flooding, extreme weather, natural disasters).

The numbers of migrants, and countries affected by migration, are increasing in most parts of the world. According to figures released by United Nations Departments of Economics and Social Affairs in 2016 approximately 1 billion people (more than 14% of the world's population) were migrants: 250 million international migrants and 763 million internal migrants. About 65 million migrants worldwide were forcibly displaced from their homes; of these, 20 million people were considered refugees. In 2017, 258 million people lived in a country other than their country of birth.

Whereas considerable attention is given to the geopolitical consequences of migration, less is known about its impact on migrants' health or the health care systems.

Environmental and occupational exposures are major risk factors for the development and progression of health disorders in migrants. We focus here the on the impact of climate change on migrants' respiratory health.

Effect of climate change is greater in migrants due to frailty, namely susceptibility and vulnerability, associated with their status (1,2). Global warming and related climate changes may particularly impact migrants' respiratory health due to coexisting exposure to environmental hazards or inadequate access to health care (3) directly through temperature, humidity, and extreme climate events (such as storms, floods, wildfires, droughts) or indirectly by increasing air pollution, pollens, molds, and by changing the habitat (promotion of vectors for transmission of infectious diseases) (4). Migrants are also extremely exposed to climate change hazards through their occupations.

It is projected that over the coming decades, due to climate change the number of people escaping their country of residence will likely increase.

Thus, research on this public health threat is needed.

Closing Plenary Session

Chair

Walter Ricciardi

CHEMICALS AND CLIMATE CHANGE: CLOSING THE GAP BETWEEN SCIENCE AND POLICY

Ake Bergman
Swedish Toxicology Sciences Research Center, Swetox, Södertälje and Örebro University, Örebro, Sweden

The environmental conditions for life on earth together with the evolution of all living matters have created a diversity of functional biota beyond imagination. However, humanity has the possibility for changing the prerequisites for life and has done so. We live longer, have cures for illnesses, advanced food production tools to feed more, produce energy for heating/cooling, transportation and production, just to mention a few advancements of human creativity. The development is driven by curiosity and desire to improve life of the human race, i.e. sciences in a range of areas. Different cultures have contributed to this development over thousands of years. The science has at a higher pace than ever before been the driver of our present society. However, the financial profits of the development became at one point and in many ways the strongest reason for innovation and development. This has created the global changes of climate, deaths and diseases among humans and wildlife being affected by anthropogenic chemicals.

A sustainable development for humans and the environment/wildlife and plants requires much closer cooperation between science and policy. The industrial developments, innovations and production, business in general must address real human needs, consumption to promote a majority of the UN sustainable developmental goals. The need for clean energy, minimizing carbon dioxide and greenhouse gas emissions is one side, hazardous chemicals today causing millions of deaths is the other. Undesirable pollution, recycling of anthropogenic chemicals into new materials and goods have to be regulated, further infrastructure developments must be based on insightful decisions and improved regulations discharges leading to contaminated air, water, food and land, likewise.

The challenges ahead require joint efforts from science and society in climate change area and on hazardous man-made chemicals. This is what can be acted on, not natural processes and chemicals. Regulations requirements need to go beyond any silo borders independent of academia, private, governmental or intergovernmental sectors.

Poster session

December, 3

ENDOCRINE DISRUPTORS AS THREAT TO ECOSYSTEMS FUNCTION: A GENOTOXICOLOGICAL APPROACH

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The Endocrine Disruptor Chemicals (EDCs) are compounds of not steroid origin which mimic estrogens and bind to estrogen receptors, interfering with the endocrine system. Many commercial chemical agents, including pesticides, like polychlorinated biphenyls and alkylphenols, or personal care products, such as shampoos, soaps, toothpastes, sunscreens and lotions, showed estrogenic effects on animals. Most of these compounds pass into the environment through industrial discharges, and, consequently, can be found in the atmosphere, in the soil, in the water cycle and can potentially enter the food chain. Exposure occurs through drinking contaminated water, breathing contaminated air, ingesting food, or contacting contaminated soil and people who work with pesticides, fungicides, and industrial chemicals are at particularly high risk for developing reproductive or endocrine abnormalities.

In the last decade, the number of researches about the dangerous effects of these compounds has increased. However, most of these studies showed an approach, both *in vitro* and *in vivo*, based on toxicologically relevant concentrations, whereas few data were reported about the effects of small doses of these compounds. *Vice versa*, in the present paper, we show results obtained by our group for some ECDs (Glyphosate, Chlorothalonil, BP-A and BP-3) tested at low concentrations, starting from the Acceptable/Tolerable Daily Intake (ADI/TDI) values adopted by Council of Europe, US EPA and FAO (0.50 µg/mL, 0.02 µg/mL, 0.05 µg/mL and 0.10 µg/mL for Glyphosate, Cholothalonil, BP-A and BP-3, respectively).

We evaluated the genotoxicity of these compounds by Chromosomal Aberrations (CAs) and Micronuclei (MNi) assays that allow the evaluation of the clastogenic and/or aneugenic properties of single compounds or mixtures of them. In particular, the CAs assay allows the detection of cells carrying unstable aberrations (chromosome and chromatid breaks, deletions, fragments and rings) whereas MNi represent acentric chromosomal fragments or whole chromosomes left behind during mitotic cell division and that appear in the cytoplasm of interphase cells as small additional nuclei.

As general result, we observed a significant increase of CAs and MNi frequencies at all tested concentrations, including the ADI/TDI concentration values and, in some cases, also their submultiples, indicating possible clastogenic and aneugenic effects of these compounds also at low concentrations. Although the limitations typical of *in vitro* studies, it is our opinion that the increased cytogenetic damage observed by our group at ECDs concentrations equal and lower than the established ADI/TDI values requires further investigations in order to establish the effective genotoxicity threshold of these extensively used compounds.

TEMPERATURE INCREASE DUE TO CLIMATE CHANGE: ANOTHER CONCERN FOR SKIN CANCER IN ADDITION TO SOLAR RADIATION

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Climate change determines a progressive increase of mean temperatures worldwide and an intensification of extreme meteorological events, including a higher frequency, intensity and duration of heatwaves. Exposure to high temperatures in living and working environments is associated with acute health outcomes and non-health consequences.

However, the potential impact of heat on cancer risk is still questioned. In this regard, skin cancer is of special interest, as skin temperature is largely affected by ambient temperature and displays physiological oscillations not occurring in deep tissues. The only indication of skin cancer in association with prolonged exposure to heat is a higher risk of squamous cell carcinoma in skin areas affected by *erythema ab igne*, a dermatosis occurring when skin is chronically exposed to localized heating (for instance in the case of metal and glass manufacturing).

Some experimental evidence suggests that the skin cancer occurrence in rodents pretreated with skin carcinogens increases with increasing ambient temperature. On the other hand, exposure to heat may generate reactive oxygen species (ROS) and induces the synthesis of heat shock proteins into the cells, the last ones able to mediate an adaptive response of the cells to heat, including a higher resistance to apoptosis.

Epidemiological studies showed the carcinogenic effect of solar radiation (SR) for both non-melanoma and melanoma skin cancer, whose rates have dramatically increased in the last decades worldwide. The carcinogenic action is primarily attributed to UVB and UVA components of SR. However, a growing body of experimental evidence indicates that near infrared radiation (IRA, which represents about 30% of the solar radiation), beside its pure thermal effect may act photochemically, disrupting mitochondrial activity, generating ROS and, finally, interfering with molecular pathways involved in cell signaling. IRA is now suspected to contribute to skin photoageing and to have a co-carcinogenic action.

Despite the lack of epidemiological evidence regarding ambient temperature and solar IRA in skin cancer induction, it is reasonable to presume that the combined exposure to a higher thermal stress and solar radiation, especially for prolonged periods, may lead to a further increase in skin cancer risk, representing a concern for people spending outdoor a significant proportion of the daily time, like outdoor workers. In this view, it is imperative to pay more attention to implement all preventive and protective measures and strategies, as enforced by the existing regulation on workers' health and safety.

CLIMATE CHANGE EFFECTS ON THE ENVIRONMENTAL FATE OF PHARMACEUTICALS: NEED FOR A MONITORING PLAN IN ITALIAN AQUATIC ECOSYSTEMS

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Climate changes can have relevant effects on the fate and pathways of the chemical contaminants in the environment through different mechanisms: for example the increase of the temperature in seawater can enhance the bioaccumulation of some hazardous substances or the extreme weather related events such as flash-floods or water scarcity can increase the level of contaminants in river ecosystems. Among the contaminants discharged and released in the environment pharmaceuticals are one of the most relevant groups taking into account the number of compounds, their transformation products, the persistence and the worldwide increasing diffusion; on the other side pharmaceuticals is a group of compounds that is scarcely regulated in the legislation, for example in the European legislation for the protection of water resources (EU Water Framework Directive) the pharmaceuticals included are very few and they are not currently included in the European priority list of substances. Also the rules and obligations foreseen for the environmental risk assessment of pharmaceuticals including antibiotics should be updated. The sources of pharmaceuticals in the aquatic environment are several (urban wastewaters, aquaculture and zootechnical activities, poultries, hospital effluents, diffuse pollution, etc). In Italy, that is one of the European countries with the greater use of pharmaceuticals, flooding and rainfall enhanced by climate changes can increase the amount of pharmaceuticals in the aquatic environment via runoff and wastewater discharge. Furthermore the effects of climate changes could enhance some specific diseases and the use of pharmaceuticals can change progressively. For this reason it is necessary to propose a monitoring strategy in Italy that must be based on a selection of pharmaceuticals more used, on their physico-chemical properties and should consider also the use of innovative methods for the detection of the effects. The monitoring data collected in representative stations of aquatic ecosystems could support the implementation of an overall strategy for the assessment and management of the pharmaceuticals in the environment and can support also the protection of human health in a new scenario caused by climate changes.

DERMOTOXICITY OF PALYTOXINS, AN EMERGING PROBLEM FOR HUMAN HEALTH

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Palytoxin (PLTX) and its analogues are non-proteinaceous marine toxins identified in *Palythoa* corals, *Ostreopsis* dinoflagellates and *Trichodesmium* cyanobacteria. In the Mediterranean area, increase of sea temperature and eutrophication due to climate changes contribute to the optimal environmental conditions for the proliferation of some dinoflagellates, including potentially harmful species such as *Ostreopsis* cf. *ovata*. As a consequence, massive *Ostreopsis* blooms and, consequently, the presence of PLTXs have been frequently reported in the last decades along Mediterranean coasts. In these areas, adverse effects in humans ascribed to PLTXs are mainly associated with inhalation of marine aerosol and cutaneous exposure. In particular, cutaneous contact to seawater and/or marine organisms contaminated by PLTXs has been associated with skin irritation and inflammatory reactions, suggesting the skin as one of the targets of these toxins. However, dermotoxicity of PLTX is still a rather underestimated effect, even though it seems to be an increasing sanitary problem.

To elucidate the effects of PLTXs at the cutaneous level, an in depth *in vitro* study has been carried out using the HaCaT cell line, spontaneously immortalized non-tumor human skin keratinocytes. Using a panel of different experimental models, the mechanism of PLTX cutaneous toxicity, from the toxin binding to HaCaT cells up to cell death, has been elucidated. In addition, the pro-inflammatory effects at skin level have been studied.

On the whole, this contribution will summarize the results obtained over the last 10 years allowing the elucidation of PLTX effects at the cutaneous level.

OCCUPATIONAL HEALTH: AN ASSESSMENT OF GLOBAL CLIMATE CHANGE (GCC) IMPACTS ON CHEMICAL RISK EXPOSURE

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According to projections, Global Climate Change (GCC) will increase extreme climate events in frequency and severity, with associated shift of the mean temperature or an increase of temperature variability or both. Climate change is expected to influence the nature of chemicals in the environment and their fate and transport and, then, may potentially affect also occupational exposure. This paper investigates the possible influence of GCC on exposure to chemicals in the workplace, by pointing out the plausible changings in the use of chemical substances in terms of higher amounts, doses and types of products as well as how climate change might influence the toxicokinetics of chemical absorption, distribution, metabolism, and excretion. Heat weaves and higher temperatures in urban areas and likely associated increases in tropospheric ozone concentrations can contribute to or exacerbate cardiovascular and pulmonary diseases, especially as far as for off-site workers. Global warming, influencing the distribution and proliferation of weeds, the impact of already present pathogens and the introduction of new infesting species, could cause a changed use of pesticides and consequently influence the human exposure to them during agricultural activities.

Warm weather conditions also affect the perspiration rate of the human body influencing the dermal absorption ability and increasing the discomfort in using Personal Protective Equipment (PPE). Climate factors such as high humidity and temperature, in fact, make the use of PPE very uncomfortable, especially respirators, facemasks and overalls and can aggravate the effect of high temperature, increasing heat and/or decreasing the efficiency of sweat evaporation. Furthermore, exposure to chemicals can affect the thermoregulatory mechanisms in humans, thereby reducing workers' capacity to adapt to heat stress. Finally, temperature directly affects breathing and consequently the inhalation rate of airborne chemical substances. Based on these considerations, it is clear that further studies on the possible impact of the GCC on health in the workplace are necessary, with the aim of preparing prevention policies to address future hazards that could be different from those of today.

A POSSIBLE RELATIONSHIP BETWEEN AIR POLLUTION AND INCREASED BASELINE FREQUENCY OF MICRONUCLEI IN SUBJECTS LIVING IN TURIN (NORTH-ITALY)

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Background. Epidemiologic studies have shown a correlation between chronic exposure to moderate or high pollution levels and increased risk of cancer, especially lung cancer. The urban population can be exposed to a variety of environmental pollutants that include different chemical and physical agents, all of which can influence the genomic instability. In this scenario, biomarker-based population studies may serve as complementary tools providing a better understanding of the relative contribution of ambient atmospheric pollution to the overall genotoxic burden suffered by city dwellers.

Aims. We used the Micronuclei (MNi) assay to evaluate the baseline genome damage in binucleated peripheral blood lymphocytes selected from subjects belonging to the general population of Turin.

Study Area. Turin, North-Western Italy, is located in the Po river valley, an area where air exchanges are limited by the surrounding mountains, dominant winds are weak, and air pollutants can accumulate easily. For these reasons Turin is one of the most polluted European cities in terms of Particulate Matter (PM) and ozone.

Methods: The study population included 150 blood donors randomly sampled. Selected individuals were subjects without any known exposure to specific xenobiotics, except those of the routine household and traffic. MNi, Nucleopalsmic Bridges (NPBs), Nuclear Buds (NBUDs) and Cytokinesis-Block Proliferation Index (CBPI) were scored in 2000 binucleated lymphocytes per subject. The frequency of MNi has been associated with age and sex in order to investigate the possible correlation between this cytogenetic marker and the above mentioned factors.

Results. The MNi, NPBs, NBUDs and CBPI average frequencies were 7.987±5.177, 5.427±2.510, 5.533±3.125, and 1.663±0.125 respectively, whereas the average of MNi, NPBs and NBUDs per cell (%) were 0.399±0.259, 0.271±0.125, 0.227±0.156, respectively. A significant correlation was found between the frequency of MNi and age (P<0.001), whereas the sex do not seem to influence the level of the genomic damage.

Discussion. The frequency of MNi observed in our sample was one of the highest reported in literature among European populations, indicating that some local environmental factors may be involved in determining the high frequency of the observed cytogenetic damage. Turin is a city with a high traffic density and consequent high levels of atmospheric genotoxic substances, such as PM_{10}, benzene, toluene, and xylene. Moreover a large automotive industrial complex is located in the inner suburbs of the city, as well as other smaller industrial installations that, with their discharge products, considerably contribute to air pollution.

SHORT-TERM EFFECTS OF AMBIENT PARTICULATE MATTER ON MORTALITY AND HOSPITAL ADMISSIONS IN ITALY DURING 2006-2015. RESULTS OF THE BEEP PROJECT

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Introduction. The health effects of ambient Particulate Matter (PM) are consolidated. However, the available evidence refers to urban areas. The BEEP project: "Big Data in Environmental and Occupational Epidemiology" aims to provide new evidence on the effects of PM and extreme temperatures on a national scale.

Objective. To estimate the short-term effect of PM_{10} and $PM_{2.5}$ on natural mortality (in 5 regions) and cardiovascular and respiratory admissions in Italy during 2006-2015; to evaluate possible effect modification by sex, age and degree of urbanization of the municipality.

Methods. Daily mean concentrations of PM_{10} and $PM_{2.5}$ were estimated in every km^2 of Italy using a "machine learning" approach on satellite data and land use variables. Daily mortality data were obtained for 5 Regions (Puglia, Sicily, Piedmont, Lazio and Emilia Romagna), while hospitalization data were collected for all Italian municipalities. The association between daily PM and mortality / hospitalization was assessed with a region-specific Poisson time-series analysis adjusted for temporal trends, temperature and influenza epidemics. Association estimates were also produced by age (<64; 65-74;> 75 years), sex and degree of urbanization of the municipality. The results are expressed as percent increases in risk (IR%), and 95% confidence intervals (95% CI), for PM increases equal to the Interquartile Range (IQR).

Results. During 2006-2015 there were 2,197,069 deaths due to natural causes in the 5 Regions and 7,717,348 and 4,154,893 urgent (unscheduled) admissions for cardiovascular and respiratory diseases throughout Italy. The effect estimate of PM_{10} on natural mortality was equal to 1.78% (95% CI: 0.55, 3.04%) for increments of 10.4

μg/m^3, and 2.45% (0.43, 4.50%) for increments of 7.8 μg/m^3 in $PM_{2.5}$. PM_{10} increments of 9.2 μg/m^3 and $PM_{2.5}$ increments of 7.2 μg/m^3 respectively were associated to IR% of 0.28% (-0.08, 0.64%) and 0.29% (-0.13, 0.72%) for cardiovascular hospitalizations and 2.14% (1.59, 2.69%) and 2.63% (1.90, 3.35%) for respiratory admissions. We observed higher effects of PM on mortality in the older age group (>75 years), and on respiratory admissions in males. Finally, the associations were also significant in the municipalities of medium and low degrees of urbanization.

Conclusions. The availability of environmental and health data for the whole of Italy has allowed to estimate the association between daily concentrations of PM_{10} and $PM_{2.5}$ and health outcomes on a national scale. In conclusion, ambient air pollution is an important risk factor not only in urban areas but also in settings with a lower population density.

**On behalf of the BEEP Collaborative Group*

THE IMPACT OF CLIMATE CHANGE ON PERSISTENT ORGANIC POLLUTANTS

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Persistent Organic Pollutants (POPs) are chemical substances that have toxic properties, persist in the environment, bioaccumulate through the food webs, are transported far from their place of release through air masses, water currents, and migratory species within and across international boundaries.

The Stockholm Convention on POPs (2001) is an international treaty aimed at protecting human health and the environment from the threats posed by POPs, restricting and ultimately eliminating their production, use, and release.

Climate change has the potential to affect POP contamination via changes in emission sources, transport processes, pathways and routes of degradation. This can result in an increase in global emissions that could offset some of the efforts undertaken under the Stockholm Convention.

Climate change may affect primary emissions of POPs by changing their rate of mobilization from materials or stockpiles, or by altering use patterns:

- alterations in temperature, precipitation or sea level may force agricultural land use changes, and the related use of pesticides;
- increasing temperatures are expected to intensify the propagation of vector-borne diseases, such as malaria, leading to enhanced demand for DDT in some regions;
- the rate of mobilization from stockpiles or POP-containing materials may be increased by higher temperatures (the vapor pressure of chemicals increases exponentially with temperature, shifting soil-air and water-air partitioning).

Climate change may also affect the environmental fate and long-range transport of POPs in the environment, through remobilization and redistribution.

The main effects include:

- increased mobilization of POPs from environmental reservoirs (e.g. soils, glaciers, sediments, the Arctic Ocean) by increased temperature, extreme weather events such as flooding and increased erosion;
- increased airborne transport to locations downwind of main emission areas because of higher wind speeds;
- altered degradation of POPs (because of the temperature-related degradation capacity of microorganisms), and increased formation of potentially POP-like transformation products;
- changes in deposition patterns from air to surface media due to altered precipitation patterns (mainly relevant on the local scale);
- enhancement of transport of water-soluble POPs, such as perfluorooctane sulfonate (PFOS), also as a consequence of modifications of ocean currents.

In areas where environmental levels of POPs increase as a result of redistribution and new releases, human exposure increases. Deeper knowledge of where and how major climate-related changes occur, and of how these changes affect levels of POPs in biota and humans is essential for further proper evaluation of health risks from POPs.

ASSESSMENT OF THE RISKS INDUCED BY CLIMATE CHANGE ON OCCUPATIONAL HEALTH

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Background. Climate change may affect human health, with specific or aggravated health effects among some categories of workers. A French national plan was designed for strengthening the management of occupational risks induced by climate change.

Aim. ANSES's work aimed at identifying occupational health risks that may be affected by climate change.

Methods. ANSES entrusted this work to a multidisciplinary working group composed of scientists specialized in climatology, meteorology, bioclimatology and biometeorology, ecology and biodiversity, epidemiology and occupational medicine. As part of a prospective anticipatory approach, the health effects linked to foreseeable climate and environmental changes within the next 5 years and until 2050 were studied. Through a literature review the ANSES first identified the main climate and environmental changes already observed and the most reliable climate change scenarios to come. The work then focused on characterizing the interactions between climate, environment and occupational health. In order to link climate change to the identified occupational health risks, knowledge about the mechanisms of climate change impact on health has also been examined.

Results and Conclusions. Despite the lack of knowledge about the mechanisms of impacts of climate change on workers' health, this work highlighted that, with the exception of risks related to noise and artificial radiation, all occupational risks are and will be affected by climate and environmental changes. Examples of occupational exposure circumstances were associated with occupational hazard potentially increased by climate change. The three main climatic and environmental changes that are responsible for occupational risks increase are: rising temperatures, evolution of the biological and chemical environment and modification of the frequency and intensity of some climatic hazards. ANSES's work also highlighted the relevance of an approach regarding the "exposure circumstances", which aim at grouping workers according to their actual exposure and not according to their professional activity.

Deontology. ANSES analyzes the links of interests declared by the members of its working groups before their appointment and throughout the work, in order to avoid the risks of conflicts of interest related to the issues addressed in this work.

FORE-MED - THE DEVELOPMENT OF A FORESIGHT METHODOLOGY FOR THE PRIORITISATION OF ANIMAL HEALTH RESEARCH IN THE MEDITERRANEAN AREA UP TO 2030

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Climate change is expected to affect all livestock systems and this could undermine food security and cause social and economic concerns. These changes are expected to have major impact on the Mediterranean basin, in particular with regard to the risk of emergency of infectious diseases in the area. At the same time, to date, animal health remains neglected and poorly represented in most policy agendas.

The FORE-Med, Foresight project for the Mediterranean, is aimed at identifying the future challenges on livestock health and aquaculture in this geographical area, to ensure an effective coordination of research activities and the delivery of timely solution to emerging issues. More than one hundred experts with multidisciplinary background and coming from countries all around the Mediterranean basin, were gathered to participate in a think-tank to develop a Strategic Research Agenda on animal health for Mediterranean up to 2030. A tailored foresight methodology was implemented, merging the best fit for purpose techniques (e.g. '7 questions', Social, Technological, Economical, Environmental, and Political (STEEP), analysis, scenario building, and backcasting). Both remote and face-to-face debates were held, to ensure fruitful exchanges and participation among experts. Analysis of the current situation identified climatic and environmental changes as one of the most relevant key drivers acting on animal health in the Mediterranean area. Then research needs were identified and prioritised, both on relevance and on temporal scale. The implemented participative approach allowed for the definition of a research priority list for animal health and aquaculture in the Mediterranean, which served as a basis to build a strategic research agenda. The latter is expected to satisfy the sectors' needs and guarantee a much-needed coordination for research activities in the Mediterranean area.

CLIMATE CHANGE AND FOOD SAFETY: INVESTIGATION ON TOXIC FISH SPECIES IN THE TYRRHENIAN SEA

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Global warming is transforming the Mediterranean Sea as a result of the increase of the sea water temperature. Exotic tropical species, originating from the Indo-Pacific area and entering via the Suez Canal ("Lessepsian" migration) are spreading (tropicalization). Some of these "alien" species, such as those belonging to the family Tetraodontidae, or "pufferfish", are toxic, as they are able to accumulate a potentially lethal neurotoxin. Several pufferfish species belonging to the Tetraodontidae family are currently present in the Mediterranean Sea. Since 2013 Lagocephalus sceleratus is increasingly reported also along Italian coasts, where other two species of less concern, Lagocephalus lagocephalus and Sphoeroides pachygaster, have also occurred since a long time. The project "Climate change and food safety: molecular, microbiological and toxicological analysis on toxic fish species in the Tyrrhenian Sea" led by the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana in partnership with FishLab, Department of Veterinary Sciences, University of Pisa and the Veterinary Services and Animal Health, Ministry of Agriculture & Rural Development, Israel, funded by the Ministry of Health, is aimed at monitoring the occurrence of toxic fish species along the Mediterranean Sea coast and characterizing them under a molecular profile to obtain a more detailed picture on the presence of these toxic species. The first part of the project was dedicated to dissemination activities using dedicated informational brochures and posters, a report form, a Facebook page and a specific section on the official site, in addition to newspaper articles, TV interviews and meetings with fishermen, divers and control authorities. All these activities were aimed at creating a network for the collection of reports and samples, to update the presence and toxicity of these species, allowing a better assessment of the associated risk. In a second phase, a retrospective study on the occurrence in the Mediterranean, and in particular along Italian coasts, of the three mentioned pufferfish species, was conducted. Overall, at least 111,079 individuals of the three species were found in the Mediterranean Sea, including 110,237 specimens of L. sceleratus (since 2003), 126 of L. lagocephalus (1878-2017) and 716 of S. pachygaster (1979-2017). The evident differences confirm the invasive character of L. sceleratus, the species of main public health concern. Although its current distribution in Italy is limited to southern regions, the picture could change rapidly thus its presence should be strictly monitored. Institutional measures should be implemented to inform people about this emerging public health hazard.

OCCUPATIONAL RISK ASSOCIATED WITH VECTOR-BORNE DISEASES

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Zoonoses, infections or diseases transmitted directly or indirectly between animals and humans, are one of the most complex and important health problems. According to the World Health Organization, vector-borne diseases account for more than 17% of all infectious diseases, mainly transmitted by the bite of blood-sucking arthropods such as mosquitoes, ticks and sandflies.

It is recognized that several factors influence the presence of the vector-borne diseases, such as climate (temperature, humidity and precipitation), environmental and socioeconomic aspects as intercontinental human mobility and trade, altering their rates, ranges, distribution and seasonality.

Climate change, in particular, has been implicated in the latitudinal and altitudinal shift of ticks such as *Ixodes ricinus* that is a vector of Lyme Borreliosis (LB) and Tick-Borne Encephalitis (TBE), the expansion of mosquitoes, such as *Aedes albopictus* which transmits Zika, Dengue and Chikungunya viruses and *Culex* responsible for West Nile Disease (WND), and of *Phlebotomus* sandflies species which transmit Leishmaniasis and Toscana Virus Disease (TVD). In 2017, clusters involving autochthonous transmission of Chikungunya virus have been detected in the Lazio region (Italy). Transmission of this type, in areas where *A. albopictus* mosquitoes are established and where environmental conditions are suitable for increased mosquito abundance and activity, is not unexpected. In fact, this is the second introduction of chikungunya local transmission in Italy resulting in an outbreak, following a previous outbreak in the Emilia-Romagna region in 2007.

Outdoor workers, which include farmers, foresters, landscapers, gardeners and others, are at increased risk of vector-borne infectious diseases, since a positive correlation between higher air temperatures and current or future expansion of the habitat of vectors is being observed. In order to assess whether some vector-borne infections could be associated with occupational exposures to LB and TVD, we conducted serosurveys in outdoor workers and found a seropositivity of 13.1% for LB in forestry workers of Lazio region and of 10% for TVD in forestry and agricultural workers of Tuscany region. Moreover, recently we prepared educational material on the appropriate protective measures that should be taken by workers exposed to biological risk, in accordance with the Law Decree 81/08.

The increased risk of infectious diseases for workers on account of climate change has not been completely assessed, and further studies should be performed. A strong cooperation between scientific experts in human and veterinary health and in the environmental field is the better strategy in tackling vector-borne diseases, according to the One-Health Approach.

CLIMATE CHANGE AND AQUACULTURE: EMERGING RISKS FOR ANIMAL HEALTH AND FOOD SAFETY

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Aquaculture has been included in the National Strategy and Plan on Adaptation to climate change for both the increasing contribution to seafood production and the climate projections for the Italian peninsula.

Warming and worsening of water quality (*e.g.* due to rainfall pattern variations, temperature anomalies, hypoxic phenomena, eutrophication etc.), are the main expected effects of climate changes that could impact the national aquaculture sector, particularly shellfish and extensive fish farming in transitional and marine coastal areas, whereas declining of freshwater resources could mainly affect land-based farming of cold water fish species. Incidence and spread of aquatic diseases in aquaculture systems as well as shellfish contamination have been recognised as emerging risks for animal and human health in relation to climate changes. Extreme weather events and consequent adverse environmental conditions could also increase stress and mortalities in farmed species.

Environmental monitoring program (Water Framework Directive, Italian Legislative Decree No. 152/2006) and health surveillance activities in shellfish areas (EU Hygiene Package and successive amendments; Directive 2006/88/EC, Italian Legislative Decree 148/2008) laid down by competent authorities provided increasing evidence on epidemiological risks and food safety issues related to environmental changes, *e.g.* emerging diseases, recurring closures of shellfish areas due to toxic algal blooms and increased detection of microbial pathogens. Literature data and stakeholders consultation also confirmed this trend.

Dualism of this issue, involving environmental and health aspects, requests a collaborative work between experts and respective competent authorities in order to increase knowledge -base data useful to assess climate change risks for aquatic animal health and seafood safety and to evaluate the economic and social impacts on aquaculture production.

This paper presents a first list of indicators of climate change impacts on aquaculture, including occurrence of aquatic diseases, mass mortalities events and quality of shellfish areas. These indicators have been proposed in a preliminary work carried out in collaboration with the National System for Environmental Protection (SNPA), aimed to develop climate change impact indicators for the most sensitive environmental systems and socio-economic sectors.

HEAT WAVES EVENTS IN ITALY FROM 1961 TO 2017: ANALYSIS OF FREQUENCY, INTENSITY AND SEVERITY

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Increasing mean temperatures observed in the last decades at the global scale, suggested to investigate changes in the extreme climate events, which can have serious and damaging effects on environment and human society. According to IPCC (AR5) changes in climatic extremes occurred since about 1950 and more frequent hot and less frequent cold temperature extremes are expected over most land areas over the next years. Most of the studies focused on the Mediterranean region indicate an increase of frequency and duration of warm events, which are among the most critical climate extremes. Heat waves are frequently defined as a period of unusually or exceptionally hot weather, however several metrics and indices were proposed to examine heat waves events. In this work we present a comprehensive analysis of heat waves over Italy from 1961 to 2017, based on a set of indices, set up by the Commission for Climatology (CCl) Expert Team on Sector-specific Climate Indices (ET SCI) of the World Meteorological Organization (WMO), with the aim to support adaptation. We studied different aspects of heat waves, as duration, frequency and severity, using indices based on maximum and minimum temperature series separately, in order to compare daytime and night-time heat waves. Furthermore, we analysed the Excess Heat Factor (EHF), a heat wave intensity index related to human health, which combines the long-term temperature anomaly (excess heat) and the short term anomaly (excess stress) at a given location. The results indicate increasing patterns for most of the heat wave indices, showing the strongest warming tendency since the early 1980s.

EXTREME EVENTS OF PERCEIVED TEMPERATURE OVER EUROPE IN THE FUTURE: THE HUMIDITY ROLE

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An increase of 2-meter temperature over Europe is expected within the current century. In order to consider health impacts, it is important to evaluate the combined effect of temperature and humidity on the human body. To this aim, projections of a basic index – the humidex - representative of the perceived temperature, under different scenarios and periods, have been investigated.

The simultaneous occurrence of observed extreme temperature events and extreme perceived temperature events is seldom found over the present climate, reinforcing the importance to investigate the combination of the two fields.

A set of 10-km resolution regional climate simulations, provided within the EURO CORDEX multi-model effort has been used. Considering the whole distribution of climate events, those determining its tails, the extreme events, are the ones supposed to have the strongest effect on health. For this reason we focus not only on moderate (90 percentile) events, but also intense (99 percentile) and extreme (99.9 percentile) perceived temperature events as defined on a daily time frequency basis over a 30 years period, under the next (2006-2035), near (2036-2065) and far (2066-2095) future. In order to provide an evaluation of the mentioned multi-model framework in simulating the *humidex* over the present climate, we compare RCMs results to the JRA-55 reanalysis. Models demonstrate ability in representing moderate to extreme perceived temperature events and to be eligible as a tool for quantifying future changes in geographical patterns of exposed areas over Europe.

Following the RCP8.5 emission scenario, an enlargement of the area subject to dangerous conditions is suggested since the middle of the current century, reaching 60 degrees North. The most significant increase of extreme perceived temperature conditions is found comparing the 2066-2095 projections to the 1976-2005 period: bearing in mind that changes in relative humidity may either amplify or offset the health effects of temperature, a less pronounced projected reduction of relative humidity in the northeastern part of Europe, associated to extreme humidex events, makes northern Europe the most prone region to an increase of moderate to extreme values of perceived temperature. This is in agreement with a pronounced projected specific humidity increase.

NÉB - NATURE IS WELL-BEING. PROMOTING CHILDREN'S HEALTH: THE E-LEARNING COURSE FOR HEALTH CARE PROFESSIONALS

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Introduction. Worldwide globalization and urbanization represent a challenge for the capacity to protect public health. Well-being of children is strictly linked to the quality of the environment and children are currently considered major stakeholders for the development of strategies to protect the environment and public health.

To address these and related topics the Italian National Institute of Health (ISS) in collaboration with CURSA (Consorzio Universitario per la Ricerca Socioeconomica e per l'Ambiente) and DEP Lazio (Dipartimento di Epidemiologia del Servizio Sanitario Regionale) developed and organized the distance e-learning course "NéB - Nature is Wellbeing. Promoting children's health". The course is part of the "Environment, Clime and Promotion of Children's Health" project founded by the Italian Ministry of Health within the Central Action Area –"CCM" 2017 Program. NéB course provides health care professionals with tools and information to sensitize and to teach parents the effects of nature and biodiversity on health and well-being of people, in particular children.

Method. Since 2004, the Italian NIH has been providing distance training in Public Health, based on the integration of active methodologies such as Problem-Based Learning (PBL) with e-learning tools provided by the Learning Management System (LMS) Moodle, expanded with the LMS Totara in recent years (https://eduiss.it).

Results. The course is free and open to a maximum of 5000 health care professionals including pediatricians and family practice physicians. It releases 16 Continuing Medical Education credits (ECM- Educazione Continua in Medicina) and is available for 12 months. The course is organized in one learning unit with several activities that reproduce the entire PBL cycle. The access to the activities is set in order to schedule the learning path according to certain conditions, such as previous activity completion. Participants can take pre- and post- self-assessment tests for self-evaluation of learned knowledge before the final test. ECM credits are earned upon successful completion of a Multiple Choice Questionnaire (MCQ) and a course evaluation questionnaire.

Conclusions. NéB course is one of the first courses dedicated to health care professionals to gain knowledge on the benefits of living in contact with nature and on the recognition of main risks associated with environmental exposures and climate changes to particularly improve well-being of children.

The distance e-learning web-based format and the free access to the course strongly fit the mandate from the Central Action Area “CCM” program which requires that educational teaching and training programs f highly relevant subjects to the National Health Care are available and accessible at national level.

NÈB – PROMOTING WELL-BEING FOR CHILDREN, INVESTING IN NATURE AND BIODIVERSITY

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Over the last few years, the scientific community has been investing increasing efforts and resources in the study of how particular lifestyles can positively influence children health. Links between green spaces and health have been identified in many scientific publications. However epidemiologic research is still limited and should be enhanced in the future.

As reported in the XIII Conference of the Parties in Cancun, the biodiversity gives rise to benefits for human health, by underpinning ecosystem functioning and resilience provision of essential ecosystem services and by providing options for adapting to changing needs and circumstances, and to climate change. Biodiversity in urban environments contributes to a feeling of wellbeing by stimulating physical exercise, providing clean air, and improving mental wellbeing, among others. By being outside and surrounded by nature, children experience an ever-changing and free-flowing environment that stimulates all the senses. Outdoor play fosters children's intellectual, emotional, social and physical development.

The Italian Ministry of Health launches the 2018 special dedicated to the pilot project "NèB - Natura è Benessere" (Nature IS Wellbeing) for enhancing actions on children health. The main objective of NèB project is to promote the knowledge regarding the healthy benefits of green spaces for children. Interacting with natural environments allow children to learn by doing and experiment with ideas, learning a plurality of cognitive strategies through a continuous and multiform process of logical openness, developing skills related to emotion, non-verbal communication, and spatially. In nature children think, question, and make hypotheses - thereby developing inquisitive minds. In an outdoor setting in an unstructured green space, children are capable of figuring out things for themselves, think creatively, and develop a cooperative spirit on their own.

One of the objectives of the project is to integrate the training of health professionals with the acquisition of a systemic approach to the complexity of living/ environmental system relationships and a more updated concept of health, understood as a process that involves activities that reflect the response of the organism to environmental stimuli. The other objective is to carry out information and communication campaigns to the public to promote the importance of the relationship between nature, biodiversity, human health and

children’s cognitive development, including through education, training and raising awareness for the general public. At the same time, promote awareness on these issues between decision-makers in the relevant sectors and at different level of government.

DIDACTIC LABORATORY IN NATURE “HEALTHY AS A FISH”

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The didactic laboratory has been carried out during the project “Junior Ranger of Nature and Culture” in Pantanello Park (Cisterna di Latina, LT). The protagonists have been the students of the first class (I B) of Borgo Faiti medium school, who designed and set a health path with specific stops to make physical activities in contact with nature, during the school year 2017/2018. Each stop has been designed to make motor exercises in the way to understand and remake some animals’ movements.

The laboratory objectives for students were: to facilitate a healthy and whole psychomotor development, to gain more consciousness about their body in the natural environment and to learn the movements of some animals that live in the Park.

The activities have been carried with four outdoor activities, led by professional educators, linked each other with in-depth studies in the classroom with the teachers.

The first step was to study, in the classroom, the anatomy and the motor skills of the animals; in the field, students sought the fauna footprints along the park paths and then mimed their movements; then, each students drew a motor-ludic tool that remade the animals’ movements studied.

During the second step, each student created a 3D model of the motor-ludic tool by using on-choice material and recycled ones; in the field, there has been a shared evaluation of the 3D models and then the students drew a 2D map of the psychomotor path with the position of the tools they chose.

In the third outdoor activity, adults and students together built the “Healthy as a fish” path, and the students simulated the exercises. In the classroom, they prepared an illustrative sheet to set along the path, with a short interpretive sentence and the drawings of the inspired animals’ movements, highlighting the involved muscles. Safety conditions were respected during all the installation work. DNA (National Didactic for the Environment) team from CURSA provided the materials (some of them were recycled ones) and the supervision of the work.

The last step was the final event in Pantanello Park, where the students, supported by the educators and the teachers, have shown all the work done to the families, becoming “Junior Ranger of Nature and Culture”.

CLIMATE CHANGE AND CHILDREN: PREVENTION

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Climate Change (CC) is "the greatest global health threat of the 21st century" and children are amongst those most sensitive to it. The effects of CC are unfolding as we speak, yet actions aimed at countering them lag behind. That is because CC is a complex problem which demands an integrated response at the health, energy, industrial and environmental protection levels; all of which, in the face of unfavourable socio-economic and political contexts.

The main strategies to curtail CC effects are: mitigation (primary prevention), namely the prevention of its causes, especially with regards to reducing greenhouse gas emissions; increasing adaptation ability (secondary and tertiary prevention), through public health interventions targeting CC consequences, so as to immediately reduce health damage via, for example, the implementation of heatwave and flood forecasting and early warning systems, and social and health interventions aimed protecting vulnerable subgroups, such as children.

Both at the individual and public level, certain interventions in the areas that most contribute to greenhouse gas emissions (namely, energy production, transport, households and cooking) stand to provide immediate, positive gains for human health. These include: lifestyle changes, reduced reliance of cars and the promotion of bicycle and on-foot commutes; reducing meat and animal-product consumption; investing in renewable energy, energy efficiency and in improving eco-friendly public transports.

In order to measure CC effects on child health, we need to define narrower quantitative measurement ranges, using monitoring systems purposely calibrated on children, so as to better quantify current impacts and to extrapolate future ones, provide realistic projections and establish priorities. Furthermore, existing public health programs should be updated to include child-specific CC preparedness and adaptation strategies. These may include early warning systems and targeted counselling interventions, for instance, in connection with environmental disasters.

Considering that in developed countries only the 3% of health investments are earmarked for prevention, compared to 97% spent on treating and curing patients, it is clear that there are not many resources available. It is therefore up to the scientific community and health professionals to submit health policy proposals, to inform the general public on behaviours and lifestyles that warrant modifying, and to provide policymakers with evidence concerning which mitigation measures to implement and their effectiveness, particularly with reference to child health.

URBAN ECOSYSTEMS: POLLINOSIS AND CIMATE CHANGES

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Pollinosis (hay fever or allergic rhinitis) are chronic inflammatory pathologies of the respiratory system representing the most diffuse allergic form Worldwide. The causes may be due either to genetic predisposition and environmental factors, as the exposure to allergenic anemophilous plant's pollen; they are constantly increasing, especially in metropolitan areas, carrying the disease's direct and indirect social costs, to a very high level.

Plants are very sensitive to climate parameters changes, in particular temperature, humidity and atmospheric concentration of greenhouse gas such as CO_2: all variables affect quantity pollen production, increasing the length of the pollen season, diffusion and spatial distribution of plants and of their pollens, as well as their intrinsic allergenicity.

Recent studies have indicated that pollen allergy has a greater prevalence in cities with heavy vehicular traffic than rural areas, because pollutants from vehicle exhaust gases, such as particulate matter or tropospheric ozone and NO_2, also appear to increase the Pollen's Allergenic Potential (PAP).

It's possible to find pollinic allergens joined not only to anemophilous plants pollen grains, but also to a smaller diameter particles derivate from breaking of particles present in atmospheric particulate matter; for this reason the pollen count estimation couldn't always correlate with symptoms level found in the patient population exposed in that same time.

Pollinosis primary prevention measures in urban area, as for other chronic diseases linked to environmental determinants, is based on the reducing the exposure to allergenic pollen and/or the factors that enhance their allergenicity, as climate changes and air pollutants; measures could be passive (online publication of pollen calendars and table indicating the level of risk from allergenic plants; guidelines implementation for new plantings of urban public green) or active (use of individual medical devices).

Epidemiological studies should be performed to relate existing information on the increase of Pollen Allergenic Potential (PAP) caused by climatic stress and air pollutants and the observed increase in the prevalence of pollinosis and worsening of symptoms in urban areas whit higher vehicular traffic.

If these studies show a direct correlation between these two elements, the Pollen Potential Allergen (PAP) could be defined as a new (indirect) indicator of environmental determinants effect on the risk of developing a pollinosis or aggravating the symptoms of respiratory pathways, by sensitive populations.

Poster session

December, 4

HOW TO MEASURE OUR SENSITIVITY TO CLIMATE CHANGE IN ORDER TO BETTER UNDERSTAND WHAT HAPPENS AND DECIDE WHAT TO DO

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We are obviously sensitive to climate changes. Several examples are illustrated elsewhere in the Conference. To measure effects is of paramount necessity. A first not specific but quite sensitive way to detect and quantify stress is heart rate variability: sympatho-vagal balance is known to be altered either in acute or even chronically according to the state and of the dynamics of each of us; specificity could be at least partially achieved by keeping fixed as much as possible every other stimuli.

Less immediate, and still originally a-specific, is the analysis of the central nervous system instead of the autonomous one: coherences among brain areas, investigated via EEG, MEG, fMRI, NIRS, do even account on our plasticity to the change.

Deconvolution of blood samples may help in noninvasively assessing un-accessible and nano-metric pituitary secretion in controlling hormone loops. A real precision analysis is needed to achieve very specific results: epigenetics makes us enhancing gene mediated protein expression in such a way that salient involved genes are detectable in assays together with their networking behavior with proteins expressed to face stimuli.

Modeling biophysical and biochemical interactions at molecular, domain and even atomic scale could become the ultimate level in approaching the effect from macro to meso, coarse and micro scales. A brief priming to such approaches will be provided on some examples in order to make aware of a battery of tools able to help both in diagnosis and possibly in therapy monitoring.

MINDFULNESS, PERCEIVED RESTORATIVENESS AND REPORTED RESTORATION AT THE BOTANICAL GARDEN AMONG ADULTS AND ADOLESCENTS: WHICH PATHWAYS TO RESTORATION?

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Environmental psychologists agree that Nature contact leads to numerous psychological benefits. In particular, based on the Attention Restoration Theory (ART), natural environments are rich in intrinsic characteristics that allow restoration. However, approximately half of the global population live in cities and it is calculated that by 2030, 60% of people will live in urban areas worldwide, characterised by few green spaces. How can this huge number of people be guaranteed the benefits of Nature contact? Botanical gardens are examples of urban Nature that could be taken advantage of in order to experience psychological restoration from daily demands and hence stimulate the "Biophilia", literally "love of life" (the hypothetical innate tendency to bond and affiliate with the natural world, defined as well as a complex of learning rules, genetically determined, that need to be appropriately stimulated in order to flourish). However, scarce scientific attention has been paid to the possible psychological benefits that Botanical gardens offer. ART states that, in order to experience restoration, a person needs to be engaged with the environment and perceive its several characteristics (multisensory perception). Overall, perception is influenced by personal characteristics (previous experiences, affect etc.). Of interest to the current study is the fact that mindful people tend to be aware of the "here and now", therefore they might be more aware and better engaged with their sorroundings than non-mindful people. Mindfulness reflects increased awareness (and attention) to the present moment and in the place where the person is. Considering this, the present study aims to examine the possible relationship between trait mindfulness and people's reported restoration after a Botanical garden visit. Specifically, we investigate the relation between trait mindfulness, dispositional affect and reported restoration, and whether such relation is mediated by perceived restorativeness, beauty of the place (aesthetics) and connectedness with Nature. It is expected that more mindful people perceive the restorative characteristics (perceived restorativeness) of a Botanical garden more vividly (as they are usually aware of their experience in the "here and now") and hence effectively feel more restored (reported restoration) than less mindful people who, on the contrary and by considering the same pathway, would not feel the

same restored after the visit (reported restoration). Data collection with both adults and adolescents is ongoing at the Rome Botanical garden and results will be presented at the conference

IMPACT OF DROUGHTS ON WATER QUALITY IN ITALY: PRELIMINARY DATA AND RISK ANALYSIS

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In order to get a first screening of the nationwide situation about potential droughts-affected water systems, two Italian artificial basins for drinking water supplying were investigated in terms of severity, duration, frequency of droughts occurrence and potential qualitative and quantitative water alterations. Because of local climatic differences and landscape features, two basins respectively in the north (Ridracoli Lake in Emilia Romagna) and in the south (Fanaco Lake in Sicily) of the Italian Peninsula were selected. Despite the complexity of the phenomenon, droughts effects may be successfully investigated throughout several indices. In this study, we applied the SPEI drought index, a recently-developed time-scale related index based on precipitation and potential evapotranspiration data. SPEI values used for the purpose were collected from the Spanish PEI Global Drought Monitor (open data), and consisted in elaborations from rainfall, temperature and geographical data acquired from January 1950 to October 2017. Raw data on reservoir storage and several analytical parameters provided by drinking water supplier were preliminary standardized, then elaborated by specific statistical methods. For both basins SPEI values were first examined, then correlations with basin storage reduction, water turbidity and several chemical parameters were analysed. Preliminary results of SPEI historical series depicted three relevant events occurred between the end of the 80s and today at both basins. Correlation analysis carried out with the optimized time-scaled SPEI produced a similar outcome for both basins as regards water level reduction and manganese concentration in water (storage reduction and manganese increased as drought severity increased). No correlation between SPEI and iron concentrations in water was observed. Specific site-related effects were observed, such as correlation with water turbidity (max positive correlation at short-time scale), nitrate, free-chlorine (positive correlation at medium-time scale) and ammonium (negative correlation at medium-time scale) at Fanaco Lake as well as total organic carbon in water (positive correlation on long-time scale) at Ridracoli Lake. In conclusion, statistical analysis fine-tuned in this study provided to be useful to characterize the effects produced by relevant drought events and to highlight basins vulnerability. Results from this kind of analysis might improve water system resilience to droughts effects providing relevant information for Risk Analysis addressed to Water Safety Plan activities, such as water treatment optimization.

CLIMATE CHANGE AND HEALTH COUNTRY PROFILE ON WATER AND SANITATION IN ITALY

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The first WHO - United Nations Framework Convention for Climate Change (UNFCCC) climate and health country profile for Italy has been recently finalized by a multidisciplinary team including over 40 Italian health and climate scientists and 12 relevant institutions.

One of the most dramatic effects related to early climatic changes is water scarcity. This condition occurs in Italy for both climatic events and human pressures, such as low rainfall combined with increasing demand (higher population along the coast in summer season in southern areas and islands, increasing demand for agriculture and animal husbandry). Other relevant climate changes directly and indirectly affecting environmental health consist of reduction of ice mass by temperature increasing in summer season and low winter snowfall (deglaciation of Alpine glaciers in northern areas), as well as severe flooding due to extreme precipitation regimes.

Forecasting for future scenarios might be more frequent occurrence of aquifer over-exploitation, reduction of water availability and drought phenomena that are expected to have severe consequences on water access (quantity and continuity of supply), and quality (e.g., turbidity for drinking water reservoirs), also affecting food production, forestry, energy and tourism. Droughts and extreme temperatures are exacerbating the water crisis with 6/20 Italian regions calling for a “state of emergency” in the summer of 2017.

Based on these issues, Italy is strengthening a strategic vision for the water sector with national policy supporting regional and local authorities in managing water resources and surveying water quality. Strategic actions are set at national level, focused on:

a) support to natural water conservation by development of a holistic water policy to promote water-use efficiency across all sectors, reclaimed water reuse, renovation of water networks and infrastructure;
b) integrate country strategies for aggregation of surveillance authorities and fragmented water management companies also by using economic instruments, such as water pricing and investments;
c) promotion of climate changes adaptation strategies and water-use efficiency by increasing resilience and improving drinking water systems in flood and droughts control through universal implementation of risk based approach in water and sanitation sector (water safety plans, sanitation safety plans), sustainable water use, and desalination technologies;
d) strengthening of preventive approach, including waterborne diseases risk assessment and management, early warning systems based on forecasts of pathogen

distributions, identification and monitoring of legacy and emerging chemical contaminants, modelling and monitoring of biogenic harmful substances (i.e., algal blooms and toxin production in the aquatic environment).

CLIMATE CHANGES IMPACTS ON GROUNDWATER: HOW DO WE COPE WITH IT?

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Groundwater provides drinking water to at least 50% of the global population. Worldwide, 2.5 billion people depend solely on groundwater resources to satisfy their basic daily water needs (UNESCO 2015). In Italy, 84% of drinking water derives from groundwater (ISTAT 2017) captured mainly from the alluvial plains and karst aquifers.

Although groundwater systems are more resilient to climate change than surface waters, they are affected both directly and indirectly. The real effects of precipitation decline on water availability must also account for human impacts, which conversely tend to increase, partly because of climate change. Especially, the so-called secondary impacts of climate change, resulting from human intervention in water systems, are expected to have the largest short-term effects on groundwater resources.

Climate changes are expected to decrease the water availability in the Mediterranean area especially during summer, due to the concurrence of a generalized negative trend in the precipitation and an increased frequency of droughts.

Possible impacts of climate changes on groundwater have been studied and described in the last years by a number of scientific papers and technical reports.

In line with international level climate policies, also the European Commission has identified the adaptation as one of the key elements to tackle climate changes impact. In 2013, EU adopted the “EU strategy on adaptation to climate change”, stating that assessing the vulnerability to climate changes and elaborating strategies for the adaptation is a priority for EU member states. As for Italy the National Strategy has been published in 2015 (SNAC 2014) and a proposal of plan in 2017 (PNACC 2017).

In the medium-long term scenario we have to consider climate change-related risks affecting recharge, discharge, and groundwater storage of aquifers, either for their impacts on availability of water for human uses or for the associated hazard to water quality and human health, on account of mobilization dynamics of geogenic and anthropogenic pollutants, or saline intrusion in coastal aquifers. The development of an holistic resiliency vision, extended to the climatic-environmental pressures to the human water uses and risks, is therefore now compelled. The election resiliency strategy is a global risk analysis covering the risk assessment applied to groundwater within River Basin Management Plans and the Water and Sanitary Safety Plans, as for human use and re-use of safe water.

FROM EAST TO WEST: AN EARLIER AND MORE INTENSE CIRCULATION OF WEST NILE VIRUS IN THE NORTHWEST OF ITALY (PIEMONTE, LIGURIA AND VALLE D'AOSTA, 2018)

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West Nile virus (WNV) is endemic in Italy since 2008. Viral circulation has been reported in Northern Regions, progressively extending the range from the East to the West in the Po river valley area. These Regions have applied since 2015 an integrated surveillance targeting mosquitoes, wild birds, humans, and horses to early detect the viral circulation and introduce control measures to reduce the risk of human infection. Veterinarian activities were coordinated by three Istituti Zooprofilattici Sperimentali (IZS Piemonte, Liguria e Valle d'Aosta, IZS Venezie, IZS Lombardia e Emilia Romagna) working as a network. Passive surveillance was carried by detection of neurological signs in equines and increased mortality among wild birds.

Entomological surveillance was activated from June to October through adult mosquito collection. Active avian surveillance was performed by virological screening in migratory and resident wild birds, mainly belonging to Corvidae genus. Since 2015 WNV detection in mosquitoes and wild birds or detection of WNV-IgM in horses were introduced as triggers for the implementation of NAT testing for human blood donor screening. An increase of WNV activity was observed during the first months (June-15th August) of 2018 vector season.

In this work we report results obtained in Piemonte, Liguria and Valle d'Aosta Regions. WNV was detected in Piemonte two weeks before the previous seasons. The virus was detected in a mosquito pool (100 *Culex pipiens*) collected in Vercelli on 11/07/2018. Six hooded crow (*Corvus corone cornix*) tested positive in Torino between 20 and 24 July. In the same week, WNV was detected in another specimen of *Corvus corone cornix* trapped in Vercelli. In the following days the virus was detected in several mosquito pools (*Culex pipiens*) (Vercelli, 25/07/2018; Cuneo, 30/07/20; Novara, 31/07/2018; Alessandria,

2/08/2018). Of interest the detection on 9/08/18 of WNV in a pheasant (*Phasianus colchicus*) found dead in Vercelli and IgM in a horse with neurological signs in Biella (8/08/2018). The introduction of WNV NAT screening in six out eight Provinces of Piemonte allowed the detection of 2 blood bags positive for WNV (Vercelli and Novara). In previous seasons no human blood donors infected were registered in the Region. In Liguria and Valle d'Aosta Region WNV has not been reported right now.

The increased evidence of WNV circulation in Italy in 2018 highlights the importance of having rigorous entomological and veterinary surveillance plans in place and of establishing close cooperation among the different players in the health field.

EVALUATION OF THE POSSIBLE EFFECTS OF THE INCREASING MEAN TEMPERATURE ON EDENDEMIC AND EMERGING VECTOR BORNE DISEASES IN ITALY

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Vector Borne Diseases (VBD) still represent some of the most important public health problems in the endemic areas but are becoming a source of concern for developed countries too. Since the last decades of the past century a number of VBD (or of its natural vectors) has been spreading geographically, being recorded for the first time in areas outside their original range.

Although VBD are considered the most susceptible to climatic changes, this phenomenon is strictly related to the peculiar characteristics of the diseases and it should be considered as the result of numerous concomitant factors, all directly or indirectly related to human activities, such as the increasing use of aircraft for the rapid transport of goods and people, the significant changes induced to the natural environment and socio-economic constraints.

In Italy, during the half century that followed the eradication of malaria, the VBD traditionally endemic in our country, were mainly those transmitted by Ixodidae ticks and by Plebotominae sand flies. Up to the late 1990's, the foci of these VBD were limited to restricted areas, while during the next decades some of these diseases have risen in prevalence and/or expanded their original range to nearest areas. In the same period the invasive mosquito, *Aedes albopictus*, was first introduced in Italy and in a few years this species became strongly established across the whole Country.

In the following years, the introduction of exotic arboviruses has resulted in seasonal outbreaks of Chykungunia virus occurred in 2007 and 2017, while West Nile encephalitis has become endemic in some regions of the North-West side of the country since 2008. These events have renewed among health Authorities a concern almost disappeared during the last 60 years.

In the light of these recent events, the surveillance for endemic and imported cases of VBD has been strengthened: national surveillance plans have been implemented for the for the early detection and control of possible autochthonous cases of human arbovirosis.

Aim of this work is to provide an overview of the current status of endemic VBD in Italy and to estimate the risk that other VBD circulating in the Mediterranean area, or that have recently shown a potential for spreading outside their natural range, may become endemic in our country.

The possibility that further vectors and/or exotic pathogens could be introduced and established is also discussed in relation to the sharp increase in average temperature predicted for the incoming future.

SURVEILLANCE ON TICKS FROM BITTEN HUMANS: INCREASED INCIDENCE IN PIEDMONT (NORTH WESTERN ITALY) DURING 2018 VECTOR SEASON

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Ticks abundance and geographical distribution is influenced by many factors including climate ones. Climate changes have effect on ticks both directly modifying their survival, activity and development and indirectly modifying the type of vegetation and host abundance.

In this work we report data from North Western Italy (Piedmont Region) that, during 2018 vector season, has registered an increased number of humans exposed to tick bites.

We collected ticks removed from bitten humans, thanks to a communication campaign and an information network between veterinary services and local human health authority.

Ticks were morphologically identified using standard taxonomic keys. Ticks removed from individuals under 18 or over 70 years old and adults with suspected symptoms or immunocompromised were screened by biomolecular essays for the presence of *Borrelia burgdorferi* sl, *Rickettsia* spp. *Anaplasma* spp..

From January to July 2018 we collected 424 ticks from 326 bitten humans. According to the life stage, most frequently collected ticks were nymphs (N=300; 70,7%) and females (N=93; 21,9%). The tick most commonly retrieved was *Ixodes ricinus* (N=342; 80,7%). Biomolecular analysis was performed on 166 tick samples. Thirty-nine ticks (23,5%) tested positive to at least one pathogen. *Rickettsia* spp. was detected in 26 samples (15,7%), including *R. monacensis* (N=20) and *R. helvetica* (N=6). *Borrelia burgdorferi* sl was detected in 12 ticks (7,2%), including 4 genospecies (*B. afzelii*, *B. garinii*, *B. lusitaniae* and *B. valaisiana*). *Anaplasma phagocytophilum* was detected in 1 sample. In 2 cases, co-infection between *Rickettsia* spp. and *Borrelia burgdorferi* sl was observed.

In conclusion, during the first month of the 2018 vector season in Piedmont an exceptional number of ticks (more than doubled compared to previous 5 years) was observed, but data on tick population and pathogen prevalence was similar to previous years. Piedmont climate in 2018 has been characterized by a moderate winter, a humid spring and a rainy summer with elevate temperatures, favouring the presence and abundance of ticks highly susceptible to climate determinants, specifically humidity and temperature.

The increasing number of humans exposed to ticks and the detection of pathogens in 23,5% of tested samples raises the attention on the importance of this surveillance as an indirect tool for evaluating the risk of tick-borne diseases in bitten individuals.

FIRST CHECKLIST OF MOSQUITO AND TICK SPECIES OF URBAN PARKS IN ROME: BIODIVERSITY RICHNESS AND HUMAN HEALTH RISK IN A CHANGING CLIMATE

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Ticks and mosquitoes are important arthropod vectors in the transmission of parasites and other pathogens worldwide. In metropolitan areas vegetation tends to be heterogeneously distributed as fragmented "green islands" within the urban landscape. Most of these green areas are urban parks designed to provide the population with a place where to spend leisure time, practice physical activities and have contact with nature. As little is known about mosquito and ticks diversity patterns in these places, the aim of this study was to assess the mosquito and tick fauna in several natural parks and reserves of Rome, the first European metropolis in terms of the extension of urban green areas. To date, two wide natural reserves, namely the Caffarella Valley (CV) within of the Appia Antica Natural Reserve and the Insugherata Natural Reserve (INR) were investigated. In 2011-2012 in INR, 140 larvae belonging to 7 mosquito species were collected: *Culex territans*, reported for the first time in Rome, was the most abundant species (35%) and specimens of *Anopheles maculipennis* complex were found after more than 50 years since their last record. Moreover, during 2011 a biweekly collection of ticks was performed obtaining the species composition and respective seasonal dynamics. A total of 325 ticks was collected belonging to 5 species, the most abundant of which were *Rhipicephalus turanicus* (72.3%), *Ixodes ricinus* (19.7%). A representative sample of tick specimens was screened for tick-borne pathogens by molecular tools and important pathogens as *Borrelia burgdorferi* sensu lato (36%), *Rickettsia* spp. (36%), and *Coxiella burnetii* (22%) were detected in both abundant tick species. In 2012-2013 a total of 1173 mosquitoes in CV was collected, belonging to 9 species: the most abundant was *Culex pipiens* (48%), followed by other interesting findings. In addition, the potential occurrence of ticks was biweekly investigated in CV, but no specimen was found in field collections.

A large amount of mosquito specimens collected in all the urban parks of Rome during past researches on environmental health conditions are currently being identified.

Studies on mosquito and ticks diversity in urban green areas can supply data aimed to deepen the diversity patterns in urban ecosystems and allow to understand the local role of biodiversity in reducing or increasing the risk of pathogen transmission. All these factors are strictly dependent on climatic conditions that directly influence bionomics of arthropods of medical interest like mosquitoes and ticks.

DETERMINATION OF THE PRESENCE AND DIFFUSION OF INVASIVE MOSQUITOES IN LOMBARDY AND EMILIA ROMAGNA, WITH PARTICULAR REFERENCE TO THE SPECIES *AEDES ALBOPICTUS*, *AEDES KOREICUS*, *AEDES JAPONICUS*

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The settlement of invasive exotic mosquitoes is a quite common occurrence in Europe. The most impressive example is the tiger mosquito (*Ae. albopictus*), which is by now steadily present in Italy, and can act as vector for the agents of many vector-borne diseases, including Dengue e Chikungunya.

The presence of others "invasive" mosquitoes, among which *Ae. koreicus* and *Ae. japonicus*, is even progressively reported but their role as vector of agents of diseases for human and animals isn't well established yet.

These species are less thermophilic than tiger mosquito; therefore, they can survive and establish in hilly areas, where the former is less diffuse or totally absent, and this situation makes them more exposed to infection with arthropod-borne pathogens.

In consequence of that, a study was undertaken with the objective to define the distribution area of invasive mosquitos' species in Lombardy and Emilia-Romagna, particularly focused on: i) defining *Ae. koreicus* distribution area (sporadic presence was previously proved just in Como and Sondrio provinces), ii) evaluating the presence of *Ae. japonicus*, iii) giving indication about the relation between tiger mosquito distribution and altitude.

During the first part of the project the invasive mosquitoes were searched actively in areas fitting with their possible survival in Lombardy and Emilia-Romagna, with particular effort in the north of Lombardy, where *Ae. koreicus* has been already sporadically reported.

In order to get these data, we used adult mosquitos' samples both taken with CO2 trapping in the framework of the entomologic surveillance plan for WND and obtained with attractive traps (BG-sentinel) in an ad hoc capture program; manual sampling was also performed to obtain larvae. Sampling sessions were done during the day with a fortnightly timeline in the Lombardy provinces of Como, Sondrio, Bergamo and Brescia in virtue of their hilly position.

Preliminary results support the previous knowledge on the wide distribution of *Aedes albopictus* in the territory of the two Italian regions and confirm the stable presence of *Ae. koreicus* in the north of Lombardy close to the Alps. During this survey we did not find *Ae.japonicus* in any of the sampled areas.

The knowledge about the detailed distribution of these invasive mosquitos is essential to correctly evaluate the health risk linked to vector-borne diseases and it could contribute to better understand the potential role of this mosquitoes as vectors in the introduction and spreading of viral agents of human and animal diseases.

DARWIN RESILIENCE MANAGEMENT GUIDELINES (DRMG)

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DARWIN is an EU funded research project under the Horizon 2020 research programme. The project is focussed on improving responses to expected and unexpected crises affecting critical societal structures during natural disasters (e.g. flooding, earthquakes) and man-made disasters (e.g. cyber-attacks). To achieve this, DARWIN has developed European Resilience Management Guidelines (DRMG) aimed at critical infrastructure managers, crisis and emergency response managers, service providers, first responders and policy makers. Infrastructure operators will have up-to-date and effective guidelines at their disposal to facilitate faster, more effective and highly adaptive responses to crises. This will have a direct impact on the safety of European citizens in times of crisis and disaster into the future. The DARWIN resilience guidelines will also be of significant benefit for governments of EU member states.

To ensure the guidelines are dynamic and user-friendly, the project has adopted innovative tools, including serious gaming and training packages. The Guidelines have also been converted into a number of formats including the DARWIN Resilience Management Guidelines book, which is a compendium of the DARWIN Wiki content from August 2018.

The DARWIN Capability Cards (CC) are the building blocks of the DARWIN Resilience Management Guidelines. While the DARWIN Resilience Management Guidelines describe what needs to be implemented, the Capability Cards explain how. They have been tested in strategic pilot studies in two key sectors Healthcare (HC) and Air Traffic Management (ATM). The results and insights generated from the pilot studies have been applied to the guidelines.

In order to foster communications between the European crisis and resilience community, DARWIN has established a Community of Practitioners (DCoP). This forum has brought together infrastructure operators, members of the crisis and emergency response community, policy makers and other relevant stakeholders across Europe to exchange views and innovations around their responses to crisis. The DCoP will exist beyond the lifetime of the project. It will also ensure transnational and cross-sector application of the European resilience guidelines, as members of the community will provide feedback on the usefulness and relevance of the evolving resilience guidelines.

Nine European organisations in the fields of resilience, crisis and risk management, communications and social media, air traffic management and healthcare form the DARWIN project consortium.

RESILIENCE IN URBAN AREAS AND LOCAL SOLUTIONS

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Climate changes interfere with local meteorological phenomena, making extreme ones more increasingly frequent and more intense. These phenomena in turn act on the effects of air pollution by intensifying and multiplying the negative impact on human health. Since most of the world's population lives in urban areas where air pollution is more intense, much attention must be paid to the effects that extreme climatic events, merging with air pollution effects, have on humans and on the environment of the cities and metropolitan areas.

An example that we all remember and confirms the above, is the heat wave that hit Paris in the summer of 2003. In a short time the effects of high temperature and air pollution caused several hundred deaths among the inhabitants, affecting in particular the risk groups: the elderly, the sick, the marginalized, the poor.

The rural areas and the towns not far from Paris that were hit by the same hot wave, did not have such a large number of victims. The air pollution present in Paris and its urban fabric made the difference.

While the dangerous mix between air pollution and heat wave is over, many issues related to the adaptation of cities are still to be explored, in order to absorb and reduce the effects of climate change and to strengthen the 'resilience' of urban areas. In particular we offer some insights on:

a) the role of the urban fabric towards air pollution and hot wave, and more generally on the phenomena due to climate change;
b) local meteorological phenomena such as the PBL (Planetary Boundary Layer) in relation to hot waves and more generally to phenomena due to climate change;
c) the impacts of Climate Change, global warming and extreme weather events affect people's behavior by increasing stress and anxiety, thus affecting the quality of life and the sense of the common good.

Many adaptation technologies are now being proposed globally or locally to reduce adverse health effects. It is becoming more and more urgent to arrange instruments able to reduce the effects of the most insidious and acute pollution / warming phenomena.

The resilient city is certainly a more livable city, on a human scale, where there is more urban green, less pollution and where human health is more protected. For the sanitization of the polluted air in limited areas particularly exposed, we examine and evaluate some solutions that require targeted actions at the local level.

INVENTORY OF MERCURY CONTAINING DEVICES IS A TRANSITIONAL PATH TO THE GREEN ECONOMY IN THE HEALTH CARE OF THE REPUBLIC OF BELARUS

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To date, consumer products are not produced in the Republic of Belarus with the addition of mercury, however, according to the inventory data for 2016, it is widely imported. The ban on the import of such products is not legally defined. At the same time, the Decree of the President of the Republic of Belarus prohibits the use of mercury thermometers and devices with mercury content to control microclimate parameters in health organizations and other enterprises.

As of December 2017, 35 items of various thermometers were entered in the state register, including various groups of mercury-containing ones, which indicates that they are available in the Republic of Belarus and are currently used.

To calculate mercury releases to the environment from mercury thermometers, monometers and sensors, the data of the National Statistical Committee for 2016 were used. Air pollution from mercury thermometers was 0.2 kg per year, water - 0.7 kg per year, waste accounted for 1.4 kg per year. Air pollution from mercury manometers and sensors amounted to 3.7 kg per year, water - 11.1 kg per year, and waste accounted for 22.3 kg per year. Thus, in the Republic of Belarus it is planned to develop a manual and technical materials on the phased withdrawal of materials containing mercury from the health sector.

WOMEN HEALTH IN GLOBAL ENVIRONMENTAL CHANGES

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Global environmental change represents an issue of considerable interest and urgency for health. Climate change, extreme events and famine have an incremental impact on population health. In particular, women in developing countries carry a double burden of deprivation since they are more vulnerable to the effects of environmental degradation plus they have to cope with threat to their daily life and their children.

Despite the supposed gender neutrality of climate change as a global process, much of the scientific literature notes that women are adversely affected by climate change. The environmental and health consequences of global change profoundly affect women, who play a key role in building mitigation, adaptation and resilience. Women may have fewer resources, including assets, education and income, to respond to extreme events.

Most distressed populations are those in developing countries. In parallel, there is an increased burden of psychological diseases and injury. Post-disaster research has widely been conducted in Western populations and very little research has been done on women in the developing countries. Climate change affects women differently according to cultural, economic, environmental and social context, and gender is a key element.

Urgent need for innovative and collective strategies, includes a gender perspective as a significant dimension in sustainability and development of environmental policies. Ecosystems and social community interventions should be based on the best available science integrated with traditional and indigenous knowledge, by gender-sensitive approaches into relevant social, economic and environmental policies and prevention health. Intersectional perspective for gender analysis in climate change, must include studies on violence against women, that represents a major global public health problem worldwide. In this sense, we argue that new alliances towards inclusive and innovative solutions will contribute in reducing the exinting injustices and addressing challenging opportunity in climate change research.

How best to ensure the inclusion of women in suitainable development policy is still a challenging answer, but to improve, rather than harm, dynamic social and political relations is mandatory. Health measures, integrated research project and follow-up assessments are needed for providing innovative interventions and solutions for decision makers and for initiatives of prevention.

CLIMATE CHANGE AND GLOBAL SOCIAL EFFECTS

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Contemporary society holds enormous potential to reduce the social effects resulting from climate change either through the creation of economic conditions aimed at a better redistribution of resources and through the opening of new systems of participation in the life of society.

The emergence of new information and communication technologies represents an opportunity in this direction. Information strategies are an integral part of adaptation such as, for instance, alerting systems that ensure awareness of natural hazards and timely responses to adverse weather conditions with the aim of avoiding the risk of an ever-widening gap between those who have access to new knowledge and those who remain excluded. Therefore, it is necessary to think not only in terms of environment, but also of social considerations when it comes to climate change, in order to understand the fragile balance of the ecosystem in the global functioning of human societies.

The study of climate change, without abandoning its traditional field of investigation, also intervenes with regard to contemporary society, on global anthropological and ecological transformations, also due to the interaction between evolutionary factors such as social, environmental, cultural, economic and technological factors.

Researchers of climate change in various areas estimate that the changes under way are modifying, in an irreversible way, our daily way of life, the way of thinking, of perceiving the world as well as the human coexistence.

Hence, that leads to the inevitable environmental migration towards safer areas that offer a greater possibility of social recovery. Likewise, the short or long-term effects of climate change (floods, droughts, rising sea levels, melting glaciers, etc.) push people towards more resource-intensive territories. Indeed, the populations of the South of the world are those that suffer the most the greatest social consequences of climate change such as the lack of water, the spread of new diseases for the migration of vectors and pathogens and temperature variations that mainly affect the poorest rural populations. The populations that have contributed the least to the degradation of the planet and its overheating are also those that have paid the most for the costs of climate change.

The various international and national organizations, either public or private, shall concentrate their efforts on the concept of medium-range theory, namely specific theories for a limited set of spatial data in the fight against climate alteration with consequences on the ecosystem that inevitably have repercussions on life systems and social processes.

GLOBAL ENVIRONMENTAL CHANGE AND MEDICAL DEVICES

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Globalization and urbanization are a challenge for the ability to protect public health. Indeed the anthropogenic impact is changing the environment on a global scale. These changes can have direct and indirect effects on the health of populations and animals, with the introduction new diseases. Heat waves and floods are an example of these changes. The consequences of Global Environmental Changes (GECs) on human health and well-being are stronger in urban centers where 70% of the European population lives. The most vulnerable population involved is the one that represented by income, elderly, children, immigrants and people with housing conditions precarious and chronically ill. In this context, the use of appropriate medical devices can also help mitigate the effects of climate change. The study of lifestyles, the quality of the environment and possible fields of application can be useful factors in the identification of possible types of medical devices that could help to support the therapeutic needs and the prevention of health both in everyday life, and in case of environmental alerts.

The Italian National Institute of Health, at the request of the Ministry of Health, is carrying out a study on the potential role of Medical Devices (MDs) in the mitigation of the effects of GEC on human and animal health in order to promote virtuous behavior through the implementation of the objectives set out in a new white paper.

The activities of the ongoing project concern some aspects aimed at achieving the goal. Two types of questionnaires were validated: one for medical doctors and veterinarians, and the second for MD manufactures. The preliminary data obtained from the current investigation confirm the strong connection between the global environmental change and the increase in the use of some MDs.

In fact some MDs can be useful to face an increase of pathologies linked to the increase in the contamination of ecosystems (allergies, respiratory deficiencies, ocular dryness, etc.), due to the change in climate, but also to the growth of topical problems (redness, swelling, small blisters, etc.) related to pests and insects that increase with the general change in the seasonal climate.

These preliminary data are also confirmed by the results obtained from the analysis of the questionnaires send to the manufacturers of MDs, who declare that differently from the past, there is no more seasonality in the production of some medical devices, in view of their market demand throughout the year.

ARE CLIMATE CHANGES TO BE ATTRIBUTED ONLY TO GREENHOUSE GASES? A POSSIBLE ROLE OF PLASTICS

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Surely the atmospheric pollution plays a main role in the climate changing; carbon dioxide is recognized as the main responsible and at world level guidelines or laws point to decrease its concentration in all the combustion process. Lots of researches deal with the problem of greenhouse gases while pollution of the other environmental compartments is little or not considered in climate studies.

Plastics are currently ubiquitous as, directly or indirectly, used in all industrial sectors. The effect of their disposal has been recognized as devastating both at an aesthetic level and above all for the effects on the aquatic environment that touches man through the food chain.

Even if plastics were found in the marine environment as early as the 1964, at the first, researches have treated big pieces or complete objects and, due to the main interest for ecologists, a wrong nomenclature between macro, and micro-plastics is still to date used. For the last, an increasing interest is demonstrated by the exponential increase of articles: from 1 in 2001 to more than 200 in 2017. As for the macroplastics, most of the articles on microplastics treat with their presence in the marine environment and food coming from it. Our preliminary studies on microplastics evidenced a scarce analytical attention in many of the articles on the topic, in particular we noted a high probability of errors coming from the very easy pollution of samples from the environment. As a matter of fact, we found that plastic fibers can pollute samples in a standard laboratory, due to their indoor presence, while fibers present in the samples, due to their lightness, can be easily removed also by a weak air flow. We also found many fibers in rain waters that demonstrated their presence in the atmosphere; in our opinion, such presence surely changes the optical properties of air and, in turn, those of the light that crosses it with a, negligible or not, possible influence on the Temperature. On the other hand, it is sure that the presence of plastic on the surface of water bodies let a decrease of their gaseous exchange with the atmosphere as well as to an alteration, both in intensity and spectrum, of the solar light crossing the water layer. It is also well known that the sea accumulates heat during the day and releases it during the night. Plastic present on soils by similar mechanisms can alter photosynthetic processes influencing the carbon dioxide concentration in the atmosphere.

A ROADMAP ON EFFECTS OF "LOW CARBON POLICIES"

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The strict correlation between the rise of the greenhouse gas concentration in the atmosphere caused by mankind's activity over last century and the global warming became the commonly accepted explanation by the international scientific community. Reached almost unanimously, but not yet equivalently ratified, the Paris agreement during the COP21 in 2015, represents an extremely important step in the fight against climate change. The ambitious goal to keep a 2°C degree rise in average temperature translates into the implementation of strong GHGs emission abatement by each country. The sixth report of the IPCC panels is undergoing but already sophisticated models provide the necessary curves on total emissions of GHGs. The current estimation on the abatement of GHGs are mostly based on the energy sector, the only one with a defined roadmap for decarbonization, through the change in the mix among fossil fuels (coal, oil and natural gas) and the shift to renewables energy generation. Still to be defined the contribution by the other sectors that have relevant emission levels. Unfortunately, if strong regulatory and political actions are not going to be taken in next years, the current path of reduction is not able to achieve the main goal. It is therefore necessary to analyze the potential impact on the environment and the biosphere by making more severe hypothesis on global warming. The current models on health impacts actually take already into consideration, first of all: drought, ecological change, and with both the amplification of climatic events - floods & storms, extreme temperatures - also the environmental increase of exposures as to the air quality (air-pollution), UV radiation and radiations (radiation dispersions); as important as it is drinkable, fresh and sanitized water for people. In addition to the energy sector we must reduce GHGs emissions from all anthropic activities such as: private heating from fossil sources, vehicular traffic, intensive livestock breeding, hoping to reverse the path to the COP21 Paris goal, on the other hand, from today, primary health prevention measures must be implemented on fronts such as air pollution, radiation and the protection of drinking water for the populations, associating them with control measures and prevention on the adverse effects of the climate that will amplify in the coming decades. The effort made in this sense will have to be continuously measured by the IPCC panels to evaluate their effectiveness and any corrective actions in progress.

CLIMATE CHANGE AND ENVIRONMENTAL CONCENTRATIONS OF OZONE IN URBAN AREAS. THIRTY YEARS TRENDS DETECTED AT THE ATMOSPHERIC POLLUTION DETECTION STATION OF THE ISTITUTO SUPERIORE DI SANITÀ

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The main expression of climate change is the increase in air temperature and the increasing number of extreme meteorological events, such as heat waves. The strong relationship between temperature and ozone formation as well as the association of adverse health effects, in particular for sensitive populations, and ozone exposure is known. These conditions are even more serious in urban areas where a large number of emission sources of ozone precursor pollutants are present and the phenomenon of heat island increases the air temperatures.

In Italy, the analysis of the climate historical series has shown, over the last two centuries, a clear increase in temperature; evidencing, from 2003 to today, the six warmest years since the beginning of meteorological surveys.

The analysis of ozone data observed at the air quality station of Istituto Superiore di Sanità (ISS), since 1984 shows that the annual average concentrations of ozone and temperatures, in the warmest semesters of the years, were well correlated.

An increasing trend in annual average concentrations from 1984 to 1999 is observed, with a mean growth of about 0.5 μg/m3 (1.6%) per year. This trend is probably due to the change in environmental concentrations of the ozone precursors and to meteorological conditions occurred during the period. This result is in line with other Italian studies that estimate, in the period 1979-2001, for central Italy, an increase in the range of 1-5%, per decade, of average ozone concentration, attributable only to meteorological variability.

From 2001 to 2017, at the ISS station, a stable trend is detected, although a significant reduction in the concentrations of the main precursors were measured. The average daily concentrations were usually higher on weekends days (Saturday and Sunday), when a lower emissions of ozone precursors is measured. The phenomenon is presumably due to the relative reduction of NO_X concentrations, with an increase in the VOC/NOx ratio.

The assessment of daily, annual and longer-term trends, as well as the ozone relationship with temperature and other pollutants emissions, in urban areas, is an important issue to be addressed and deepened in order to provide effective support to adopt the most appropriate control policies of the pollution and health protection.

IN VITRO EVALUATION OF GENOMIC DAMAGE INDUCED BY 2.5 PARTICULATE MATTER ON HUMAN LYMPHOCYTES

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Background. The increased exposure to environmental pollutants has led to the awareness of the necessity for constant monitoring of human populations, especially those living in urban areas. Indeed, the prolonged exposure to high levels of urban pollution was associated with increased risk of cancer, especially lung cancer. In this scenario, biomarker-based studies may represent useful tools providing a better understanding of the contribution of atmospheric pollution to the overall genotoxic burden suffered by urban residents.

Aim. We analysed the effects of urban air fine particles (PM2.5) on human lymphocytes by *in vitro* Micronuclei (MNi) assay. MNi originate from acentric chromosome fragments or whole chromosomes that fail to segregate properly during mitosis and appear in the cytoplasm of interphase cells as small additional nuclei. Therefore, MNi assay allows the evaluation of both clastogenic and aneugenic effects of different xenobiotics and published studies provided evidences for a relationship between high levels of MNi in peripheral blood lymphocytes and increase of cancer risk.

Study Area. Meteorological-chemical stations were positioned in the urban area of Turin (Italy), a city located in the Po river valley, an area where air exchanges are limited by the surrounding mountains, winds are weak, and air pollutants can accumulate easily. For these reasons, Turin is one of the most polluted European cities and, for many years, the average annual PM2.5 pollution in Turin was higher than limits set by the WHO.

Methods. PM2.5 sampling was performed from January to December 2017, using a sampler, according to directive UNIEN14907. Peripheral venous blood was collected from 5 healthy subjects. Lymphocytes were exposed to four concentrations of PM2.5: 5, 10, 15 and 20 μg/mL. MNi, Nucleoplasmic Bridges (NPBs) and Nuclear Buds (NBUDs) were scored in 2000 binucleated lymphocytes per subject per concentration, whereas the Cytokinesis-Block Proliferation Index (CBPI) was calculated on a total of 1000 cells observed.

Results. PM2.5 significantly increased the frequencies of MNi, NPBs and NBUDs at all concentrations tested, with respect to controls. Vice versa, the CBPI was significantly reduced only at the concentrations of 15 and 20 μg/mL, indicating that the PM2.5 cytotoxicity threshold could be close to 15 μg/mL.

Conclusion. Although simple *in vitro* experiments cannot accurately mimic the complex *in vivo* kinetics of xenobiotic compounds, the results we obtained point to the necessity of further investigations in order to establish the adoption of more stringent measures reducing the presence of these pollutants in the environment.

INVESTIGATING THE INFLUENCE OF LOCAL METEOROLOGY ON AIR QUALITY USING BOOSTED REGRESSION TREE TECHNIQUE

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Weather exerts a strong and complex effect on the ambient concentrations of pollutants, making the air pollution sensitive to climate change. The local meteorological conditions can affect the temporal and spatial variations in the atmospheric pollutants, hiding their real concentration trends and making difficult to assess the improvements due to the changes in the emission levels or to the air pollution control policies.

A deeper investigation on the sensitivity of the air pollutants to individual meteorological parameters is, therefore, required. This represents a challenging issue due to the complex interactions between variables and the rarely linear relationships between variables themselves. Moreover, the effects of the aforementioned interactions can vary from one air shed to the next as well as across seasons, requiring site-specific assessments for characterizing local responses.

Advanced data mining and machine learning methods, such as the neural networks and Boosted Regression Tree (BRT), are being increasingly applied in air pollution field to model the nature of pollutant response to individual meteorological parameters in a flexibly way, also taking into account the non-linear effects and the interactions between variables.

The present work explores the potentiality of BRT to describe the relationships between meteorological variables and air pollutants in an industrial site of south Italy housing the largest European on-shore reservoir and the largest crude oil pre-treatment plant within an antropized area.

For this purpose, a BRT based model has been developed using pollutant concentrations data (mainly those referable to plant emissions such as NO_x, SO_2, etc…), as dependent variables, and meteorological data (wind speed and direction, temperature, pressure, etc…), as predictor variables. Besides meteorological predictors, variables representing temporal trend (daily, weekly, yearly and seasonal variability), have been added to improve the model explanatory power. All data used in this work have been monitored by the Environmental Protection Agency of the Basilicata Region, in an area close to the plant, from 2006 to 2016, and made publicly available.

As a result, the relationships between each pollutant and each predictor have been quantified on a percentage scale and graphically visualized, providing essential information on the interactions between the industrial emissions, the meteorological conditions and the air quality levels in the examined area.

These findings may contribute to optimize the health-relevant measures of air quality. Moreover, an improved understanding of the influence of meteorology on the air pollution processes at local scale can advance our knowledge on air quality-climate connections.

APPLICATION OF AEROBIOLOGICAL PROCEDURES IN INDOOR WORKPLACES TO ASSESS POLLENS AND FUNGAL SPORES

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Despite past, as many people spend most of their time in indoor environments (more than 90% in Europe and America) indoor air quality is a key issue for occupational and human health. Air pollution is the major environmental health risk in Europe, responsible of adverse health effects well documented from the results of an extensive research in many countries. Over the last years, air quality monitoring is gaining attention as exposure to biological and chemical pollutants to identify combined effects on occupational and human health. Given that, the pollutant believed most dangerous to public and occupational health, is Particulate Matter (PM), its adverse effects have been investigated in detail in the literature. The U.S. Environmental Protection Agency (EPA) defines PM "as a mixture of extremely small particles and liquid droplets comprising a number of components, including "acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen and mold spores)". Indoor PM can originate from various indoor sources, including heating, smoking and from outdoor particles so indoor PM may exceed outdoor PM levels.

In general, we apply some conventional methodologies used for outdoor air quality to evaluation of indoor occupational settings, focusing on the aerobiological monitoring according to UNI 11108/2004 and following. In this work, we have considered a winter field campaign of aerobiological particle in a Research Center. We have selected our data in two classes: *working hours* (7.30 a.m.-7.30 p.m.) and *non-working hours* (7.30 p.m.-7.30 a.m.). By the comparison between two classes, our results seem to indicate an increase in aerobiological particles concentrations during working hours. We have found an increment of 91% for pollens and 83% for fungal spores during the daily hours compared to the night ones. These values confirm the role of individuals as passive source of biological diffusion. Because of this evidence, in order to assess risk to exposure to biological allergens, these results may be useful to implement preventive measures based on control strategies to reduce dangerous effects on worker's health.

THE SUSTAINABILITY OF PLASTICS IN THE LIGHT OF GLOBAL CLIMATE CHANGE

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The ubiquitous issue about plastics is related with its major impact on the aquatic ecosystems, with its production from the depletion of non-renewable fossil fuels, with its continuous and unfair use in consumer goods with short life.

Single Use Plastic items represent about 50% of all marine litter items found on European beaches by counts. Top-10 SUP plastic items represent 86% constituting thus 43% of all marine litter items by count.

For these reasons the challenge on plastics sustainability is actually based on three pillars: in the substitution, when it is possible, of the use of fossil fuels as a raw material for plastics; in the ubiquitous decrease of use, at a global level, of plastic items starting from single use and coming to poor post-consumer management; design and re-engineering of plastic products.

Making sustainable plastics in the perspective of global environmental changes necessarily means freeing up production from fossil raw materials. New zero fossil-carbon polymers have to be developed from renewable materials, mainly agricultural production waste not aimed at their production, which are durable in their use, but biodegradable, both on land and in the marine environment, according to validated international standards.

The ban of the use of plastic from fossil sources products must be pursued decisively, starting from the countless single-use products. This can be achieved by simultaneously implementing alternative solutions, with different and/or reusable, and multi-use materials.

Short but large-scale supply chains must be redesigned, with sustainable industrial processes especially in the value chain of plastic in contact with food and beverages, maintaining the highest standards of health protection for users, both through the design of new materials and products, creating the so-called re-engineering “benign by design”.

At the same time, the management of plastic products that become waste must find a new and decisive development in local management, in the single product, even for the individual types of plastic. This is necessary to optimize the recovery and recycling of the plastic material according to the highest quality standards, of course, from the perspective of possible contaminants and to allow all possible secondary uses, so that the product value chain does not fail, involving the unsustainability of the processes.

The aim is to find a new dimension for these issues in the European directives, however will be the policies and the research to mark the step for sustainability of the plastic and to improve the health of ecosystems for the future.

CYANOBACTERIAL TOXINS AS AN EMERGING PUBLIC HEALTH RISK: OCCURRENCE IN INLAND WATERS OF GREECE

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Toxic cyanobacteria are becoming one of the greatest inland water quality threats to public health and aquatic ecosystems worldwide. Several studies indicate that freshwater cyanobacterial blooms are increasing globally, favored by rising temperatures and nutrient concentrations. Cyanobacterial toxins (a.k.a. cyanotoxins) comprise a wide range of diverse secondary metabolites that are toxic to aquatic organisms and humans, such as cyclic peptide microcystins or alkaloid cylindrospemopsins, saxitoxins and anatoxin-a. Main routes of human exposure to freshwater cyanotoxins are drinking water consumption, contact or ingestion during recreational activities in lakes, accumulation through the food-web and inhalation of aerosols near surface water bodies.

Monitoring of a wide range multi-class cyanotoxins in surface waters is essential in order to assess the possible risks for human health. Reports of the occurrence of cyanotoxins are generally spatially and temporally scattered and fragmented; past studies have mainly focused on certain classes of compounds, especially on microcystins, or on a limited number of waterbodies. Also, in many studies screening methods were employed (e.g. ELISA), that are not conclusive of the presence of cyanotoxins. Our group developed and validated new LC-MS/MS methods to study the occurrence of multi-class toxins in Greek surface water bodies. Those methods were used in a wide multi-lake study that aimed to conclusively report the presence of multi-class cyanotoxins in Greece, to investigate incidences of "cyanotoxin cocktails" and to review and confirm earlier studies and results.

A wide range of cyanotoxins (CYN, ANA-a, STX, neoSTX, dmMC-RR, MC-RR, MC-YR, MC-HtyR, dm3MC-LR, MC-LR, MC-HilR, MC-WR, MC-LA, MC-LY, MC-LW and MC-LF) were detected in Greek lakes, with microcystin congeners being the most commonly occurring. Several microcystin congeners, as well as cylindrospermopsin and anatoxin-a were conclusively identified for the first time in Greece. Saxitoxins were also reported for the first time in three lakes. Mixtures of hepatotoxins (microcystins, cylindrospermopsin) and neurotoxins (anatoxin-a, saxitoxins) were also reported in several lakes for the first time. Results of this multi-lake survey, including harmonized-validated protocols for wide-range cyanotoxin monitoring, set a basis for assessing drinking water and recreational health risks, as well as for future evaluation of the effects of rising temperatures on the proliferation of toxic cyanobacterial blooms.

PREDICTING PRESENCE-ABSENCE AND RESPONSE TO CLIMATE CHANGES OF THE CRITICALLY ENDANGERED FISH SPECIES SQUALIUS LUCUMONIS IN ITALY

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An increasing number of studies on aquatic biodiversity conservation have been recently based on habitat modeling. This approach was also used for fish fauna, aimed at identifying the ecological requirements for the life of stream fish and at predicting species distribution up to the year 2070, based on climate change scenario A1F1, which foresees a 4°C warming. In this case study a Random Forest model based on the integration of landscape-scale habitat variables and fish occurrence was used to obtain distribution maps for the IUCN Critically Endangered Squalius lucumonis, an endemic and moderately thermophilic fish species of the Tyrrhenian river basins of Central Italy. Model performance was evaluated by means of Cohen's Kappa. Air temperatures and rainfall were identified to be the most relevant abiotic characteristics driving fish distribution. The model predicted an upstream shift of the suitable area for this species, mainly due to water temperature warming. The new insights into current and future distribution patterns of this species might represent a valuable tool to monitor ecosystem health and to identify sustainable management strategies based on specific actions plans for the conservation of this species.

A SMALL AQUATIC ECOSYSTEM IN URBAN AREA: THE CASE STUDY OF ROME

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Small wetlands are object of several studies aimed at their safeguard and management as they are extremely important for a correct conservation of the humid areas.

The small watercourses present in the urban area of Rome need a preliminary ecologic characterization in order to finalize future requalification interventions.

In this study 13 sampling sites have been selected along 6 small tributaries of Tiber and Aniene rivers. The analysis of the macrophytic community has been performed according to the indications reported in the ISPRA biologic protocols using Indice Biologique Macrophytique en Riviere for the evaluation of the ecologic status.

For heavy metal analysis water and sediment were analyzed and the concentrations were evaluated by EPA method followed by mass spectometry analysis.

Analysis of macrophytic community showed a difference among the tributaries as well as among the sampling sites. Mcrophytic community was absent or very simplified in the majority of the stations. Because of the low percentage of macrophytic coverage it was possible to calculate IBMR only in 4 stations with a medium and very high trofic level. These results can be due to the several pressures on watercourses such as bank modification and periodic cleaning, diffuse pollution, and to natural factors, such as the types of substrate. In this study, the limit values defined by the D.lgs 152/2006, were considered relatively to sites for public, private, and residential green for soil instead of limit values of Marine water and sediment (D.lgs 260/2010).

In the sediments B, Co and Zn were above the limit in all the stations and in two stations also As, Cu, Pb, V overcome the limit. In water B was over the limit in all the stations. As and Mn were over the limit in some sampling stations.

These results can be attributed to natural contribution and to diffuse pollution in the areas surrounding the watercourses.

The results of this study show a high heavy metal contamination in all watercourses analyzed. Further and more detailed analysis on the different sources present on the territory are need to address the restoration interventions.

BIODIVERSITY SPOTS IN URBAN AREAS: THE GARDEN OF THE ITALIAN NATIONAL INSTITUTE OF HEALTH (ISS)

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Urban green areas, although small, may play a key role in locally reducing adverse effects of climate changes: they can contribute to biodiversity conservation and to population health by mitigating heat waves.

In the Istituto Superiore di Sanità (ISS) there is an historical garden dating back to the Institute's foundation (over 80 years ago). Besides its architectural role, it has an important function in the workers welfare (aggregation and relax). This main and other secondary green areas of the Institute host historical fauna and flora that over the years have been integrated with invasive animal and plant species, often coming from typically tropical habitats/environments. In particular, over a period of 15 years, opportunistic and occasional samplings in the gardens and in the green areas of the Istituto Superiore di Sanità, have revealed the presence of more than 60 different species of insects, belonging to 11 taxonomic orders. Among these, we report *Aedes albopictus* (Diptera, Culicidae) at present, ubiquitous in our country, *Rhynchophorus ferrugineus* (Coleoptera, Curculionidae) and *Paysandisia archon* (Lepidoptera, Castniidae). These latter two species were introduced in Italy in 2002 and 2004, respectively and are both responsible for the destruction of many varieties of palm trees (plants diffusely utilized in the garden).

Other examples of naturalized insects are *Bruchidius siliquastri* (Coleoptera, Bruchidae), which infest *Cercis siliquastrum* seeds (Judas tree), *Lauritrioza alacris* (hemiptera) which attack the laurels, *Latipalpis plana* (Coleoptera), the oaks and *Eucallipterus tiliae* (aphid) the tilia. Among the flora we found species such as palms, laurels, pine trees, cedars of Lebanon and tilia all common in early 20th century gardens and other spontaneous species such as caper and maidenhair.

This is a small contribution to the knowledge of the entomological fauna and flora of this area, but highlights the role that green spots play in providing food and habitats for several species of insects, and also in maintaining a relevant degree of biodiversity within a metropolis like Rome. Protection of these small green areas and of their characteristic biodiversity includes also the mitigation of alien and invasive species propagation. Due to climate changes, these species tend to invade the habitat of the autochthonous species and/or attack species historically present in Italian green areas. The ISS, aware of the role of this small hot spot (biological, social, historical, health) considers the garden a flagship to preserve and develop with a view to raising awareness among citizens and workers.

BIODEGRADABLE PRODUCTS - ALTERNATIVE OF PLASTICS AS A MAJOR THREAT FOR THE WORLD OCEAN

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The most common type of contaminants found in the environment are plastics, especially plastic bags, bottles and single-use plastic bags. Options are being developed for new environmentally friendly produced organic, bio-degradable and recyclable and energy efficient, alternative packaging materials. The production of such products in the last decade can be compared with that of the whole XX century. If this trend continues calculations show that in 2020 the European Union market will release 66,5 Mt plastic, and by 2050 the world production of plastics will triple.

Plastics is a serious threat to the environment. In fact, it is almost eternal. Sea water cools it significantly, obstructing sunshine and heat, which prolongs the period of its decomposition. For a piece of plastic to be completely degraded takes centuries.

WHY DIATOM COMUNITIES REPRESENTA RAPID RESPONSE TO THE ENVIRONMENTAL CHANGE?

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Few objects are more beautiful than the minute siliceous cases of diatoms: were they only created to be admired under the microscope? asked Charles Darwin in 1859.

These brown algae in the class of Bacillariophyceae, can represent a rapid respond to environmental change, due to their wide distribution in aquatic ecosysmtes, the most important and dominant component of the benthic and planktonic assemblages and their characteristic of biological indicators.

The siliceous cell wall, called frustule and its ornamentations are species-specific ornamentation, and identification of diatoms is based on morphological analysis of this.

Global environmental changes caused by human activities as excessive land use and deforestation, hydro-morphological alterations, emissions of chemical contaminants can modify, sometimes permanently, the structure and the composition of aquatic ecosystems.

These alterations can be recovered by diatoms communities analysis because they have strict ecological needs concerning to physical variables and chemical parameters as nutrients and or organic pollution. For example, alterations due to eutrophication and organic pollution can be detected by presence/absence or dominance of some taxa. Indeed several biotic indices have been developed on sensitivity and reliability as indicator of freshwater diatoms.

The consistency of diatom analysis is well recognized and they are one of biological elements required by Water Frame Directive 2000/60/CE, for the ecological status assessment too.

A shift from adnate pioneer taxa to filamentous species can respond to variation of current speed, degradation of river habitat are recognized by a dominance of planktonic form instead of benthic ones; indeed in four weeks diatom community can be restored by an extreme events, such as flooding.

Chemical contaminants, uptaken within cell can induce malformation at cell wall made of silica such as abnormal valve outline, abnormal striation pattern.

Indeed Diatoms, representing the first trophic level of ecosystem, respond rapidly to environmental change and act as early indicators of environmental change.

ENVIRONMENTAL CHANGE ON AQUATIC ECOSYSTEMS: A LOCAL STUDY FOR ASSESSMENT OF ECOLOGICAL QUALITY STATUS AND RELATED MICROBIOLOGICAL RISKS

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The anthropogenic pressure as well climate change can affect the structural and functional role of aquatic ecosystem, the latter are systems of primary importance for human being because they provide several benefits among which water and food supply, microclimate mitigation, tourist and recreational aspects enhancement, etc.

Moreover, the human health can be directly or indirectly the influence of environmental factors, for example the human being can be exposed to contaminants through aquatic ecosystem. Regarding to the assessment of surface water quality the Directive 2000/60/EC (*Water Framework Directive - WFD*) establishes a framework for Community action which consists on the analysis of biological community (diatoms, macroinvertebrates, macrophytes and fishes) but there is not addressing to the evaluation of water quality from sanitary hyenic point of view. The purpose of the study was to evaluate the environmental impact of exceptionally water abstraction of a Tiber river tributary as well as deepen the knowledge on the linkage of human and environment health.

The 2017 summer, in central Italy was characterized by high temperature (heat wave) and rainfall scarcity that causing an impact on the main reservoir of drinking water (Bracciano Lake). To avoid a reduction supply of drinking water to people living in urban and sub-urban area of Rome, as well as to preserve the lake ecosystem, the local authorities adopted an extraordinary plan. The action plan consisted in the reduction in terms of liters/per min of water abstraction from lake and this hydrological gap was filled by the water abstracted from a Tiber River tributary (Farfa River). The experimental approach, based on the assessment of environmental parameters and ecological status using biological indicators according to the *WFD* (2000/60/CE). At the end the evaluation of microbiological risk was evaluated through the of potential pathogens recovery.

Water, sediment and biological samples were collected in three sampling points along Farfa river in different campaigns one before the abstraction (September 2017) and other two performed in April and June 2018. The results of this study showed that overall sites are in a good ecological status, but on the contrary, an environmental circulation of pathogens has been observed. In conclusion, the ecosistemic approach adopted in this study to describe the ecological status of surface waters and the related risk for human being have provided a complete vision useful for the planning of prevention and /or protection measures both for aquatic ecosystem and human health.

WATERBORNE PATHOGENIC PROTOZOA SURVIVAL TO CLIMATIC CHANGES

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Global climate change is causing the average temperatures increase and consequent intensifying of the hydrological cycles. Heavy precipitation events promote the sewage effluent provision in rivers, lakes and sea whilst drought leads to waterborne pathogen concentration. Both the extreme events affect the drinking water supply, indirectly, causing severe consequences to public health.

Performing a scientific literature review based on Medline database and appropriated key words; it has been possible to identify waterborne outbreaks worldwide potentially linked to different types of extreme weather events.

Unfortunately, gaps in knowledge on relationship between extreme climatic events and diseases still exist whereby research has to be encouraged to suggest actions for health prevention in this context.

In our experience, one year monitoring of lake waters normally used for recreationally purposes, gave evidence of cysts/oocysts of pathogen protozoa belonging to different species, in presence of high rainfall. The analysis on the same sampling sites after two years of strong increase in drought and high decrease of water level has given evidence of a different environmental contamination pattern and a changed risk exposition for human health. This study provides useful suggestion for a health prevention approach in presence of extreme climatic events.

WATERBORNE NOROVIRUS EPIDEMICS IN ITALY AND THE POTENTIAL IMPACT OF CLIMATE CHANGE SCENARIOS - A REVIEW

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Norovirus (NoV) is the leading cause of acute gastroenteritis (AGE) in humans worldwide. It is responsible for substantial morbidity and mortality across all ages, and for substantial healthcare costs. According to CDC data, every year NoV causes 685 million cases of AGE, about 200 million of which are among children less than 5 years of age.

NoV is recognized as "the ideal human pathogen", having all the attributes of a perfect infectious agent: it is abundantly shed, highly contagious, persistent in the environment, has a broad genomic diversity, and is constantly and rapidly evolving. Transmission of NoV occurs through contaminated food, water, surfaces or by person-to-person contact. NoV is a major agent of waterborne disease worldwide, often caused by sewage contamination of wells and groundwater or recreational water. In Italy, several waterborne NoV outbreaks have been documented, and the virus has been frequently detected in different water environments. Owing to its winter seasonality, NoV has been referred to as the "winter vomiting disease virus". Outbreaks do occur during summertime, however, albeit at reduced rates.

Climate change is likely to influence the seasonal patterns of NoV infection, as well as its prevalence, geographic distribution, and transmission.

The presentation will touch upon the prevalence and concentration of NoV in different water environments in Italy (sewage, river, lake, seawater), and provide an overview of the waterborne NoV outbreaks reported in this country since 2000. Based on current knowledge, we will then consider likely direct and indirect consequences of climate change on the risk of waterborne NoV infection to support preventive and response actions within risk analysis for water resources, supply and uses.

RELATIONSHIP BETWEEN CLIMATE CHANGE AND AQUATIC ECOSYSTEM MONITORING: THE CASE STUDY OF BASILICATA REGION

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In the monitoring of the aquatic ecosystem by the use of the the biologic elements, the *Agenzia Regionale per la Protezione Ambientale* (ARPA) have to plan activities based on the sampling periods which are indicated in specific protocols of *Istituto Superiore per la Protezione e la Ricerca Ambientale* (ISPRA). In this context the *Istituto Superiore di Sanità* (ISS) stipulated a scientific collaboration with ARPA Basilicata finalized to evaluate the ecologic status of surface water and to improve the monitoring network.

In 2017 and 2018 two monitoring campains were performed which included sampling and analysis of the biologic components: diatoms, macroinvertebrates and macrophytes.

In particular, analysis of macrophytes are taken into account to evaluate the ecological status of watercourses in summer 2017 and 2018.

During the sampling, microclimatic changes were recorded along the same sampling season as well as the two monitoring campains into the same aquatic ecosystem.

During 2017 some areas of the Region recorded very high temperatures and low rainfall, causing water scarcity whereas in 2018 heavy rains caused flooding which prevented biological sampling.

The summer monitoring in 2017, in some aquatic ecosystem, reported an algal bloom (*Cladophora spp.*) coincident with macrophytes maximum development, causing an alteration of biological communities.

During the monitoring in 2018 the algal bloom has not been recorded but has been recorded from ARPAB technicians in the following months coinciding with low level of river water. The two years' study in Basilicata region underlines the need to rightly time the sampling campaigns in rivers.

The assessment of the effects of the climate change on the water cycle at regional level and their management, according to sustainable uses, identifies the pathways of analysis and definition of very complex risks.

Intense rainfall events or long periods of drought involve economic and social aspects mainly for the Basilicata region which shares water resource with other regions.

WATER QUALITY UNDER WATER FRAMEWORK DIRECTIVE AND CLIMATE CHANGE

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Water is a crucial resource for human health, generating and sustaining economic growth and prosperity, and it is also at the core of natural ecosystems and climate regulation. The EU's water policy has been helping to protect our water resources since the adoption of the Water Framework Directive (WFD: 2000/60/EC) in 2000. The WFD establishes a community framework to protect all waters in the European Union adopting common objectives, principles and basic measures and through an integrated management of water resources, aimed at sustainability. The main aim of WFD is to achieve "good ecological and chemical status" of all waters by 2027 at the latest. Adequate actions have to be developed in a six-year cycle. Climate change also affects aquatic ecosystems. In the past two decades policy discussions and scientific studies have not always underlined the important linkages between water quality and climate change, whereas the impacts of climate change (rainfall and temperature) on the quality of freshwater systems are likely to be significant. The expected changes in rainfall and air temperature, for example, could affect river flows and increase sediment loads, causing alteration in river morphology, transfer of sediment to lakes and therefore modifications of natural habitats in both ecosystems. Although climate change is not explicitly included in the text of the WFD, the European Commission requested Member States, starting from the second River Basin Management Planning (RBMP) cycle, to take climate change projections into due consideration within the assessment of pressures and impacts, monitoring programs and design of measures. Among the first actions it is helpful to assess direct and indirect climate pressures on ecosystems and detect climate change signals through monitoring data from existing networks. Robust information on changes at reference sites, locations that by definition are subject to limited anthropogenic modification, is the primary means of distinguishing between the impacts of human activities and the ones of climate changes. Although in Italy improvements have been made in the planning cycles, the challenge for the future is to improve the knowledge of climate change impacts on water bodies in order to manage them more and more properly.

CHARACTERIZATION OF A2 ADENOSINE RECEPTORS ROLE IN HEAT STRESS-INDUCED SYNAPTIC AND COGNITIVE IMPAIRMENTS IN MICE

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Among the various climate changes, global warming and extreme high air temperatures directly contribute to deaths, particularly among elderly people. In the heat wave of summer 2003 in Europe for example, more than 70.000 excess deaths were recorded. While heat stress-induced cardiovascular and respiratory diseases are well-known phenomena in humans, the brain (synaptic, memory, cognitive) impairments due to high temperatures are less characterized. The heat waves (HWs) have devastating consequences for public health globally, and, recently, it has been demonstrated what even common sense suggests, namely that residents of non-air-conditioned buildings have reduced cognitive function during a heat wave. Heat stress induces many pathophysiological responses and has a profound impact on brain structure. It has been demonstrated that exposure to high temperature induces cognitive impairment also in experimental animals. Although the effects of heat stress have long been studied, the mechanisms by which heat stress affects brain structure and cognition are not well understood. While the contribution of adenosine A_2 receptors (A_{2A}Rs) activation to cutaneous vasodilatation during hyperthermia has been extensively investigated, their role in temperature-dependent brain alterations has never been evaluated.

For a first general characterization, the basal levels and functional features of A_{2A}Rs in C57Bl/6 mice exposed to heat stress once a day for 7, 14, or 45 days, respectively, will be studied in old (40 weeks of age) mice. Heat exposure will be achieved by transferring the mice from their home cage into a chamber maintained at 43°C and 60 ± 10 % humidity for 15 min once a day. We will evaluate if chronic inhibition of A_{2A}Rs is able to modulate the synaptic and behavioral alterations typical of heat-stressed mice; to this end we will treat mice daily, from 28 to 40 weeks of age (with heat stress between 34 and 40 weeks of age), with KW6002 (istradefylline), a selective A_{2A}R antagonist. We will perform extracellular electrophysiology experiments on hippocampal slices in order to evaluate a paradigmatic form of synaptic plasticity, namely LTP, in heat stressed- and control mice. As for the behavioral evaluation, the following parameters will be evaluated as a measure of drug effects: general health (body weight, food and water consumption) and cognition (Novel Object Recognition). Therefore, the aim of the present study will be to characterize the A_{2A}Rs role in heat stress-induced synaptic and cognitive impairments in mice and to predict their therapeutic potential in heat-related illness in humans.

IDENTIFICATION OF CYANOBACTERIA IN SURFACE WATER BY FLUORESCENCE *IN SITU* HYBRIDIZATION TECHNIQUES

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Harmful cyanobacterial blooms have been increasing in freshwater ecosystems in recent decades, mainly because of eutrophication and climate change. Of the 150 known cyanobacteria genera, more than 40 species produce toxins, which are natural compounds showing different chemical and toxicological characteristics. Cyanobacterial toxins are responsible for both acute and chronic poisoning in animals and humans. Among the main classes of cyanotoxins, microcystins are among the most frequently found in the environment. Fast and sensitive methods to identify unequivocally Microcystis aeruginosa and Planktothrix agardhii are very useful to discriminate these species with respect to the other non-toxic cyanobacteria. For this purpose, we designed, developed and validated some oligonucleotide probes (GNPlankS02, PkAgD03, MicAerD03) for FISH (Fluorescence In-Situ Hybridization) analysis to detect these species in freshwater samples. The FISH probes were designed using the ARB software with the Silva database in the framework of the MicroCoKit project. We tested different fixative methods to minimise the natural autofluorescence from chlorophyll-a to visualize Microcystis aeruginosa and Planktothrix agardii under a laser confocal microscope. Firstly, the FISH probes designed have been tested on pure cultures of M. aeruginosa and P. agardhii species, and then the probes were successfully applied to natural samples collected from surface waters.

A SIMPLE AND RAPID METHOD FOR THE DETECTION OF CAMPYLOBACTER BASED ON ELIME ASSAY PRINCIPLE

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Food- and water-borne infections are a worldwide problem, affecting both developed and developing countries alike. Campylobacteriosis is a gastrointestinal illness that produces diarrhea, fever and abdominal cramps. In addition to acute enteritis, campylobacteriosis may result in reactive arthritis and Guillain-Barre syndrome. Campylobacter jejuni is responsible for approximately 90-95% of the human cases, while Camplylobacter coli is responsible for the rest of infections. As the official cultural method for the detection of Campylobacter in food (ISO 10272) is labor intensive and time consuming, it is evident that alternative methods to perform rapid and multi-sample analysis are required.

In this work a sandwich ELIME (Enzyme-Linked Immuno Magnetic Electrochemical) assay to detect Campylobacter is presented. Magnetic beads (MBs), coupled to a strip of 8-magnetized screen-printed electrodes, were used as supported of a sandwich immunological complex. The enzymatic product is measured by Differential Pulse Voltammerty. Different antibodies were purchased and their functionality has been demonstrated in ELISA using a ready-to-use positive control of C. jejuni.

Then, the sandwich ELIME-assay was set-up and tested towards positive control and standardized pure broth cultures of two ATCC strains of C. jejuni grown in Tryptic Soy Broth (TSB), under microaerophilic conditions. Only the positive control gave an high current signal, while the pure broth cultures did not provided any response. Because from the literature it appears that the culture medium composition can influence the antigen expression and then the next interaction with antibodies, we prepared pure broth cultures of three ATCC strains of C. jejuni and one of C. coli, also in Bolton Broth (BBH), a specific medium for Campylobacter growth. All antibodies were then screened by ELISA as a function of the growth medium (TSB and BBH) and cellular treatment (i.e. whole cells inactivated with NaN3, heat killed cells) in order to select the optimal conditions for the ELIME assay. To date, the best results for C. jejuni and coli were obtained using standardized pure broth cultures prepared in BBH, heat killed cells, Polyclonal antibodies (PAb) from KPL, as capture element (on MBs surface), and the same PAb conjugated to Alkaline Phosphatase, as detection antibodies. The ELIME assay was designed so that the two sequential incubations for

the two immuno-recognition events occur in a single step of 1 h. Preliminary results regarding the application of the method to the analysis of surface water samples will be presented. The same samples were analyzed by Rt-PCR and ISO methods.

DEVELOPMENT OF A PORTABLE GENOMIC LABORATORY FOR WATER METAGENOMIC ANALYSIS

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Currently available methods for surface water microbiological monitoring are based on the analysis of a limited number of cultivable marker species and requires laborious and time-consuming microbiological approaches. Numerous studies are currently demonstrating the advantages of novel metagenomic analysis based on Next-Generation-Sequencing (NGS) for the characterization of microbiome in different environments. As compared to the traditional methods, these approaches potentially enable the characterization of every microorganism within a given community. However, the use of NGS methods is limited due to the need of specialized laboratories equipped with highly expensive instruments. Embedded within the European Intcatch project that aims at developing smart monitoring tools for water management, the present work focused on the setup of a portable genomic laboratory for the analysis of water microbiome on site.

The analysis of bacterial DNA was performed with a cheap and portable sequencer with small dimensions, i.e. few centimeters in size, and minimal requirement of power supply (USB connection). Most of lab equipment and reagents were optimized, and/or replaced, with portable, user friendly and stable reagents that could perform properly in the field.

Overall, the results obtained has highlighted the feasibility to perform rapid metagenomics analysis on-site, where the water samples are collected. Data generated with such portable genomic laboratory have the potential to provide the whole picture of water microbiome in real-time, thus unravelling the presence of pathogens as well as alterations of the bacteria community due to possible pollutants. Furthermore this tool, for the potential to give rapid results about the microbiome composition in the environment, can be used also as an early warning system in case of extreme weather events connected to climate changes.

NEW SOLUTIONS FOR DRINKING WATER PROTECTION IN RURAL AND URBAN ENVIRONMENTS: THE LOWER LLOBREGAT RIVER CASE STUDY

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Water is essential for life. We use it for drinking, food preparation, cleaning and recreational use. Despite this, the quality of freshwater in Europe is under constant pressure and not improving. This persistent problem is a big threat for our drinking water resources that will exacerbate with climatic change in areas that may suffer from extended drought periods. Diffuse pollution with pesticides and fertilizers (nitrate) of drinking water sources caused by agricultural activities remains one of the biggest problems to solve.

In this context, the WaterProtect project (Horizon 2020 programme) aims at developing new solutions and tools to effectively uptake and realize management practices and mitigation measures to protect drinking water resources. WaterProtect proposes seven European case studies in which multiple actors including water authorities, scientists, farmers and society are involved in water monitoring and management. One of these areas of study (action labs) is the lower basin of the Llobregat River (NE Spain).

The lower Llobregat River basin is located in the metropolitan area of the city of Barcelona. The catchment area includes more than 700 wells for drinking, agricultural and industrial uses and one point of surface water for the production of drinking water. The area presents many agricultural activities typical of the Mediterranean climate and high pollution also coming from urban and industrial sources (numerous wastewater treatment plants). This work presents the actions done within the WaterProtect project in this action lab.

Water management needs in the area were identified using a multi-actor participatory approach. Moreover, based on historical data and a participatory monitoring approach, knowledge gaps on the water quality in the area are being covered. A practical collaborative open access tool that integrates water quality data has been created. Best

management practices that can be successfully implemented in the action lab have been identified and they are being promoted among farmers. Finally, in the framework of the project, two bioremediation techniques to treat water polluted with pesticides are also being tested.

ECO-ALPSWATER, INNOVATIVE ECOLOGICAL ASSESSMENT AND WATER MANAGEMENT STRATEGY FOR THE PROTECTION OF ECOSYSTEM SERVICES IN ALPINE LAKES AND RIVERS

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The main objective of Eco-AlpsWater is to integrate the traditional monitoring approaches used in the Alpine region and at the European level with advanced and innovative methods, providing solid and qualified knowledge to further support water resources management plans. The new approach will use Next Generation Sequencing - NGS technologies to analyze environmental DNA (eDNA) extracted from water samples collected in lakes and rivers. These new techniques, based on the amplification and analysis of millions of DNA sequences and on the use of smart technologies including automation in data processing and storage, and information retrieval, allow a rapid and low cost identification of aquatic organisms, from bacteria to fish. The data will, in particular, identify the areas most at risk due to the presence of toxic cyanobacteria, pathogenic bacteria, and invasive or potentially invasive organisms. The project runs from April 2018 to April 2021.

A RAPID MOLECULAR APPROACH FOR THE SIMULTANEOUS DETECTION OF *SALMONELLA CAMPYLOBACTER* AND *YERSINIA ENTEROCOLITICA* IN AQUATIC ECOSYSTEMS

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Salmonella, *Campylobacter* and *Yersinia enterocolitica* have been recognized as important causes of enteric infection. Contaminated water represents one of the most important routes for their transmission to humans or animals. In recent decades, several studies have shown that floods are often associated with an increase in the incidence of enteric disease.

Pathogenic microorganisms often occur in low concentration in the aquatic ecosystem and/or in plants and currently cultural methods used to evaluate their presence are laborious and time-consuming.

The aim of this study was the development of a platform for the rapid and simultaneous detection of *Salmonella*, *Campylobacter* and *Yersinia enterocolitica* by Real-Time PCR on raw water samples.

Aliquots of raw water were filtrated through a 0.45 μm pore size filter by a vacuum pump. The membrane filters were placed in specific enrichment broths and incubated at their optimum temperature for target microorganisms recovery. The DNA extraction was carried out and simultaneous real-time amplifications with the target genes *ttr* (*Salmonella*), *16S-rRNA* (*Campylobacter*) and *ail* (*Y. enterocolitica*) were performed by each samples.

The results obtained showed that Real-Time PCR is able to detect simultaneously Salmonella, Campylobacter and Yersinia *enterocolitica*. Further, this molecular approach represents a useful tool for the prevention and control of infection vehicled by aquatic ecosystems especially during extreme events such as floods.

INFLUENCE OF SEASONALITY ON THE PATHOGENESIS OF VENOUS THROMBOEMBOLISM EVENTS IN INDIVIDUALS FORWARDED TO FIRST AID UNITS

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Relationship between Venous Thromboembolism (VTE) and meteorological factors is complex also because of differences in climate between the various geographical areas. The aim of the present study was to investigate the relationship between the incidence of venous thromboembolism and seasonality.

A four-year evaluation (2013-2016) was carried out on individuals forwarded to hospital first aid units (FAiUs), Catania (Italy). To investigate the association between VTE and meteorological variables we used the negative binomial regression model. The model included seasonal (summer-spring *vs* autumn-winter) counts as the dependent variable and average daily values of temperature, atmospheric pressure, wind speed, relative humidity, age and gender as the independent variables.

One hundred and nine consecutive patients were diagnosed as having VTE (47.7% PE, 52.3% DVT). VTE frequency per year was 2.9/10,000 (2013), 4.9/10,000 (2014) 3.6/10,000 (2015), and 5.1/10,000 (2016). We checked the number of PE and DVT events occurring in different climatic periods of the year finding that the frequency of PE in cold months (autumn-winter) was higher than warm periods (summer - spring) (48.6% *vs* 47.2%) whereas the frequency of DVT in cold months (autumn-winter) was lower than warm periods (summer - spring) (51.4% *vs* 52.8%).

We found a significant protective association between frequency of PE and daily average temperature (OR 0.915, CI 95% 0.860-0.973) and wind speed (OR 0.958, CI 95% 0.914-1.003). In particular, the increase in average daily temperature with 1°C was associated (p-value =0.005) with a decrease of the risk of occurrence of idiopathic PE of 8.9% (2.7%-15%) and the increase in average daily wind speed with 1 m/s was associated (p-value =0.068) with a decrease of the risk of occurrence of idiopathic PE of 4.3% (0.3%-9.0%).

A significant not protective association was found between frequency of PE and daily average relative humidity (OR 1.064, CI 95% 1.029-1.100) and atmospheric pressure (OR 1.063, CI 95% 1.001-1.130).

In particular, the increase in average daily relative humidity with 1% was associated (p-value=0.000) with an increase of the risk of occurrence of idiopathic PE of 6.2%

(2.9%-9.5%) and the increase in average daily atmospheric pressure with 1 hpa was associated (p-value=0.047) with an increase of the risk of occurrence of idiopathic PE of 6.1% (0.1%-12.2%).

According to the results of this study we can conclude that seasonality may influence the incidence of venous thromboembolism.

ARE MEDICAL PROFESSIONALS CONCERNED ABOUT THE CLIMATE CHANGE THREAT IN BULGARIA?

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Climate change is treated nowadays as a risk factor for health, together with the other risk factors such as smoking, alcohol consumption and low physical activity. It is very important for people working in the health care sector to be informed about the effect of climate change on human health, especially in countries like Bulgaria where the problem became public only in the recent years (mostly after the big flash floods with victims in 2014). The first step to this is raising their awareness on the topic.

In November 2015 the American Pew Research Centre published a world report about the public awareness on climate change problem, Bulgaria is not taking part in this study. We used the Pew questionare to study the awareness of people working in the health care sector in Bulgaria. More than 100 professionals were interviewed, and we also included questions about their concern on the ways climate change affects public health.

Poster session

December, 5

ISOLATION AND CHARACTERISATION OF SHIGA TOXIN-PRODUCING *ESCHERICHIA COLI* IN MUSSELS (SOUTHERN ITALY)

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The incidence of foodborne disease is generally correlated with climate conditions. Environmental temperature is considered an important factor in the transmission of bacterial agents causing enteritis. It is therefore plausible that an increase in warmer weather may facilitate the transmission of infectious intestinal disease. Therefore, since temperature increases and changes in rainfall patterns have an impact on the persistence and occurrence of bacteria, the aim of this study was to investigate the occurrence of Shiga toxin-producing *Escherichia coli* **(**STEC) in mussels from Apulia (Southern Italy) during a year-monitoring, above all because of their filter-feeding behaviour and because they are traditionally consumed raw or undercooked, representing a potential risk to public health. In 2017, 120 bivalves were collected from different harvesting areas along the coasts of Apulia (southern Italy). Ten bivalves per month have been sampled in order to assess the interaction between the climate and the presence of pathogenic STEC. Microbial enrichment of the samples followed by DNA extraction with subsequent screening of STEC associated genes was performed as described in ISO/TS 13136:2012. Real-time PCR assays were conducted for genes encoding Shiga toxin (*stx1* and *stx2*), intimin (*eae*) and the five major serogroups of concern (O157, O26, O111, O145 and O103).

In the screening step, 16,6% of the 120 mussels examined (20/120) were positive for *stx* and *eae* genes. Of these 20 samples, 6,6% (8/120) were positive to *stx2* gene, 1,6% (2/120) samples to *stx1* and *stx2* genes and 8,3% (10/120) to *eae*. No STEC strains were isolated from overall analyzed samples.

Ct's values greater than 25 may not lead to an sure achievement regarding isolation of bacterial cells. For all presumptive positive samples, the Ct's in the real-time PCR were higher than 30 for *stx1*, *stx2* and *eae* genes. Taking into account that the isolation of a STEC strain may also depend on the competition with background microflora, in some cases we could have low concentrations of STEC but also high background microflora, not giving the possibility to isolate the targeted bacteria. In addition, the presuntive positivities have been observed in almost every month but with a peak in April. Not having isolated any VTEC and being preliminary data, a continuous monitoring activity is required and further studies are needed to investigate about the correlation between changing climate and VTEC presence in seawater and in mussels.

SALMONELLA IN PIG UNDER A CHANGING CLIMATE

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Salmonellosis is the second most frequent bacterial gastrointestinal disease in humans in Europe. Although since 2001 a declining trend in salmonellosis incidences was observed in Germany, changing climatic conditions may lead to a trend reversal. Particularly rising temperatures favor growth, development and thus, spread of bacteria, such as Salmonella. While the average global temperature increase acts regularly and slowly, short-term extreme temperatures at the local scale were shown to increase under climate change. These short-term temperature spikes may be the upcoming challenges in zoonoses and food-borne disease outbreak control. We here present an approach linking effects of changed climate to the risk of human health.

We extend and apply the multistep process-based "EFSA farm to fork model on Salmonella in pigs". In the model salmonella prevalence and quantitative contamination is being calculated all along the implemented stations i.e. farm, lairage and transport, slaughter, processing, retail, preparation and up to the probability of illness arising from pork consumption. We will rate the effect of climate change on processes and parameters in the farm to fork model and directly estimate the effect on human health. Along the "green side" (animal production) we identified three likely impacts of rising temperatures on the prevalence rate in pigs. Furthermore, along the "red side" (meat production) we identified one step where a hotter environment will act on prevalence and likely not be counteracted by cooling facilities:

a) Pig feed especially oilseeds produced and stored may be contaminated to a higher level by salmonella due to beneficial growth conditions
b) Salmonella survival in the environment is temperature and humidity dependent (changed persistence)
c) Extreme temperatures increase the stress level of pigs at the farm and during transport, changing animal susceptibility to infection and defecation rates (Salmonella shedding)
d) Salmonella growth during the un-cooled transport of the meat from store to home.

We will apply the model using the latest regional climate change scenarios derived from global scenarios (RCP2.6 to RCP8.5) and we will focus the study on the effects of short term heat waves during summer. At all steps, we will study potential differences between conventional and organic animal production modes.

At the meat-production steps we address throughout this study, we thoroughly identify points of intervention, and provide guidance on how to overcome climate change provoked increases of Salmonella prevalence.

REDUCING FOOD WASTE THROUGH THE CHILL CHAIN

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Temperature is one of the most important factors influencing the ability to multiply and survive of microorganisms in foods. An inadequate stocking temperature during commercial life can underestimate the microorganism growth capacity by overestimating the shelf life of Ready-To-Eat foods (RTE) and thus endangering the health of the consumer.

It is now well-known that the temperature during the first steps of the chain (i.e. processing and distribution) are in most cases satisfactorily controlled whereas some retail display cabinets and especially the home refrigerators are less controlled.

Temperature control during transport, storage and at retail is usually the responsibility of the retailer and not within the manufacturers' direct control while the temperature of domestic refrigerators depends on the diligence of the consumer.

Thanks to the collaboration with a retail partner, it was possible to monitor the temperature inside an exposure bench and, in particular, understand the thermal performance of the indoor environment of a large refrigerated storage cabinet considering the impact of external and internal variables on the food storage temperature instrument.

The results showed that the most important external variables are represented by the temperature of the point of sale and by the presence of air currents that hit the refrigeretor when placed near doors or corridors of passage; the most significant internal variables are represented by the air circulation, the thermal inertia of food and consequently, the different ways of loading food in refrigerators

According to these results, the National Reference Center for emerging risk on food safety in collaboration with the IIZZSS Italian network, has started a research project (*National survey on the temperature of household refrigerators in Italy*) financed by the Italian Ministry of Health, intended to study the temperature in domestic refrigerators, with the aim of:

- define a national average level of temperature inside household refrigerators;
- define "reasonably foreseeable conditions" under which it will be possible, by the FBO, to conduct challenge testing of RTE foods in full compliance with Community requirements;
- provide FBO instruments for monitoring the shelf life of food, regardless of the presence of pathogenic microorganisms all along the distribution chain;
- correlate the risk of *Listeria monocytogenes* in RTE foods at the real level of temperature along the supply chain and distribution of food.

THE IMPACT OF CLIMATE CHANGE ON NUTRITIONAL COMPOSITION OF CEREAL GRAIN

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The continuous rise of global temperature, accompanied by more frequent extreme weather events is expected to have a highly significant impact on all components of the agricultural systems as regards to e.g. crop suitability, yield, livestock as well as changes in nutrient composition of crops and cereals. CO_2 is the main source of nourishment of plants that through the process of photosynthesis transform it into carbohydrates and, ultimately, into agricultural production, so if on the one hand the increase in CO_2 acts as a fertilizing intervention for plants by stimulating photosynthesis and increasing the yield of crops. Emerging evidences have shown that elevated levels of CO_2 will reduce the concentration of grain protein and micronutrients like zinc and iron, in cereals (pulses are less affected). The concentration of cereal grain protein and its composition are important factors of the nutritional value and bread making quality. The degree to which protein is affected by CO_2 depends on the temperature and available water. Recent studies have found that elevated CO_2 is associated with lower protein content in grasses, with a 6.3% decrease in wheat grains and a 7.8% decrease in rice grain, but no significant effect in soybeans or crops like maize. Decreased grain protein and micronutrients concentration, could affect nutrition in developing areas with more limited access to food, and people may need to consume more (at more cost) in order to meet their basic nutritional needs. Studies have pointed out that elevated CO_2 levels can affect plant physiology and soil microbes which may alter the degradation of organic pollutants by weakening the self-cleaning ability of soils related to these compounds. Understanding how cultivated plants, their associated community members (including pest insects, natural enemies, soil microbes), and their interactions respond to warming to influence crop yields is critical to current and future food security in order to develop breeding programs designed to decrease the vulnerability of key crops to these changes.

THE HOUSE OF THE SUSTAINABILITY, A NEW APPROACH TO ENVIRONMENTAL HEALTH THROUGH SCIENCE COMMUNICATION

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The involvement of all stakeholders is fundamental to understand global health challenges and contribute to the sustainable development goals set by the UN in the 2030 Agenda. The National Institute of Health in Italy (ISS) has introduced the concept of communication to different stakeholders in its mission and vision and has recently started a stronger commitment in this regard. In this context, the project of “the house of sustainability” was developed as an incubator aiming to create awareness on sustainable development for present and future generations.

The project is based on the necessity to start concrete actions to support the principles of the sustainability and contribute to global health through scientific communication. The house will be build inside the ISS premises and will form part of a bigger project of scientific communication addressed to different stakeholders, in particular students and the general public.

The house of sustainability will show how to exploit renewable resources and energy, reduce waste and enhance reuse, recovery and recycling. In this perspective, the ISS garden represents an ideal continuity of the "home" in a synergic osmosis of reciprocal interaction within the ISS ecosystem. In the history of the Institute, the garden has been used only in special occasions, but recently it has been opened for events addressed to the general public in line with a public heath approach addressed to all stakeholders.

The house of sustainability can immediately enter into operation as a prototype in original communication strategy aiming to create awareness on sustainability issues through the involvement of all stakeholders. From the very beginning, in fact, it will host training courses, scientific laboratories for students, workshops, exhibitions and other dissemination activities.

ANNEX I

MINUTES FROM STAKEHOLDER PRE-MEETING, OCTOBER 9, 2018

On October 9th 2018 on the initiative of Professor Walter Ricciardi, President of the *Istituto Superiore di Sanità* (Italian National Institute of Health), the Workshop: *Salute e cambiamenti climatici - Stakeholder a confronto*, was held. The Workshop was organized by the Istituto Superiore di Sanità together with the Bridge Foundation and the Italian Ministry of Health as a sort of pre-meeting / debate among stakeholders to share ideas/vision/policies/planning on the subject of Health and Climate Change in preparation for the First International Scientific Symposium which will take place at the Institute's premises in Rome on December 3rd to 5th, 2018. Results and outputs of the Workshop will be presented at the Symposium in the session devoted to Stakeholders.

The discussion among participants focused on how to tackle potential climate change related health risks and prioritized issues will be dealt with in the round table on December 5th. The October Workshop featured plenary sessions and working groups and hosted 32 participants who all took the opportunity to speak.

This is the list of participants and their affiliations:

Sergio Achille - Protezione Civile, Fabiana Baffo - Ministero Ambiente, Daniele Biagioni Coordinatore - Rete Città Sane, Giuseppe Bortone - Direttore ARPA Emilia Romagna, Mario Carere - Istituto Superiore di Sanità, Francesco Ciancaleoni - Coldiretti Area Ambiente e Territorio, Maurilio Cipparone - Consorzio Universitario per la Ricerca Socioeconomica e per l'Ambiente, Anna Citterio CNH Industrial N.V. Head of Sustainability, Planning and Reporting, Giovanni Damiani - Italia Nostra, Aldo Di Benedetto - Ministero Salute, Umberto di Maria - Fondazione The Bridge, Eugenia Dogliotti - Istituto Superiore di Sanità, Mario Figliomeni - Istituto Superiore di Sanità, Marta Frittella - Funzionario comune di Terni, tecnico referente ANCI in Materia di Qualità dell'Aria,Walter Ganapini - Direttore ARPA Umbria, Simona Gaudi - Istituto Superiore di Sanità, Fabiola Giuliano - Istituto Superiore di Sanità, Maria Rosaria Iardino - Presidente Fondazione the Bridge, Carmela Marino - Responsabile Divisione tecnologie e Metodologie per la Salvaguardia della Salute, ENEA, Valerio Manfrini - Lega Navale, Laura Mancini - Istituto Superiore di Sanità, Stefania Marcheggiani - Istituto Superiore di Sanità, Antonio Navarra- Direttore Centro Euro-Mediterraneo sui Cambiamenti Climatici, Giuseppe Onorati - Dirigente ARPA Campania, Giuseppe Onufrio - Direttore Esecutivo Greenpeace, Emanuele Pantone - Consorzio Universitario per la Ricerca Socioeconomica e per l'Ambiente, Antonella Penna - Marevivo - Università di Urbino, Camilla Puccinelli -

Istituto Superiore di Sanità, Benedetta Rossi - Medico Climatologo Coord. Sezione Clima e Salute, Italian Climate Network (COLLEG), Nunzia Rossi - Regione Lazio, Tonino Sofia - Istituto Superiore di Sanità, Luigi Stefano Sorvino - Commissario Straordinario ARPA Campania. L'Unione nazionale Comuni e Comunità Enti Montani (UNCEM) (Marco Bussone, Presidente) also expressed its support by sending a document.

The success of the workshop was also due to the precious help of Luisa Brogonzoli, Beatrice Nicotera and Gianna Chiocchio, Research Center and Organization Secretary of Fondazione The Bridge.

Overall 20 institutions were represented. These institutions/associations are involved in different sectors and are located across the country. During the first part of the morning explanations were provided concerning the rationale and aims of the workshop and the following guideline-question was proposed for discussion:

How can stakeholders synergically contribute to the mitigation and prevention of the effects of climate change on health? and specifically:

Which synergy? Which priority actions need to be taken to raise collective awareness? Are there any best practices (training/ awareness raising/ communication) to be shared? Policy development/support.

The following actions were suggested

- supporting the development and spread of policies;
- improving stakeholders' understanding of the problems and challenges related to adaptation;
- supporting the establishment of networks and the provision of information for specific areas and problems of adaptation;
- empowering and supporting operators in implementing adaptation processes.

The second part of the morning each representative spent some time presenting him/herself and their organization and interacting with the chairs and other participants.

The afternoon focussed on discussion of the issues raised in the morning and stemming from the guideline-question

The priority topic to be discussed at the round table on December 5th will be: stakeholders recommendations to bridge the gap between scientific research/data, the public, and policy makers

The Chairpersons of this round table (Dott.ssa Iardino e di Dott. Di Benedetto) registered the participants willingness to take part and the following names are proposed to all involved to be agreed on as representing all positions on the issue:

- Giuseppe Bortone Director, Arpa Emilia Romagna;
- Anna Citterio CNH Industrial N.V. Head of Sustainability, Planning and Reporting;
- Benedetta Rossi Climate Physician, Coord. Sezione Clima e Salute Italian Climate Network ONG;
- Daniele Biagioni, Coordinatore Rete Città Sane;
- Giuseppe Onufrio, Direttore Esecutivo Greenpeace.

A mail shall be sent to all to approve the synopsis, to circulate the group photo and to collect the brief summaries to be included in the abstract book of the symposium.

This part has therefore a well-defined objective and will end with the symposium and the drafting of the Rome Charter on Health and Climate Change.

The proposal set forth during the workshop, however, intends to be more far-reaching and the workshop itself stands only as the beginning of a common path aiming to establish a permanent stakeholder network which shall meet once a year (October 9th) to share objectives and information.
The publication of a "Rapporto Istisan" was proposed which would act as a sort of "white book" of national stakeholders and at the same time be a flexible tool able to include further contributions as the network strengthens and grows. The network as a strong asset, wealthy in ideas and actions, to combat climate change and to protect health.

National Stakeholder Network On Health And Climate Change

Next steps:

1. Common Summary Document;
2. Agreement on Topics and Names of Stakeholders Participating in the Round Table at the Symposium;
3. Common Summary Document to be Included in Abstract Book;
4. Participation in the Symposium;
5. Drafting the White Book;
6. Meetings in Remote:
7. Sharing information and Participation in Actions and Events;
8. II National Stakeholder Meeting on Health and Climate Change October 9, 2019 in ISS.

The Workshop was a *Green Event as adapted from "Health and Climate" WHO conference (Geneva, August 27-29, 2014). Impacts will be compensated*

AUTOR'S INDEX

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