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25-27 September 2019 - Lisbon, Portugal

**"NEW" CHALLENGES FOR THE FUTURE -
ABSTRACT PROCEEDINGS OF INTERNATIONAL
CONGRESS ON ENVIRONMENTAL HEALTH 2019**



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FOREWORD

The Environmental Health area of the Teaching and Research Unit in Clinical Laboratory, Public Health and Environment of the Lisbon School of Health Technology, in conjunction with the National Environmental Health Association, the Departments of Environmental Health of the Coimbra Health School and the School of Health of Polytechnic Institute of Porto Porto hold the International Congress on Environmental Health “New” Challenges for the Future (ICEH 2019). The event runs concurrently with the 40th anniversary of the National Health Service with a tribute to Environmental Health Technicians whom in 2019 complete 40 years of profession at the National Health Service. ICEH 2019 take place in the Lisbon School of Health Technology, between the 25th and 27th september of 2019 in the School’ auditorium. ICEH 2019 presents the most recent scientific and technological developments in the field of environmental health, emphasizing in individual disciplines, namely Air Quality, Biomarkers of Exposure/Effects, Climate Change & Sustainability, Emergency Preparedness, Environmental & Occupational Toxicology, Environmental Risk Assessment, Food Safety, Health Impact Assessment, Health Tracking & Informatics, Healthy Homes, Occupational Safety & Health, Public Health & Epidemiology, Waste Management, Water Quality and Zoonoses.

The meeting aims to bring together researchers from a number of different countries and continents, involved in these issues. Therefore, the Organizing Committee is pleased to announce an exciting innovative congress, with scientific presentations covering a wide range of topics.

The Organizing Committee

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PROGRAM

25 SEPTEMBER 2019 :: WEDNESDAY					
08:00		Registration desk open at ICEH 2019 Venue			
Workshops					
08:30 12:30		Health and Impact Assessment 1.10 Room	Arthropod Vectors of Disease: From Field Collection to Laboratory 1.6 Room	Future Healthy Homes and Neighborhoods 1.9 Room	Endocrine Disruption: Mixtures and Toxicity 1.4 Room
12:30	14:00	LUNCH TIME			
25 SEPTEMBER 2019 :: WEDNESDAY					
14:00	15:00	Auditorium: WELCOME AND OPENING OF THE ICEH			
		Mário Pinto*, Advisor to the Presidency of the Republic for Health			
		Diogo Cruz, Deputy Director General of Health			
		Beatriz Fernandes, Vice-President of ESTeSL			
		Silvia Silva, President of APSAi			
		Marina Almeida-Silva, Chair of the ICEH2019			
		Tribute "40 years of SNS, 40 years of Profession"			
Auditorium: #1 PLENARY SESSION					
Chair: Julio Jesus, President of Portuguese Association of Impact Assessment					
15:00	15:30	P1.1	Without health there is nothing: taking stock of health in impact assessment	Ben Cave, President of the International Association for Impact Assessment	
15:30	16:00	P1.2	Opportunities not to be missed: emerging guidance on Health in Impact Assessment	Filipe Silva, Public Health by Design	
16:00	16:30	P1.3	Health Impact Assessment in Brazil: Experience from UNIFESP	Simone Miraglia, UNIFESP	
16:30	17:00	P1.4	Development of a Training Program in Health Impact Assessment (HIA) in Portugal	Luciana Gonçalves da Costa, INSA	
17:00	19:00	WELCOME DRINK			

26 SEPTEMBER 2019 :: THURSDAY							
Auditorium: #2 PLENARY SESSION							
Chair: Marina Almeida-Silva, ESTeSL-IPL							
08:30	09:00	P2.1	Shaping Smart Healthy Communities			Masi Mohammadi, Eindhoven University of Technology	
09:00	09:30	P2.2	The usefulness of human biomonitoring in occupational risk assessment			Susana Viegas, ENSP, Nova University Lisbon	
KICK-OFF PARALLEL SESSION #1 and #2							
9:40	10:00	244	Pollution Characterization, Source Identification, and Health Risks of PM2.5 at Multiple Sites in Europe and Asia			S.M. Almeida, M. Manousakas, E. Diapouli, Z. Kertesz, L. Samek, et al.	
10:00	10:20	47	Health consequences of pesticide exposure in male Ecuadorian banana plantation workers			H.P. Hutter, P. Wallner, H. Moshammer, M. Kundi, H. Ludwig, et al.	
10:20	11:00	COFFEE BREAK					
		Auditorium: #1 PARALLEL SESSION			Room A: #2 PARALLEL SESSION		
		Chair: Marisa Freitas, ESS-IPP			Chair: Hugo Osório, CEVDI-INSA		
11:00	11:20	23	Health impact assessment of vehicle emissions on South American largest urban center	S. G. E. K. Miraglia, D. Debone, L. Leiriao	122	Awareness about vector-borne diseases among pet owners and citizens from Portugal	T.L. Mateus, A.I. Pena, S. Moreira, R.L. Maia
11:20	11:40	146	Commuter exposure and inhaled dose of particulate matter in four common modes of transport in Lisbon	C. Correia, V. Martins, I. Cunha-Lopes, I. Faria, E. Diapouli, K. Eleftheriadis, S.M. Almeida	111	Leptospira spp. in soils and freshwater collections: a public health concern	M. Fernandes, F. Delgado, T. Carreira, R. Teodósio, M.L. Vieira
11:40	12:00	165	Economic losses of air pollution in Sao Paulo, Brazil	K. C. Abe, S. G. E. K. Miraglia	75	The importance of wildlife health on zoonotic bacteria transmission – interactions between Borrelia burgdorferi s.l. and its avian hosts	A.C. Norte, D. Heylen, P.M. Araújo, L.P. Silva et al.
12:00	12:20	16	Air quality and health impact assessment of truckers: strike in major highways of São Paulo state, Brazil	D. Debone, L. F. L. Leirião, T. Pauliquevis, N. Rosário, S. Miraglia	130	Gene amplification and a novel kdr mutation mediate insecticide resistance in the mosquito vector Aedes aegypti from Madeira Island	C. Marques, C.F.J. Ayres, B. Gouveia, A.P. Araújo, B. Viveiros, et al.

12:20	14:00	LUNCH					
		Auditorium: #3 PARALLEL SESSION			Room A: #4 PARALLEL SESSION		
		Chair: João Brandão, INSA			Chair: Vítor Manteigas, ESTeSL-IPL		
14:00	14:20	22	Aspergillus spp. prevalence in one Portuguese hospital. A reason to be worried?	C. Viegas, M. Dias, B. Almeida, I. Paciência, J.C. Rufo, J.P. Teixeira, C. Pereira	154	Lisboa a sustainable city to Climate Change in action	M.J. Telhado, M.C. Almeida, M. Perdigão, C. Jeremias
14:20	14:40	55	Bioburden in Indoor SPAs Air	A. Monteiro, J. Cardoso, A. Mergulhão, J. Moreira, B. Almeida, C. Viegas, S. Cabo-Verde	246	The role of the schools at the climate changes' fight	J. Lage, V. Manteigas, A. Despiny, R. Rato, F. Silva, et al.
14:40	15:00	56	Prevalence of airborne pathogenic bacteria in Portuguese Healthcare	A., E. Ribeiro, S. Cabo-Verde, C. Viegas	209	Climate Change: A Prospective Study on the Health Impact of Population in Norway and Portugal	I. Nunes, S. Paixão, J. Almeida, N. Marques, J. Figueiredo, A. Ferreira
15:20	15:40	159	Indoor-to-outdoor levels of size-segregated particulate matter in urban microenvironments	V. Martins, T. Faria, E. Diapouli, M.I. Manousakas, K. Eleftheriadis, M. Viana, S.M. Almeida	124	Adaptation to Climate Change in the Health Sector's case study of Lezíria do Tejo Region (Portugal)	S. Capela, M. Magina, I. Caria
15:40	16:10	COFFEE BREAK					
16:10	17:30	POSTER SESSION					

27 SEPTEMBER 2019 :: FRIDAY					
Auditorium: #3 PLENARY SESSION					
Chair: Carla Viegas, ESTeSL-IPL					
09:00	09:30	P3.1	Mosquitoes and mosquito-borne diseases in Europe: from surveillance to control	Hugo Osório, CEVDI-NSA	
09:30	10:00	P3.2	Exploring fungal contamination in the sand and water around the Mediterranean Sea and other water bodies of Europe	João Brandão, INSA	
KICK-OFF PARALLEL SESSION #5 and #6					
10:10	10:30	176	Metal contaminated wastewater in irrigation of lettuces: effects on anti-oxidant, polyphenols, flavonoids and chlorophyll contends	M. Matos, M.P. Robalo, J. Coelho, R. Herenguel, C. Breton, M. Ferreira	
10:30	10:50	245	Exposure to source-related components of particle air pollution	S.M. Almeida, T. Faria, V. Martins, N. Canha, E. Diapouli, M.I. Manousakas, K. Eleftheriadis	
10:50	11:30	COFFEE BREAK			
		Auditorium: #5 PARALLEL SESSION		Room A: #6 PARALLEL SESSION	
		Chair: Susana Viegas, ENSP-Nova University Lisbon		Chair: Susana Marta Almeida, IST	

11:30	11:50	224	Contrast agents in Magnetic Resonance imaging: The new challenges regarding toxicity and increased safety	M.M. Ribeiro, A. Coelho	113	Childrens exposure assessment to particulate matter in Lisbon metropolitan area	I. Cunha-Lopes, V. Martins, T. Faria, C. Correia, S.M. Almeida
11:50	12:10	108	Removal of diclofenac from wastewaters by a hybrid adsorption/nanofiltration process	D. Duarte, A. Barreiros, R. Viegas	262	Portuguese consumer exposure to cosmetic products: risk assessment of ingredients in facial and body moisturizers	A.Marques, M. Rodrigues, R., M. Vieira da Silva
12:10	12:30	212	Occupational exposure to hexavalent chromium: biomarkers of genotoxicity in human peripheral blood	C. Afonso, B. C. Gomes, H. Louro, A. Nogueira, H. Pinhal, et al.	172	Thermal environment analysis in nursing homes in the Atlantic climate	P. Torres, A. Teixeira-Gomes, L. Aguiar, N. Forcada, B. Tejedor, et al.
12:30	12:50	203	Occupational exposure to metals fumes: A case study in a metalworking industry	P. Reis, E. Pinto, P. Neves, T. Ferreira, M.A. Rodrigues	63	The impact of indoor air quality on respiratory health of older people: spirometric and exhaled breath condensate assessments	J. Belo, P. Carreiro-Martins, A.L. Papoila, T. Palmeiro, I. Caires, et al.
12:50	14:00	LUNCH					
		Auditorium: #7 PARALLEL SESSION			Room A: #8 PARALLEL SESSION		
		Chair: Edna Ribeiro, ESTeSL-IPL			Chair: Susana Paixão, ESTeSC-IPC		
14:00	14:20	167	Occupational Health: is there a place for nutrition promotion programs?	V.Costa, C. Calixto, L. Mendes	102	Smoking behavior and secondhand smoke exposure in higher education	R. Alves, J. Precioso
14:20	14:40	53	Potentially pathogenic microorganism's sampling and detection in water thermal SPAs.	A. Monteiro, J. Santos, E. Ribeiro, S. Cabo-Verde	138	Children integrated exposure to chemical compounds in particulate matter	T. Faria, V. Martins, N. Canha, E. Diapouli, M. Manousakas, K. Eleftheriadis, S.M. Almeida
14:40	15:00	251	Relevance of Anisakis simplex in Portuguese fresh fish: is it a risk for consumers and occupational exposure?	M. Machado, A. Silva, M. Freitas, M.V. Silva	250	Environmental Audits: an analysis prior to the participation of Portuguese schools in the ClimACT project	V. Manteigas, J. Lage, M. Gomes, G. Giorgetti, S.M. Almeida
15:00	15:20	110	Is the sleep structure vulnerable to indoor air contaminants?	J. Belo, M. Picado, A. Sousa, C. Lopes, J. Conceição, et al.	101	Knowledge, attitude and practice of self-medication among college students	R. Alves, J. Precioso
15:40	16:10	COFFEE BREAK					
#4 PLENARY SESSION - Chair: Marina Almeida-Silva, ESTeSL-IPL							
16:10	16:30	P4.1	The air we breathe and the new health challenges		Myriam Lopes, CESAM, UA		
16:30	17:00	CLOSING OF THE ICEH 2019					

ABSTRACTS

PLENARY SESSIONS

S1 PLENARY SESSION 01

Without health there is nothing: taking stock of health in impact assessment

Ben Cave

President of the International Association for Impact Assessment

This talk will consider how health is addressed in impact assessment and some of the opportunities and challenges this poses. As with many issues that span the environment and public health we need to work across different sectors. What are the implications of bringing public health and environmental health together with planners and environmental scientists etc. How are key terms defined? What data is used to inform decisions? Who determines whether an assessment is conducted properly? The presentation will introduce examples of health in impact assessment from around the world and conclude with some reflections for European member states.

Plenary
Sessions

S1 PLENARY SESSION 02

Opportunities not to be missed: emerging guidance on Health in Impact Assessment

Filipe Silva

Public Health by Design

This presentation address how health impacts tends to be addressed within various forms of environmental assessment, especially environmental impact assessment and strategic environmental assessment, how such inclusion tends to not be adequate and how that translated into missed opportunities for public health and good planning and development. It then provides an overview of emerging guidance on the appropriate inclusion of health within EIA and SEA as well as the ongoing revision of the IAIA Special Publication – Health Impact Assessment – International Best Practice Principles. It concludes with the building blocks for institutionalizing HIA and health in environmental assessments as well as pressing questions on integration and impact assessment.

Plenary
Sessions

S1 PLENARY SESSION 03

Health impact assessment in Brazil: experience from UNIFESP

Simone Miraglia

UNIFESP

The presentation will show a brief history on Health Impact Assessment activities in Brazil concerning the main publications. I will present the experience of the Federal University of São Paulo, Brazil relating to HIA studies in large enterprises (hydroelectric dams' impacts) and on air pollution studies. As a result of the efforts on studies of air pollution impacts on health, the Federal University of São Paulo took part on the ONU statement call for action in order to reduce air pollution focusing both direct health effects and climate change.

Plenary
Sessions

S1 PLENARY SESSION 04

Development of a training program in Health Impact Assessment (HIA) in Portugal

Luciana Gonçalves da Costa, Teresa Caldas de Almeida

National Institute of Health, Portugal

Plenary
Sessions

BACKGROUND:

The new Public Health Law proposal proposes mandatory HIA studies at the national level, in a “whole of government” perspective. Under the scope of the Biennial Collaborative Agreement (BCA) between WHO Regional Office for Europe and the Portuguese Ministry of Health, the National Health Institute Doutor Ricardo Jorge (INSA), initiated a HIA capacity building training Program.

OBJETIVES:

The main objectives of this Program were: i) to build technical expertise and capacity to assess and evaluate policies, plans, programs and projects, and ii) to develop a HIA toolkit, validated for use in Portuguese context based on case studies.

RESULTS:

In this context, INSA organized two Workshops to build technical expertise to further support the development and implementation of HIA in Portugal. Following a “Learning By Doing” approach, three prospective equity focused HIA studies were proposed and are ongoing. Also, a network of stakeholders is sharing information throughout an online platform as a starting point to develop a community of practice at national level. Importantly, a policy dialogue between health and other sectors was performed and a brief published online. It is expected that a guidance document for HIA implementation will be produced, taking into account the experience shared through the training program under progress.

CONCLUSIONS The main lesson obtained from the work developed so far is that for proper HIA implementation, further investment on trained professionals able to develop HIA and tools fit to the national and local characteristics is still needed, as well as more engagement of other sectors to undertake a multisectoral approach. Importantly, a model to operationalize and integrate HIA as a tool that is consistently and routinely used in the public health services waits to be defined.

S2 PLENARY SESSION 01

Shaping Smart Healthy Communities

Masi Mohammadi

Eindhoven University of Technology

This plenary gives insight about some upcoming smart neighborhoods in The Netherlands. Prof.dr.ir. Masi Mohammadi is the principal investigator and leader of the research program 'Empathic Living Environment', an ongoing interdisciplinary study into smart healthy neighborhoods. By implementing the developed principals and methods in several Living Labs throughout the Netherlands, she aims to explore the next generation smart homes, and to examine the impact of these interventions on the real life of users.

Plenary
Sessions

S2 PLENARY SESSION 02

The usefulness of human biomonitoring in occupational risk assessment

Susana Viegas

ENSP-UNL

Human Biomonitoring (HBM) allows to assess the magnitude of internal exposure to environmental substances and how exposure is changing over time. In occupational health interventions, the main role of HBM is to assess exposure by all routes and to complement information obtained by workplace environmental monitoring (e.g. air monitoring). This is of most importance in occupational settings where workers handle or contact with substances that have the capacity to be absorbed through the skin and/or are very stable and can be present in the workplace surfaces during long periods of time promoting exposure by hand-mouth route. From the risk management angle, HBM can help to answer several questions related with the effectivity of the risk management measures in place, if there are differences in exposure between worker groups, what are the highly exposed groups and much more. However, in occupational health regulatory framework, HBM is seen only as a health surveillance tool and not as an exposure assessment tool. Additionally, when HBM data are available, there is no guidance regarding the minimal data that should be available and reported to employers and enforcement bodies to allow risk assessment and management at workplaces.

Nevertheless, the continuous use of HBM in exposure assessment programs and the development of research projects (e.g. HBM4EU) will contribute to harmonize HBM protocols and to demonstrate the utility of HBM for assessing workers exposure and risk management measures effectivity.

Plenary
Sessions

S3 PLENARY SESSION 01

Mosquitoes and mosquito-borne diseases in Europe: from surveillance to control

Hugo Costa Osório

CEVDI - National Institute of Health, Portugal

Mosquitoes are a public health issue either when they cause nuisance or when they transmit disease agents. Mosquito-borne diseases (MBD), such as dengue, chikungunya, yellow fever and Zika are emerging and re-emerging globally. In Europe, the introduction of invasive mosquito species, together with the spreading of some native vector mosquitoes, has increased the risk of pathogen transmission. The expansion of MBD is explain in part by the conditions that favour the dispersal and proliferation of vector mosquito species. During the past 30 years, we have been watching the rapid expansion of the geographic range of *Aedes albopictus* and the establishment of *Ae. aegypti* along coastal areas of the Black Sea region and on Madeira, Portugal. Entomological surveillance, as a component of MBD surveillance programs, is crucial to identify the changes in the geographic distribution, and obtain relative measurements on seasonality and abundance of mosquito populations, to facilitate appropriate and timely decisions on vector control strategies. A brief overview of the most important vector mosquito species and MBD in Europe will be introduced, including and results of the vector surveillance in Portugal and practical tolls in control programs.

Plenary
Sessions

S3 PLENARY SESSION 02

Exploring fungal contamination in the sand and water around the Mediterranean Sea and other water bodies of Europe

João Brandão

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Plenary
Sessions

Research on microbial life in beach sands began during the 1980s. Since then, many reports and scientific papers have been published on the subject. Especially after the year 2000, the number of publications in this area has been increasing exponentially. Many of these address methodological approaches and considerations on the microbiome characterisation and its influence on human health. Clear and precise guidance on the subject, however, has not been achieved. Global warming and climate change is expected to generate a regional de-characterization of the microbiota, due to the geographic expansion of endemic microbes. This will originate infections which are diagnosed with some degree of unexpectedness or difficulty by local clinicians.

Much has happened pointing out variants of concerns implicated in future regulation of microbial sand contamination. Yet, most groups working in this theme have one aim and one aim only: To avoid run-off and tide retraction contamination of recreational waters by whatever may lie in the sand (specifically, fecal indicator bacteria, the current parameters used in recreational water quality regulation due to their strong correlation with waterborne gastro-intestinal illness). In light of this fact, a group of medical mycologists and some water microbiologists got together to voluntarily help generate data on fungal contaminants in beaches of Europe.

The idea behind the project is to create recommendations of experts on fungal contaminants, who have the knowledge and capability to point out and demonstrate that certain groups of fungi also matter when in the sand, be it beach or of recreational sandboxes and parks. Some of the fungi can also clarify the type of microbial pollution on a beach sand, regardless of its taxonomic nature.

S4 PLENARY SESSION 01

The air we breath and the new health challenges

Myriam Lopes

CESAM, UA

Plenary
Sessions

KICK-OFF PARALLEL SESSIONS

Kick-Off Parallel Session 1

Pollution Characterization, Source Identification, and Health Risks of PM_{2.5} at Multiple Sites in Europe and Asia

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Fine particulate matter (PM_{2.5}) – those particles with an aerodynamic diameter of less than 2.5 µm – is a key air pollutant in terms of adverse health effects. According to the document “Air Quality in Europe – 2017 report”, published by the European Environment Agency (EEA), in 2015 75% of the stations located in 27 of the 32 countries reporting PM_{2.5} data exceeded the World Health Organization (WHO) guideline for PM_{2.5} annual mean (10 µg/m³) (EEA, 2017). The 2018 edition of the same report states that in 2015, 422000 premature deaths in Europe were attributed to PM_{2.5} (EEA, 2018). These numbers indicate that despite the great deal of improvement as a result of emission control strategies in European urban areas, PM_{2.5} is still a major problem regarding its detrimental impact on human health.

This work presents the results of a PM_{2.5} source apportionment study conducted in urban background sites from 16 European and Asian countries, within the International Atomic Energy Agency (IAEA) Technical Cooperation Project “Supporting Air Quality

Management". For some Eastern European and Central Asian cities this was the first time that quantitative information on pollution source contributions to ambient particulate matter (PM) has been performed. More than 2200 filters were sampled and analyzed by Particle-Induced X-Ray Emission (PIXE), X-Ray Fluorescence (XRF), and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to determine the contents of chemical elements in PM_{2.5}. Samples were also analyzed for the contents of black carbon, elemental carbon, organic carbon, and water soluble ions. The EPA Positive Matrix Factorization receptor model (version 5.0) was used to characterize similarities and heterogeneities in PM_{2.5} sources and respective contributions in the 16 cities.

From the averages of sources contributions, considering all cities, 17% of PM_{2.5} was attributed to biomass burning, 14% to secondary sulfates, 13% to traffic, 13% to soil, 6.8% to fuel oil combustion, 4.0% to coal combustion, 2.3% to salt, 1.6% to industry emissions, 4.7% to "other sources" and 23% to unaccounted mass. The results of this work indicate that biomass burning, traffic and industry are important contributors to air quality degradation in the 16 studied cities. The investment in clean energy in households, the development of sustainable transport solutions and the reduction of industrial emissions are the key targets towards healthy cities.

Kick-Off Parallel Session 2

Health consequences of pesticide exposure in male Ecuadorian banana plantation workers

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Introduction: Intensive agrochemical applications in banana production has been documented in Ecuador, which is among the top banana producing countries, with a total of 6% of the world production and 8 million tons per year. Our study assessed working conditions, wellbeing and health of farmworkers in conventional farming using biocides and in organic farming.

Methods: In a cross-sectional epidemiological study pesticide exposed and non-exposed male farmworkers were interviewed based on standardized questionnaires about, inter alia, exposure history, pesticide application practices, health and wellbeing. Furthermore, swab samples of buccal cells were taken, fixed, stained and later blindly evaluated for nuclear anomalies indicative of cytotoxic and genotoxic effects, according to the standard protocol of the buccal micronucleus cytome assay (BMCA).

Results: In total, 68 farmworkers participated (5 locations in the provinces Los Rios and El Oro); 87% resp. 78% of the pesticide exposed respondents did not use masks/gloves at all; 10% resp. 19% used masks/gloves all the time. Pesticide workers (n=31) showed significantly more often symptoms such as nausea/vomiting (OR=7.50), diarrhoea (OR=6.43), strong tiredness (OR=4.96), dizziness (OR=4.80), burning eyes (OR=4.10), and skin irritation (OR=3.58). Furthermore, seven out of nine biomarkers of the BMCA were significantly more frequent among exposed workers (p<0.001). The frequencies of pyknotic and basal cells did not differ between the two groups.

Discussion: Our findings indicate that the impact of pesticide use in banana farming is not restricted to acute effects on health and wellbeing, but also point to long-term health risks. BMCA results suggest that pesticide users have a higher risk of developing cancer, since chromosomal damage is increased in the exposed individuals. There is an urgent need for safety training and minimizing application of pesticides.

Kick-Off Parallel Session 5

Metal contaminated wastewater in irrigation of lettuces: effects on anti-oxidant, polyphenols, flavonoids and chlorophyll contents

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The scarcity of freshwater is an unambiguous reality in many areas of the Earth, however, with the impact of global warming this reality is spreading rapidly all over the planet. Areas of Portugal, such as the Algarve and Alentejo, are probably facing serious risks in the near future. It is therefore important to define strategies for water reuse. Reuse of water is nowadays a reality in the driest countries but probably it will be also our reality in the future. The Water Framework Directive (Directive 2000/60/EC) is clear in defining this objective to Europe.

Most of the consumed water in Europe is sent to wastewater treatment plants and discharged in rivers or sea after treatment without reuse. Less than 0.5% of annual EU freshwater withdrawals is reused, in Portugal the treated water is around 600 million of m³/year and only 1.2% is reused (ERSAR Report, 2015).

One of the most obvious reuses of treated wastewater is in irrigation with a very positive impact on water sustainability. However, this use is not without risk. The most important risks are fecal coliforms, toxic metals and also emerging new pollutants. Among these, we study the impact of the presence of toxic metals (Cd, Cr, Ni and Pb) in the wastewater used for the watering of a comestible vegetable, lettuce. The impact was measured by determining the antioxidant activity, the content of polyphenols, flavonoids and chlorophyll in the lettuces. These are important constituents of plants from the nutritional point of view but also reveal the state of health of plants.

In this study, the plants were watered with tap water and with treated wastewater with each metal at the maximum concentration allowed by law for treated wastewater. A mixture of all metals, each one at maximum allowed concentration, was also used. The option for synthetic treated wastewater is related to the control of the metal concentration in the wastewater.

After two months of irrigation, antioxidant activity, polyphenol content, flavonoids and chlorophyll were determined on lettuces. The antioxidant potential was evaluated by

DPPH method and total phenolic and flavonoid contents of the extracts were evaluated by Folin-Ciocalteu and aluminum chloride (AlCl₃) methods, respectively.

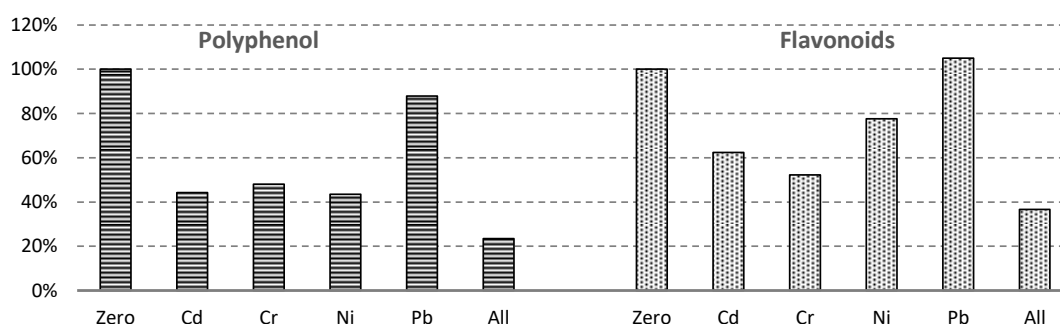


Fig.1 – Polyphenol and flavonoids content relatively to lettuces irrigated with tap water.

The results showed that chromium, cadmium and nickel have a considerable effect on reducing the levels of flavonoids, polyphenols and antioxidant capacity of lettuces. Surprisingly, lead has a small effect on the decrease of these compounds in lettuces. The most drastic effect occurs with the conjugation of the four metals. In this case the effect is quite pronounced showing that for a correct risk assessment the concentration of metals should be considered together and not separately as the current legislation determines.

Kick-Off Parallel Session 6

Exposure to source-related components of particle air pollution

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Particulate matter (PM) air pollution exposure has been identified as a global health threat. Past research has focused primarily on PM mass concentration measured in fix monitoring stations, so the types and sources of particles most responsible for these adverse health associations are not known. Therefore, the World Health Organization (WHO) has placed a high priority on determining which constituents and sources of the PM are most responsible for these reported health effects. As noted by the WHO (2007), this would "facilitate targeted abatement policies and more effective control measures to reduce the burden of disease due to air pollution."

LIFE Index-Air project (www.lifeindexair.net) presents a novel policy tool for the development of effective PM pollution strategies, based on an integrated exposure-dose-burden of disease assessment. The tool is being initially implemented in Lisbon and Porto (Portugal), Treviso (Italy), Athens (Greece) and Kuopio (Finland). Nevertheless, it has been designed in such a way as to allow in the future adjustment of its content and inclusion of other cities as well. The tool focuses on the exposure of school children and uses data collected experimentally in Lisbon on PM concentrations outdoors and in selected indoor microenvironment (homes, schools, and transport modes), as well as time-activity information. This work integrated the data collected in the different microenvironments and identified the sources that affect the children exposure to particles in Lisbon.

This study was performed at 40 houses, 5 schools and respective outdoor sites during the years 2017-2018. Leckel MVS6 samplers were used to collect PM_{2.5} and PM_{2.5-10} on Teflon filters, which were analysed by X-Ray Fluorescence for the measurement of major and trace elements, and on quartz filters, which were analysed by the Thermo-Optical Transmittance method for the determination of the organic and elemental carbon. A source apportionment analysis of the PM data was carried out by means of Positive Matrix Factorization to identify the main sources and their contribution.

The PMF identified six source factors that contributed to PM: vehicles exhaust, secondary sulfates, mineral dust, a Pb source, sea salt and road dust.

The mineral factor was identified by crustal species such as Al, Si, Ca, Ti, Fe, Cr. In schools, the contribution of this source was significantly higher than in homes and outdoors, showing the important contribution of the high activity of primary schools students in the resuspension of deposited particles in classrooms.

Vehicles exhaust and road dust profiles comprise organic and elemental carbon from motor exhaust, metals from brake wear and mineral elements from the soil resuspension. Results showed a good correlation between the vehicles contribution to indoor (both in homes and schools) and the correspondent outdoor sites indicating significant children exposure to PM originating from outdoor urban sources, due to high aerosol infiltration rates

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References

WHO (World Health Organization). 2007. Health Relevance of Particulate Matter from Various Sources. Report on a WHO workshop Bonn, Germany 26–27 March 2007. Copenhagen, Denmark: WHO Regional Office for Europe.

PARALLEL SESSIONS

S1 PARALLEL SESSION 01

Health impact assessment of vehicle emissions on South American largest urban center

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Since air quality is a consequence of several factors such as anthropogenic emissions, rate of secondary pollutant formation, meteorological conditions and others, one of the greatest difficult faced when evaluating health effects of vehicle emissions is to understand the specific contribution of these emissions to air quality and the extent to health impacts. During seven days in May-2018, Brazil experimented a truck drivers' strike, which provided conditions for a real experiment concerning vehicle emissions, air quality and health impacts. Sao Paulo is the South American largest urban center and experimented a period of no trucks' circulation, buses circulation reduced to 40-70% and a reduction on autos' circulation was also observed. The aim of this study was to evaluate the impact on air quality and on public health of reducing vehicles' circulation during the truck drivers' strike in Sao Paulo. We compared by Two-way ANOVA test Sao Paulo's air quality during the strike, based on NO_x, PM₁₀ and O₃ concentration levels, with the air quality registered on days with similar conditions of precipitation, air temperature, air relative humidity and wind speed. Pollutant concentration data were consulted on Sao Paulo's Air Quality Information System (provided by Sao Paulo's Environmental Company) and meteorological data were from the meteorological station of Institute of Astronomy, Geophysics and Atmospheric Sciences of Sao Paulo University. A relative-risk function recommended by World Health Organization was used to associate the decrease in PM₁₀ concentration during the strike with avoided all-cause mortality. Health data inputted on relative-risk function were consulted on the official Brazilian Health Database. The results demonstrated that the minimal circulation of vehicles during the strike was responsible for 27.4% - 42.38% improvement on NO_x air quality and 12.12% -24.77% on PM₁₀ and it avoided between 3.34 and 8.48 deaths. Concerning O₃ concentration, no difference was identified between strike days and comparative ones. A specific analysis for different sites of the city revealed that the greatest air quality improvement occurred near an arterial road with intense trucks circulation on regular days. Air quality improvement was also detected in a park, demonstrating the magnitude of vehicle circulation impacts. The results of the study provide evidence to support cleaner transportation investments and traffic restriction policies.

S1 PARALLEL SESSION 02

Commuter exposure and inhaled dose of particulate matter in four common modes of transport in Lisbon

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Exposure to air pollutants, namely particulate matter (PM), is particularly high in the transport' microenvironment due to the proximity to mobile sources. Commuters spend a considerable amount of time in this microenvironment, which may result in adverse effects on human health. Despite the fact that there has been an increase in the implementation of measures aiming at reducing the citizen's exposure to air pollutants, the problem persists. To conceive policies aiming at reducing the number of exceedances and the pollutants concentrations, it is fundamental to study air quality in the area of study. This study aims to assess commuters' exposure to PM in the modes of transport most frequently used in the city of Lisbon.

Field measurements were performed in car, bicycle, metro and bus mode in a representative route of the daily commutes of the citizens, covering a distance of 6.7 km from the residential area of Telheiras to Praça dos Restauradores in the city centre. Measurements were performed in five periods of the day (at 8h, 10h30, 13h, 18h and 20h) during 21 weekdays from June to October 2018 in a 105 set of periods of measurement. Mass concentration of particles with aerodynamic diameter (AD) smaller than 2.5 μm (PM_{2.5}) and 10 μm (PM₁₀), black carbon (BC) and number concentration of particles with AD from 0.01 to 1 μm (PN_{0.01-1}) were measured. There was no control over the ventilation system in buses. Considering the measurements in cars, in order to cover a wide range of exposure conditions, measurements were performed in private cars powered by different types of fuel and using different types of ventilation.

Results show that average concentrations of PM_{2.5} and PM₁₀ were higher in the metro, whereas BC and PN_{0.01-1} average concentrations were higher in car and bus journeys, respectively. Inside cars, PM_{2.5}, PM₁₀ and BC concentrations were clearly influenced by the use or disuse of ventilation. In fact, the ventilation system that most of the cars used in this study appeared not to have efficiently removed the BC from the outdoor air. On the contrary, the use of ventilation appeared to have a reducing effect on PM_{2.5} and PM₁₀ concentrations from the air that enters in the car cabin. For all the pollutants, the highest concentrations were measured in the streets where traffic density was higher and where the street morphology did not allow the dispersion of pollutants.

The highest inhaled doses, as shown in figure 1, were measured in bicycle journeys due to the greater inhalation rates and travel times associated to this transport mode.

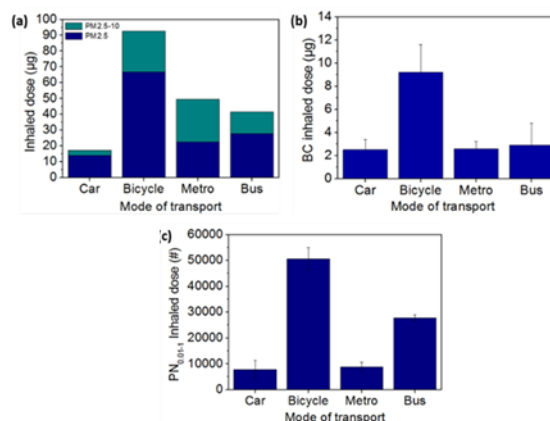


Figure 1. Inhaled doses per trip of PM2.5 and PM2.5-10 (a), BC (b), PN0.01-1 (c).

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S1 PARALLEL SESSION 03

Economic losses of air pollution in Sao Paulo, Brazil

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Background: Studies regarding air pollutants have documented the adverse health effects of air pollution exposure, even at levels below the World Health Organization (WHO) limit recommended. In this sense improvement of population health is an argument for further air pollution reduction policies. Mortality and hospital admissions due to respiratory and cardiovascular effects are supported by the stronger evidence of association with air pollutants exposure. Because of vehicles are responsible for 70% of environmental pollution in European cities, national and international organizations have encouraged non-motorized transport and public transport in cities in order to decrease some of the most serious health and environmental issues. Besides health effects, air pollution-related illnesses have economic implications for society often underestimated by governments. Therefore, any decrease in air pollution levels, can mean an expected reduction in total external costs. From this perspective, economic studies are important for the debate and improvement of public policies. **Objectives:** The main goal of this study was to determine the economic valuation in terms of life years lost of particulate matter smaller than 10 μm (PM10) pollutant exposure in São Paulo city, Brazil. The health outcomes studied were cardiovascular and respiratory mortality from 2006 to 2011. **Methods:** The health effects of PM10 pollutant were estimated with Poisson generalized additive models and we used the values of the coefficients to obtain the percent of change in Relative Risk according to an increment of 10 $\mu\text{g}/\text{m}^3$ in PM10 concentrations. To achieve the economic valuation we conducted the disability-adjusted life years (DALY) method to analyzed the years of life lost component (YLL) due to PM10 exposure on cardiovascular and respiratory mortality. Finally, we converted the YLL total to economic loss by the value of a life year (VOLY). **Results:** As expected our results confirmed an association between PM10 and cardiovascular and respiratory health adverse effects. The YLL totaled 106,620 years, meaning an overall economic loss of more than € 3,1 billion euros. **Conclusion:** Our study has improved the knowledge regarding the costs of premature deaths related to air pollution and actions can be addressed to governmental authorities in order to improve public policy and to facilitate decision making in the context of scarce resources, especially in developing countries.

S1 PARALLEL SESSION 04

Air quality and health impact assessment of truckers' strike in major highways of São Paulo state, Brazil

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Constant diesel oil price adjustments and the cost of freight are among the main reasons for the Brazilian truckers' strike that occurred at the end of May 2018. This event showed the strong influence of the road transport sector in the economy and air quality on different urban centers of the São Paulo state, such as Cubatão, Osasco and Guarulhos. The purpose of this research was to assess the impact of the truckers' strike on air quality and health in different municipalities of São Paulo state, which are strongly influenced by road transport emissions, particularly in Anchieta, Castelo Branco and Presidente Dutra highways. PM₁₀ and NO₂ values were compared during the strike days (May 24 to 30, 2018) and similar days (between 2015 and 2018) by considering similar meteorological conditions of temperature, relative humidity and wind speed. From pollution reduction results for strike days, we calculated the relative risk and avoided deaths attributed to each pollutant. The assays indicated that air pollutants concentrations were significantly reduced in all analyzed roads. Only in one of the analyzed monitoring stations, close to Anchieta highway, PM₁₀ and NO₂ concentration reductions reached almost 60%. Taken together, the analyzed stretches of roads showed that associated health impacts were about 1,3 and 3,3 avoided deaths, due to reductions of PM₁₀ and NO₂, respectively, which represent an economy of more than US\$ 8 million. Estimates for a whole year scenario results in 92 (PM₁₀) and 242 (NO₂) avoided deaths for 2017 period, considering the reductions achieved during strike, equivalent to an impressive gain of US\$ 627.92 million annually. The results show the important role of the transport sector on deleterious impacts on human health and the urgency for sustainable alternatives of transportation and multimodal solutions. This study was financed by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 1808529.

S2 PARALLEL SESSION 01

Awareness about vector-borne diseases among pet owners and citizens from Portugal

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Vector-borne diseases are infections transmitted by the bite of infected arthropod species that are widespread in Europe. It is clear that climate is an important geographic determinant of vectors, so considering the recent climatic changes, these diseases deserve our best attention. Among them, *Dirofilaria immitis* is one of the most frequently detected mosquito-borne zoonotic nematode in mammals in Europe and is considered as an emerging zoonosis. Leishmaniasis is transmitted through the bite of phlebotomine insects, and in Portugal its incidence in animals and humans is increasing. Ehrlichiosis and anaplasmosis are diseases transmitted by ticks which are in expansion highlighting the risk of exposure and transmission of diseases. The aim of this study was to assess the awareness of pet owners and citizens about these vector-borne diseases in two different regions (Minho and Alentejo) from Portugal. For this purpose, three questionnaires were constructed, tested and administered to the costumers of veterinary hospitals and to citizens. Statistical analysis was done using IBM® SPSS® Statistics vs.24.0. About dirofilariasis 316 persons have completed the questionnaire, most of them live in a high risk exposure area (53%). The majority (58%) choose the tick and only 27% considered the mosquito, the most dangerous vector. Only 34% recognize the term dirofilariasis. Only 13% recognized the disease as a zoonosis. Half of the respondents would like to receive more information about dirofilariasis, mainly via email or by their veterinarian. About tick-borne diseases, 239 persons completed the questionnaire, and admitted (80%) to deworm their pets, although they do not know exactly for what neither the correct frequency. Only 7.9% of the respondents recognise the names of the diseases but even less know them as zoonosis. Most of them (82.8%) want to receive information mainly through the veterinarians (48.0%) and family doctors or nurses (39.9%). About leishmaniosis, 291 persons completed the questionnaire, only a minority vaccinate their animals for prevention of this diseases, even if 62.5% had heard of it. Most of them (56.0%) are unaware about the zoonotic potential of leishmaniosis. Most (75.9%) expressed interest in receiving information about the disease through the veterinarians (46.7%) and the family doctor or nurse (26.1%). It seems that there is a need to inform but also to communicate as even those who seem to have knowledge still adopt risk behaviours. The veterinarians may have an important role in public health education, but the authors suggest that the investment in health literacy should be jointly by animal and human health professionals in a One Health perspective.

S2 PARALLEL SESSION 02

Leptospira spp. in soils and freshwater collections: a public health concern

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Leptospirosis is an infectious zoonotic disease of worldwide importance. Rodents are the most common reservoirs in *Leptospira* spp. dissemination. When excreted in urine, spirochetes can survive for several weeks or months under favorable conditions (wet soil, water with neutral or slightly alkaline pH). Thus, contaminated water and soils become important vehicles of transmission to humans, which can be infected by penetration of these infectious agents into intact mucous membranes (nose, mouth, eyes), or to healthy or injured skin.

In an earlier study, carried out in Sanitation workers (risk group) from Lisbon and Tagus Valley region (Portugal), no antibodies against any pathogenic *Leptospira* were detected in the serum of the participants, although 77% of the respondents had spotted rodents near sanitation structures. At the time, it was accepted that the use of Personal Protective Equipment (PPE's) by the vast majority of participants could have been an important element in the prevention of possible contact with the bacteria. However, it remained to be clarified if soils and freshwater collections were contaminated with *Leptospira* spp, raising the risk of transmission to humans if the use of PPE's is neglected. Thus, this study aimed to evaluate the presence of *Leptospira* spp in soils and freshwater collections from two districts of Portugal mainland (Lisbon and Setubal).

Samples from distinct freshwater collections (surface of lakes, ponds, rivers, streams and public fountains) (N=161), as well as soils (near freshwater collections, dustbins or wooded areas) (N=89) were collected in nine cities from Lisbon and Setubal districts. At the collection sites, chemical and physical parameters (e.g., pH, nitrites, temperature) were evaluated, and recorded its location.

After DNA extraction, two nested-PCR protocols with different primers were used. At first, it was applied a nested-PCR protocol with universal primers (A and B) from the *rrs* (16S) gene, for *Leptospira* spp detection. Each sample with leptospiral DNA amplification, was submitted to a second nested-PCR protocol, with specific primers (targeting *LipL32* gene) for detection of pathogenic species.

The nested-PCR protocol using universal primers allowed the detection of leptospiral DNA in 100 water samples (62%) and 75 soil samples (84%). After further evaluation with

LipL32 primers, it was detected pathogenic leptospiral DNA in 38 water samples (24%) and seven soil samples (8%). Preliminary sequencing results showed the presence of *Leptospira borgpetersenii* serovar Hardjo-bovis in water samples from different sites of Lisbon district, while in Setubal, it was also found *Leptospira interrogans* serovar Copenhageni. Regarding soil samples, it was found *Leptospira mayottensis* in a sample from Setubal district.

The amplification of leptospiral DNA in more than half of the water samples and in the majority of soil samples represents a disturbing result, leading to a significant public health concern about the risk that it poses to population health.

2 PARALLEL SESSION 03

The importance of wildlife health on zoonotic bacteria transmission – interactions between *Borrelia burgdorferi* s.l. and its avian hosts

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Borrelia burgdorferi sensu lato (s.l.) is a tick-borne zoonotic agent maintained in enzootic cycles in nature by vertebrate reservoir hosts, including mammals, lizards and birds. To understand the eco-epidemiology of Lyme borreliosis it is necessary to evaluate the relationships between *Borrelia* genospecies and vertebrate reservoir hosts. We surveyed *Borrelia* infection prevalence in avian hosts and using wild birds as models, we assessed the physiological impact of infection in reservoir hosts and how exposure to stress could affect hosts' infectivity to vector ticks. This helps to understand how these host-parasite interactions may affect tick-borne zoonotic agents' circulation and transmission, and, ultimately, disease risk.

Thrushes (*Turdus* spp.) were the most important birds in the enzootic cycle of *Borrelia*. The diversity of *Borrelia* genospecies detected in ticks feeding on birds was high, and the most common genospecies was *B. garinii*, a pathogenic genospecies. The ubiquitous blackbird *Turdus merula* successfully transmitted *B. turdi*, *B. valaisiana* and *B. burgdorferi* s.s. to vector ticks in laboratory conditions. There was no evidence that exposure to stress increased infectivity of wild avian hosts to vector ticks in an experiment performed in captivity. However, oxidative balance (protein carbonyls and glutathione peroxidase levels) of naïve blackbirds was affected by experimental infection with *Borrelia*, suggesting that these bacteria may inflict non-negligible physiological harm on its natural reservoir hosts with potential impact on transmission success.

S2 PARALLEL SESSION 04

Gene amplification and a novel-kdr-mutation mediate insecticide resistance in the mosquito vector *Aedes aegypti* from Madeira Island

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Insecticides are the backbone of vector control strategies aimed at interrupting arboviral diseases transmitted by *Aedes aegypti*. However, in addition to the environmental impact produced by the use of these compounds, insecticide resistance has emerged in several populations of this mosquito species. Therefore, the study of the underlying mechanisms responsible for this phenomenon is of paramount importance to develop more eco-friendly control tools.

Since 2005, *Ae. aegypti* is present in Madeira Island (Portugal) and was the incriminated vector of a dengue outbreak that occurred in this island in 2012. Although there are no records of continuous usage of chemical insecticides by local health authorities, previous studies have reported high levels of insecticide resistance in this mosquito population.

In this study, we aimed to: (i) evaluate the present status of susceptibility to chemical insecticides of the *Ae. aegypti* population from Madeira Island, by performing WHO bioassays, (ii) detect knockdown resistance mutations (kdr) associated with target-site resistance mechanisms, using allele-specific PCRs and, (iii) estimate copy number variation (CNV) of several genes involved in metabolic resistance by applying a novel qPCR methodology.

Results showed that the *Ae. aegypti* population from Madeira remains resistant to all tested insecticides (temephos, deltamethrin, permethrin, bendiocarb, cyfluthrin, etofenprox, dieldrin, DDT), with mortality rates varying from 3% to 93%. Similar to previous studies, the F1534C kdr mutation remains fixed in the population. The frequency of mutation V1016I increased significantly ($p < 0.006$) between 2013 (0.17) and 2019 (0.31). The recently described mutation, V410L was also present in a moderate frequency (0.33), and it was in association with mutation V1016I ($p < 0.0001$). Our finding is the first record of the V410L mutation in a field population outside Latin-America.

Metabolic resistance associated genes CCEae3A and CypP9J23 displayed CNV variation when compared to the reference susceptible strains Rockefeller and Bora Bora. These results agree with previous data in which CCEae3A and CypP9J23 were

overexpressed in specimens from the same population using a microarray approach. This is the first report of gene amplification in *Ae. aegypti* populations from European territories.

Given that vector control in Madeira Island relies on community-based measures, persistence of the resistance profile found may be related with either domestic insecticide usage or to other pest control management. These results emphasize the relevance of environmental control strategies currently used in the island, such as breeding site elimination, in reducing transmission risk of future arboviral *Ae. aegypti*-mediated diseases.

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S3 PARALLEL SESSION 01

Aspergillus spp. prevalence in one Portuguese hospital. A reason to be worried?

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Aspergillus genus is responsible for over 80% of pulmonary invasive fungal infections in humans. Invasive aspergillosis, caused by *Aspergillus fumigatus* in 80% of the cases, is the most common invasive fungal infection.

The aim of this study was to assess prevalence of *Aspergillus* genus in a Portuguese hospital, using a wide sampling approach combining active and passive methods.

A total of 15 sampling sites were defined, distributed by the different hospital areas - emergency room, day hospital, internment ward, operating room and outpatient area. Active (air impaction) and passive (surfaces swabs, settled dust, filters from heating, ventilation and air conditioning (HVAC) systems and electrostatic dust collectors (EDC) sampling methods were applied. Samples were impacted/washed and seeded on: malt extract agar (MEA) supplemented with chloramphenicol (0.05%) and dichloran-glycerol agar (DG18).

The samples collected by air impaction presented the higher fungal diversity, yet *Aspergillus* sp. was not the most prevalent genera (2.69% MEA; 15.41% DG18). Within *Aspergillus* genus, section *Fumigati* was the one with highest prevalence in both culture media (86.67% MEA; 45.09% DG18) with other sections (*Aspergilli*, *Candidi*, *Nigri*, *Restricti*, *Versicolores* and *Usti*), presenting lower counts in both culture media.

Surface swabs were the only sampling method recovering *Aspergillus* section *Circumdati*, and on DG18. Concerning the settled dust samples, *Aspergillus* sp. was not the most prevalent (25% MEA; 9.26% DG18), with *Fumigati* section the only isolated on MEA and *Aspergilli* (35.71%) and *Versicolores* (64.82%) sections on DG18. On the EDC and HVAC filters samples *Aspergillus* sp. was not found.

Overall, the results of this study highlight *Aspergillus* sp. presence in the assessed premises. The *Aspergillus* section *Fumigati*, with increased clinical relevance, was often detected in this clinical environment. The observed levels and distribution of *Aspergillus*

suggest the need to implement corrective measures not only due to *Aspergillus* counts, but also due to the toxigenic potential of some *Aspergillus* sections. The different fungal prevalence found with the different methods applied, validates the utility of having multiple sampling strategies when defining a regular routine assessment in clinical environments.

S3 PARALLEL SESSION 02

Bioburden in Indoor SPAs Air

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The indoor environment of Portuguese thermal spas can influence the health of users and their attending staff. These facilities can be a source of microorganism and can constitute a public health concern.

The aim of this study was to assess bioburden in two Portuguese thermal spas and to develop protocols and recommendations for bioburden control. Samples were collected in May 2019 using active method for air sampling by impaction (Millipore air Tester, Millipore, Billerica, MA, USA) and passive sampling methods (surfaces and electrostatic dust collectors - EDC).

In spa A, the total bacterial air load ranged from 1.4×10^2 (reception) to 4.4×10^2 CFU.m⁻³ (otolaryngologist treatment). Coliform load in indoor air ranged from 4 (workers' bathhouse) to 24 CFU.m⁻³ (thermal pool). Surface samples showed a range of total mesophilic bacteria counts between 1×10^3 (double cab treatment) and 1×10^7 CFU.m⁻² (Vichy shower treatment). Coliforms in surface samples were only found in Vichy shower treatment with a load of 3.5×10^4 CFU.m⁻². Total bacteria count in EDC ranged from 10.6×10^2 (Double Cab and Vichy shower treatment) to 131×10^2 CFU.m⁻² (workers' bathhouse).

In spa B the total bacterial air load ranged from 20 (thermal pool- building 2) to 2.3×10^2 CFU.m⁻³ (otolaryngologist treatment - building 2) and coliforms counts ranged from 4 (otolaryngologist treatment and reception – building 2) to 8 CFU.m⁻³ (Vichy Shower treatment – building 2). For surface samples, the total bacterial concentration ranged from 1×10^3 (reception - building 1 and otolaryngologist treatment – building 2) to 4.8×10^5 CFU.m⁻² (Vichy Shower- building 1) and coliforms were only detected in Vichy shower – building 1 at a concentration of 9.5×10^4 cfu.m⁻².

Fungal air load in the spa A ranged from 12 (in the double cabinet treatment) to 5.4×10^2 CFU.m⁻³ (in the reception) on MEA, and from 4 CFU.m⁻³ (in the Vichy shower) to 88 CFU.m⁻³ (in the thermal pool) on DG18. The swab samples showed a contamination range between 0 to 5.0×10^6 CFU.m⁻² (in the Vichy shower) on MEA, and between 0 and 5×10^6 CFU.m⁻² (in the otolaryngologist treatment) on DG18; the EDC showed contamination values between 0 (in the SPA pool) and 1.1×10^5 CFU.m⁻² (in the double cabinet treatment) on MEA, and between 0 and 1.1×10^5 CFU.m⁻² (in the SPA pool) on DG18.

Fungal air load from spa B, ranged from 4,0 (in the thermal pool of building 2) to 1.2×10^3 CFU.m⁻³ (in the thermal pool of building 1) on MEA, and from 12 (in the thermal pool of

building 2) to 1.13×10^3 CFU.m⁻³ (in the workers locker room in building 2) on DG18. The swab samples presented a contamination range between 0 and 5×10^6 CFU.m⁻² (in the workers locker room in building 2) on MEA, and between 0 and 5.15×10^6 CFU.m⁻² (in the Vichy shower in building 2) on DG18.

Quantitative and qualitative results highlighted the need of intervention since immunocompromised patients/users can be present in this environment. Further results, covering fungal species identification, will be important to characterize more accurately the bioburden exposure risk for users and staff. Additionally, the results interpretation should focus not only on the quantitative mandatory requirements, covered by Portuguese enforcement, but also the potential health effects due to species present.

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S3 PARALLEL SESSION 03

Prevalence of airborne pathogenic bacteria in Portuguese Healthcare Facilities

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It is currently acknowledged that health care facilities create an optimal environment for the growth and spread of potentially pathogenic microorganisms particularly associated with nosocomial infections. Several outbreaks of *Legionella pneumophila* recorded in healthcare facilities and associated diseases have been considered a severe public health issue. Potable water was recognized as the major environmental source and the microaspiration the major mode of transmission of healthcare-associated Legionnaire Disease, not only in patients but also in workers. Moreover, the World Health Organization (WHO) describes antimicrobial resistance to human pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA) as a global health challenge. MRSA is well-known worldwide as a cause of numerous hospitalizations and deaths associated with extremely high mortality rates for invasive infections.

The objective of this study was to estimate the prevalence of airborne pathogenic bacteria, namely *Legionella* sp. and Methicillin-Resistant *Staphylococcus aureus* (MRSA) in healthcare units with different typologies

33 samples were collected in total in two different healthcare settings: 10 Primary Health Care Centers (PHCC) and 1 Central Hospital (CH) in December 2018. Water samples were collected from showers of the workers' toilets and from condensate trays of the heating, ventilation, and air conditioning systems (HVAC). The sampling and lab procedures followed instructions by the Portugal Health Ministry and the culture method described in ISO 11731:2017 was applied for the isolation of *Legionella* and estimation of their quantity in water samples

For MRSA detection, samples were inoculated in Tryptic Soy Broth enrichment media for 24h at 37°C and inoculated in non-selective (Columbia blood agar) and selective culture media plates (Chromogen MRSA Selective Agar). MRSA isolates were confirmed by immunologic assays.

For the collected samples, culturable *Legionella* species were not detected, whereas MRSA was isolated in one surface swab which corresponds to a prevalence of 0.5% in all samples (1/187) and 1.2% in surface samples (1/82).

Due to their characteristics, health care facilities can provide optimal conditions for the development of *Legionella* and *Staphylococcus* genus. The presence of MRSA in health care facilities, even in low prevalence levels is of significant concern considering the immunocompromised state of patients that may be exposed. It should also be taken into consideration that although negative results were obtained in the *Legionella* cultivation, an effective monitoring must be done periodically, throughout the year, namely in cold and hot season to prevent the infection of patients and workers.

Acknowledgments

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S3 PARALLEL SESSION 04

Indoor-to-outdoor levels of size segregated particulate matter in urban microenvironments

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Airborne particulate matter (PM) is an issue of increasing importance due to its effects on human health [1], especially to children who represent a vulnerable group, with developing immune and respiratory systems. The harmful potential of particles is related to their ability in crossing the respiratory system, depositing in the deepest and most defenceless regions of the lung, carrying several toxic compounds [2].

This study aimed to evaluate the relationship between indoor and outdoor size distributions of particles and its chemical constituents affecting children exposure. This characterization was carried out in homes and schools located in Lisbon city centre.

The aerosol size distribution was obtained using a Personal Cascade Impactor Sampler (PCIS). Particles were separated in five aerodynamic diameter ranges: <0.25; 0.25–0.5; 0.5–1.0; 1.0–2.5; and >2.5 μm . Moreover, the data collected simultaneously by a medium volume sampler, for the coarser size fraction (2.5–10 μm), was used to complement the results obtained by the PCIS. The samples were representative of weekly (5-day) occupied-hours. Major and trace elements were analysed by X-Ray Fluorescence. Organic (OC) and elemental carbon (EC) concentrations were determined by thermo-optical method.

The highest indoor PM₁₀ levels were registered in the schools (33–97 $\mu\text{g}/\text{m}^3$), while the lowest values were measured in the homes (11–38 $\mu\text{g}/\text{m}^3$). In general, PM₁₀ concentrations inside the homes were lower than those measured outside, while the opposite was observed in the schools. On average, PM mass in homes was more concentrated in the smallest size range, while in the schools the coarser particles represented most of the PM mass (Fig.1).

OC represented the major component in the indoor of both homes and schools for all size ranges, accounting on average for 14.0–68.7% of the total mass. EC represented the second largest component for PM_{0.25}. For the remaining size ranges, the second most abundant specie was the Ca in the case of the schools, which could be related to the use of chalk on blackboards. For homes, this characterization depended largely on the particle size.

The sources of carbonaceous aerosols can be determined by analysing the correlation between OC and EC. A significant correlation was observed for PM_{2.5-10} ($R^2 = 0.79$), PM_{1.0-2.5} ($R^2 = 0.69$) and PM_{0.5-1.0} ($R^2 = 0.59$), suggesting that they come from related sources or are transported to the site together.

The sea salt and mineral dust were present dominantly in the coarse mode, as expected.

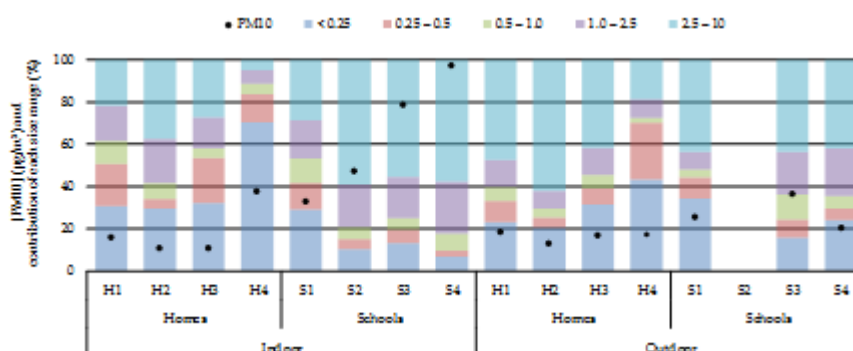


Fig. 1 – PM₁₀ concentrations and respective size distributions in the indoor and outdoor of the homes and schools.

The mass size distribution of the particles and its chemical constituents was very heterogeneous, not only among locations (home vs. school) but also between indoor and outdoor microenvironments.

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[1] Shaughnessy, W.J., et al (2015). Atmos. Environ. 123: 102-111.

[2] Valavanidis, A., et al. (2008). J. Environ. Sci. Heal. Part C, 26:339-62.

S4 PARALLEL SESSION 01

Lisboa a sustainable city to Climate Change in action

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Now-a-days, Cities are the places where Europe's growth potential is greatest and where the society see the sustainability policy in action. The Lisbon municipality its one leadership case-study of a Sustainable policy to face Climate Change (CC) using a holistic strategy. The implementation of this vision asks for an ambitious agenda for Lisbon city.

The international commitments on going, allows the city to monitor the benefit-costs already achieved with the investment in its sustainability strategy, in terms of Safety and Awareness, Environmental Efficiency, Mobility, Climate Change, Energy and Health. Also reinforce the urgent need to take action with a joint investment to:

- Manage the present territory considering the future expected CC scenarios
- Increase the quality of life of those who live, work, study or travel around the city
- The main steps taken highlight the following initiatives:
- Strength partnerships at national, regional, local level, between public and private sectors, involving decision-makers, volunteers and researchers
- Share the best practices in development on Lisbon with SDG, Agenda 2030, Global Covenant of Mayors for Climate and Energy, Local Agenda 21 and Sendai Framework for Disaster Risk Reduction
- Invest in a participatory process as a relevant remark to involve citizens as key actors co-responsible for the implementation of innovative urban resilience policy in the city.
- Relevant milestones in Lisbon environmental policy to CC are:
- measures ongoing to decrease CO₂ emissions placing Climate and Energy concerns at the centre of its agenda
- Urban and emergency planning instruments approved, such as the Master Plan, the Municipal Adaptation Strategy for Climate Change and the Sustainable Energy and Climate Action Plan (SECAP)
- Winner city of the next European Green Capital Award 2020, an initiative to set higher standards in sustainable urban development, listening to what their citizens want and pioneering innovative solutions to attract investment.
- EU RESCCUE project with the goal promote the reassess of the Lisbon's Action Plan to CC and strength strategies between Bristol and Barcelona, other 2 research sites involved in this framework

- Lisbon Metropolitan Plan for CC Adaptation involving all the municipalities of this region us another step up to updating Portuguese political response to promote CC strategy
- Design the architecture of a dashboard application to evaluate the urban floods at local level, integrating a GIS approach, as part of the intelligent city management platform.

Based on this continuous and intervened process the face CC Lisbon municipality promotes the present investment in innovative, urban resilient and sustainability strategies to CC leading to improve the life quality of the people of the city, promote Lisbon as one of the "BEST CITIES TO LIVE" and prosper well into the future.

S4 PARALLEL SESSION 02

The role of the schools at the climate changes' fight

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Climate change is one of the most important environmental impacts that earth is being targeted, being the main cause excessive resources consumption and reliance on fossil fuel leading to CO₂ emissions. Huge reductions of these emissions are imperative to limit catastrophic impacts in the environment and human beings.

The implementation of a Low Carbon Economy, by incorporation of complementary approaches such as energy efficiency, smart growth initiatives, transportation control measures, energy-efficiency, product procurement and resources conservation, conducts to important environmental, economic and social benefits. It reduces private and external costs and contributes for the accomplishment not only of energy related targets but also of the 3rd priority objective defined by the 7th Environment Action Program 'to safeguard the Union's citizens from environment-related pressures and risk to health and well-being'.

The Interreg Sudoe ClimACT project was created in order to act against actual environmental challenges, helping to support 39 pilot school, from Portugal, Spain, France and Gibraltar, to the transition to a low carbon economy. It's imperative for schools to reduce energy and environmental related expenditures, without affecting educational operations, by applying procurement and behavioral-related measures.

This work presents a methodology developed in a researchaction approach in 6 Portuguese ClimACT schools. This methodology was based on 4 main actions: 1. technical audits performance to assess schools' environmental and energy performances; 2. benchmarking of schools based on the implementation of Key Performance Indicators; 3. environmental and energy assessment based on project scores; 4. assessment of schools' carbon balance.

Results showed that schools have a large range of improvement in all analysed sectors. Regarding carbon balance, it can be observed that the sources impact is bigger than compensation achieved by the sinks. It was found that for schools, the main emission sources were the energy consumption, and their daily commuting options. Furthermore, it was also possible to conclude that emissions associated with water consumption, and waste production were almost negligible. As a general remark, it was observed that according to the characteristics of the schools –

building characteristics, space management, etc – their associated carbon emissions vary. So, it is possible to highlight that schools have considerable room for improvement, by the implementation of measures in the various sectors analysed.

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S4 PARALLEL SESSION 03

Climate Change: A Prospective Study on the Health Impact of Population in Norway and Portugal

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The Earth's climate is not constant, and its natural variation obeys relatively well-defined cycles. The abnormal temperature increase that has been observed recently, has largely exceeded the natural climatic variations of the last 1000 years. A group of scientists argue that the planet is moving rapidly to the point of no return with the effects of climate change. It is estimated that the main impacts of changes in the global climate system are the continuation of temperature rise, sea level rise and the intensity and frequency of extreme weather events, such as storms, heat waves, floods and droughts. The objective is to know the impact of climate change on people's health in Portugal and Norway, as well as the climate variations that have existed. It was also intended to study which diseases can occur in the population, and finally to find out if the population is informed and considers this a relevant topic. The study was an observational, analytical and retrospective cohort study. Respondents answered to a survey assessing their knowledge of the subject. The survey was applied to people living in Norway and Portugal aged over 18 years. We obtained 181 replies (151 replies from Portugal, 30 replies from Norway). It was verified that the majority of respondents are female (Portuguese: 84.7%; Norwegian: 42.9%; and "Others": 75% women). The results were evaluated in the IBM SPSS version 25 program, and it was concluded that temperatures, in both countries, have been increasing. In Portugal we obtained 99.3%, in Norway, all 23 answers obtained, account for a rise in temperature (100%) and that there has been a decrease in precipitation (from Portugal 93.8% responses, 100% of Norwegian nationality and 66.7% from other nationalities). The seasons where there have been more variations for Portugal are winter (63%) and summer (53.4%), in Norway it's winter (100% from Norwegian and from another nationality 72.2%) and Spring (from Norwegians 83.3% and from another nationality 33.3%). We conclude that people are informed about the issue, regardless of the country. In Portugal, according to the diseases with the most responses, 92.7% stated that allergies were one of the consequences of climate change, 46.7% responded to undernourished, 42% responded to pulmonary diseases chronic obstructive diseases and 32% responded to mental illness. On the other hand, the Norwegians, 57.1% answered to allergies, 28.6% to undernourished, 14.3% to chronic obstructive pulmonary diseases and 71.4% to mental illness. The study made it possible to understand that living in a country with a different type of climate does not mean that people don't worry about it. However, people only remember climate change when

something large-scale happens. The fact that the man performs actions that harm the environment only harms this further. It is extremely important that there is a high level of information to the populations so that they can be informed and have knowledge of what they can do to help the planet in this problem. In this way, measures and strategies can be created to help the populations of both countries to be assured on the future of the country in which they live.

S4 PARALLEL SESSION 04

Adaptation to Climate Change in the Health Sector – case study of Lezíria do Tejo Region (Portugal)

S. Capela¹, M. Magina², I. Caria²

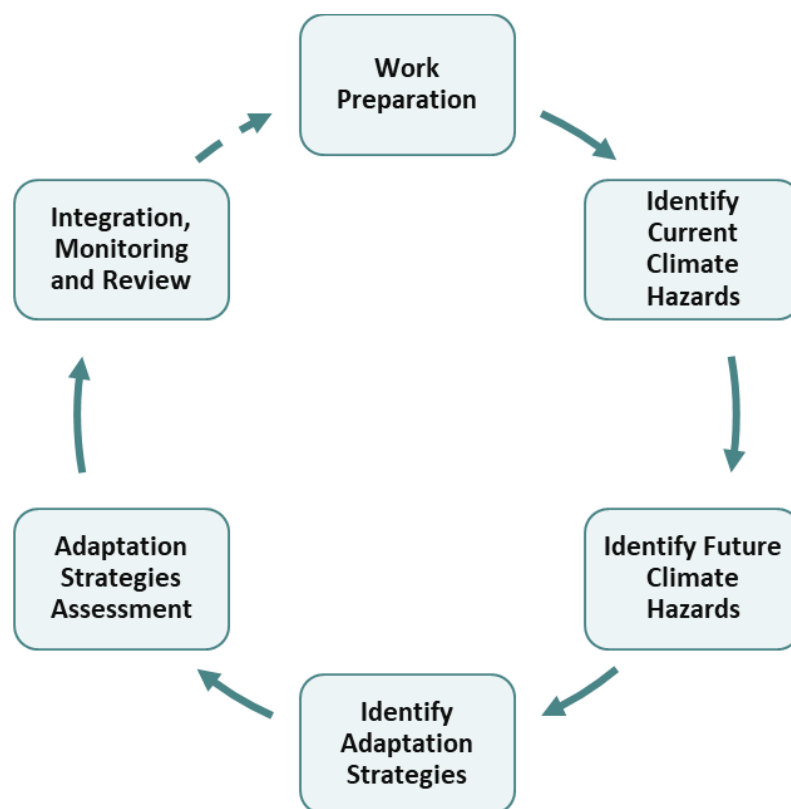
¹Ecoprogresso, Portugal, ²Procesl, Portugal;

The Portuguese national strategy on adaptation to climate change identifies Health as a priority sector, by its high vulnerability to the effects of the local climatic impacts.

In fact, according to the Portuguese report “Climate Change and Human Health” (ARS LVT, 2012), the climate change has adverse effects on the population health, who need fresh air, quality water, diversified food, and in enough quantity, and a shelter, in order to preserve it.

More specifically, variations in temperature patterns as well as the occurrence of extreme weather events lead to changes in the heat waves' s frequency and duration and, indirectly, in the degradation of ambient air quality, as a consequence of the fires that occur more often and more severely under favorable climatic conditions. On the other hand, variations in precipitation patterns, and the minimum temperatures increment observed in the last decade, can lead to the emergence of vector-borne diseases that may have significant impacts on human health. There are also other climatic events, which can, in extreme cases, affect public health, such as hurricanes and flooding (by excessive precipitation) that may compromise a region's access to primary health care, food and water quality, in addition to generating unsanitary conditions due to poor hygiene conditions.

Considering the urgent need of action in the adaptation to climate change, not only for health issues but also for other important sectors, as agriculture, forests and biodiversity, the region Lezíria do Tejo developed, between 2017 and 2018 an Intermunicipality Plan to the adaptation on Climate Change. This plan follows the methodology of the Urban Adaptation Support Tool (Climate Adapt) adapted to the national reality. This methodology comprises 6 main steps, as shown in the figure below.



All the process was developed around the identification of current and future vulnerabilities, and subsequent identification, evaluation and monitoring of adaptation and mitigation measures for each priority sectors.

Lezíria do Tejo is a region with 11 municipalities, developed around Tejo estuary, with temperate climate and dry summer. During winter, the region is affected by periodic flooding, which causes some disturbances, but is also responsible for the high fertility rates that alluvial soils have. In fact, the climate and geography are prone to the development of agriculture, a sector with high relevance for the region's economy.

This article aims to present the vulnerability assessment results and the adaptation measures to be implemented in the region of Lezíria do Tejo, focusing on the Health sector. The adaptation options developed are essentially related to the increment of the building's resilience to heat waves, to the air quality improvement and awareness of the general population and health professionals to the climate change issues. The results may be considered as an orientation to other regions around the world, with similar geographical and climatic conditions.

S5 PARALLEL SESSION 01

Contrast agents in Magnetic Resonance imaging: The new challenges regarding toxicity and increased safety

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The Magnetic Resonance Imaging (MRI) provides images of any part of the body with multiplanar spatial location and is currently a widespread used imaging method in the clinical diagnostic routine. Indeed, MRI provides better soft tissue contrast than the other imaging methods and can better differentiate fat, water, muscle, and other soft tissues. The first MRI contrast agent to be used was ferric chloride in 1981. Over the past 3 decades, many contrast agents have been developed for use in clinical practice and some of them were withdrawn due to safety conditions. The justified use of gadolinium-based contrast agents (GBCAs) carries some risks, including side effects such as allergic reactions and nephrogenic systemic fibrosis (NSF). The Gadolinium related toxicity has been documented for at least 10 years, with potentially life-threatening disease recognized in 1997 in 15 dialyzed patients. The MRI contrast agents include T1-weighted (T1W) and T2-weighted contrast agents. Since its image signal increases the positive contrast, gadolinium (Gd) chelates as (T1W) contrast agents, dominate the current market of MRI. The current scientific evidence, from the last 4 years, recognizes a concentration-dependent deposition of gadolinium in the brain of the post-mortem human or animal mainly through the high signal intensities in the globus pallidus and dentate nucleus on T1W images, demonstrating roundly the residual deposition of gadolinium T1-hyperintensity in anatomical areas, raising new concerns on the safety of GBCAs. Since 2017 the International Society of Magnetic Resonance in Medicine (ISMRM) Safety Committee, the US Food and Drug Administration (FDA) and The Pharmacovigilance Risk Assessment Committee (PRAC) produced many recommendations and some restrictions on the use of linear gadolinium agents, giving preference to these contrast agents only for liver scans in low concentrations. From this recommendation some types of linear agents were suspended and replaced by more stable and appropriate gadolinium agents known as macrocyclic agents, like gadoteric acid, gadobutrol, and gadoteridol. Regarding that problem, with the focus on the research of new contrast agents, new-typed nano-scaled T1W MRI contrast agents have been designed to overcome the drawback of clinical gadolinium agents. So, due to the better biocompatibility compared with the Gd-chelates, magnetic iron oxide nanoparticles (MIONs) have been increasing attention as MRI contrast agents. So, due to the better biocompatibility compared with the Gd-chelates, MIONs have attracted increased attention as MRI contrast agents.

The recently emerged exceedingly small MIONs (ES-MIONs) are promising to overcome the disadvantages of the Gd-chelate-based T1W contrast agents and MION-based T2W contrast agents because they have good biocompatibility and can be used as T1W contrast agents. Compared with the commercial gadolinium agents, nano-scaled gadolinium-based inorganic agents exhibit excellent T1W MR performance with good biocompatibility. Furthermore, these nanoparticles can be easily conjugated with biomolecules making a multifunctional nanoplatfrom based on gadolinium nanocomposites that can be apply for multimodal imaging and therapy. Other options are the biomedical applications of MXene-based nanoplatfroms by exploring further functionalization strategies and also provide a novel and efficient theranostic nanoplatfrom that successfully constructed a novel superparamagnetic MXene-based theranostic nanoplatfrom based on tantalum carbide (Ta_4C_3) MXene. With this presentation the authors propose to explain and highlight the most recent progress and challenges in the synthesis and modifications of paramagnetic contrast agents showing the currently, newer and more reliable MRI agents, capable of targeting specific organs, tumours and other diseases, with greater specificity.

S5 PARALLEL SESSION 02

Removal of diclofenac from wastewaters by a hybrid adsorption/nanofiltration process

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The worldwide occurrence of pharmaceutical compounds (PhCs) in water sources has been increasingly reported (Ebele *et al.*, 2017, in <http://doi.org/10.1016/j.emcon.2016.12.004>). Due to the increased presence in water bodies, diclofenac (DCF) was classified as a contaminant of emerging concern (CEC). Besides the potential risk, DCF is recalcitrant to conventional treatment in water and wastewater treatment plants (WTPs and WWTPs) and has high potential for bioaccumulation.

Although these compounds aren't (yet) regulated, in the scope of the Water Framework Directive (Directive 2000/60/EC) a first watch list for Union-wide monitoring was published (Commission Implementing Decision 2015/495), including the non-steroid anti-inflammatory DCF.

In order to control DCF discharges into the environment, advanced treatment processes are being developed or optimized. Amongst them, hybrid processes comprising powdered activated carbon (PAC) adsorption and membrane filtration such as nanofiltration (NF), PAC/NF, are particularly promising due to their low risk of oxidation by-product formation and low operating pressures (< 2 bar). The PAC can effectively adsorb PhCs, whereas these membranes safely retain turbidity, bacteria, intermediate-high molar mass organic matter and the fine PAC particles

Following LIFE aWARE project (<http://www.life-aware.eu/>) in which different PAC/NF configurations were assessed for enhanced PhC removal from wastewaters, the main objective of this study was to further evaluate different operation strategies to optimize DCF removal through the hybrid PAC/NF process.

For the studies, model solutions of DCF (2,5 mg/L) in inorganic background were used. As analytical methods, spectrophotometry (286nm) was used to quantify the presence of DCF and the inorganic matrix was characterized in terms of pH and conductivity at 25 °C by potentiometry. (Viegas *et al.*, 2018, in www.ersar.pt).

The lab-scale PAC/NF unit comprised a hollow fiber module, X-Flow HFW1000, with hydrophilic modified polysulfone NF membrane (1000 Da), operated in continuous crossflow filtration mode at constant permeate flow rate (Fig.1). The PAC used was the Norit SA-UF, dosed at 16 mg/L.

In order to maximize DCF removal, the PAC/NF performance was evaluated under different operating conditions: PAC dosing mode (continuous or in pulse), hydraulic residence time (HRT) and concentrate recycle/permeate flow rates ratio.

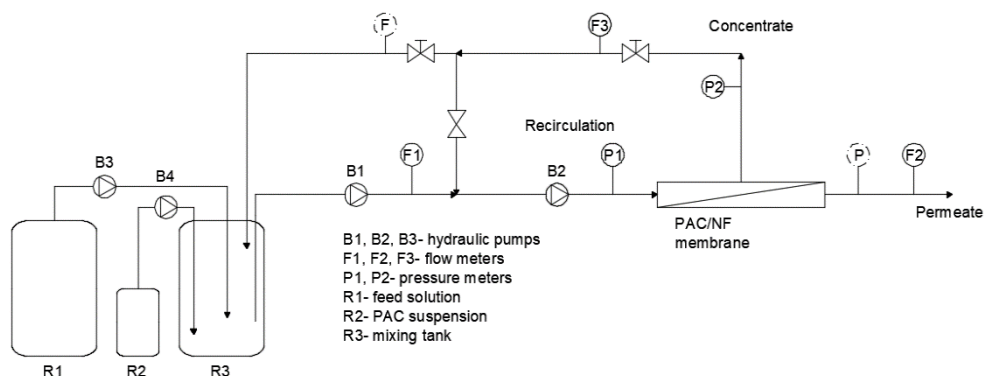


Fig.1: Schematic representation of the PAC/NF lab unit

The experimental tests were run up to 7 hours and for all the conditions tested no pressure increase was observed, corresponding to a TMP of 1.1 bar, showing that the PAC doesn't promote membrane fouling.

The results obtained showed that PAC continuous dosing is more efficient than the pulse dosing mode. The results also showed that increasing the HRT up to 1 h allowed enhanced removal of DCF while for longer contact times no significant improvement was observed. Regarding the tested concentrate recycle/permeate flow rates ratio, the higher DCF removals were obtained for a 50/50 ratio.

Figure 2 depicts the DCF permeate concentration and the process removal efficiency (accumulated) versus time for the selected configuration, detailed above, leading to DCF removals of 93 %.

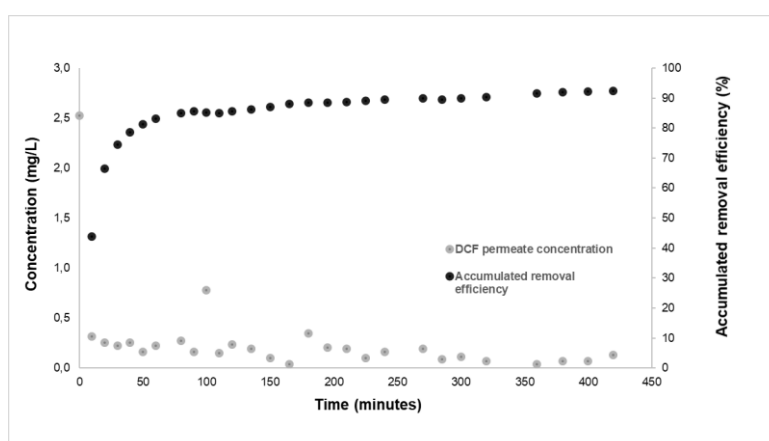


Fig.2: DCF permeate concentration and accumulated process removal efficiency versus time for the selected configuration

The results obtained showed the high potential of this hybrid technology for enhanced removal of DCF, and of other recalcitrant CIEs, from wastewaters.

S5 PARALLEL SESSION 03

Occupational exposure to hexavalent chromium: biomarkers of genotoxicity in human peripheral blood

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The hexavalent chromium [Cr(VI)] is a human carcinogen, which is still authorized for use in several industrial settings because it has been difficult to replace. This was the reasoning to select it as a priority chemical by the European Human Biomonitoring Initiative (HBM4EU, <https://www.hbm4eu.eu/>), which aims to bridge chemicals human exposure to their possible impact on health. For that purpose, not only exposure needs to be assessed but also early effect biomarkers are valuable to reflect health outcomes. The cytokinesis-block micronucleus (CBMN) assay in peripheral blood lymphocytes (PBLs) is one of the most widely used effect biomarker for measuring chromosome alterations in human cells. Since it represents a measure of both chromosome breakage and loss, an increased frequency of micronucleated cells (MNC) can reflect the effect from exposure to genotoxic agents. Moreover, there is evidence that the micronucleus (MN) frequency in PBLs is predictive of cancer risk. As part of an European multi-centre occupational study, 50 Portuguese workers exposed on a daily basis to Cr(VI) and 27 healthy controls non-exposed to Cr(VI) or other chemicals were studied. The present work intended to assess, in a more detailed manner, the early effects in a subgroup of workers (n=6) that use daily paints with Cr(VI), comparatively to that of a control group matched for age, gender and smoking habits. All participants accepted to participate by signing an informed consent previously to the blood withdrawal. An individual questionnaire to collect contextual information, e.g. personal information, lifestyle habits (smoking habits, alcohol consumption, diet), and health status was filled. Personal air samples were collected in order to assess occupational exposure to Cr(VI) soluble and insoluble compounds. Following blood culture, lymphocytes harvesting and staining using standardized methods, MNC were scored in 2000 PBL per individual. The frequencies of MNC obtained for the exposed and control groups were compared using Fisher's exact test. Results from personal air sampling are still under evaluation. A significantly increased frequency of MNC was observed in PBLs of the 6 workers under study, comparatively to the matched controls ($p < 0.001$, Fisher's exact test). These results are in line with the preliminary data obtained for the overall exposed group vs controls. The present results suggest that the

frequency of micronuclei in PBLs is a reliable early effect biomarker in the case of occupational exposure to Cr(VI). Moreover, the findings also suggest a potential health risk for this group of workers. These results should promote the investment in new risk management measures and the effective application of the ones already in place, such as adequate local exhaust ventilation and a more frequent use of personal protective equipment. Additional work, considering the overall exposed group, will be developed aiming to clarify if the obtained results are due to the single exposure to Cr(VI) or to the co-exposure to several other chemicals commonly present in this type of occupational setting.

Acknowledgments

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S5 PARALLEL SESSION 04

Occupational exposure to metals fumes: A case study in a metalworking industry

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During welding process, a visible smoke that contains harmful metal fume and gas by-products is produced. The exposure to these welding fumes can bring adverse effects for workers' health, such as fever, bronchitis, fibrosis, chronic inflammation, functional changes in the lung and increased risk of cancer. The workers performing welding tasks are directly exposed to the metal particles produced by the weld. However, it is important to realize that not only the welders may be exposed to these fumes. If there is no particle suppression, these particles can reach other workers. Despite the importance of indirect exposure to welding fumes in metalworking industries, only few studies analyzed this topic. In view of this, the present study aims to characterize the exposure of workers from different departments of a metalworking industry to total and respirable metal particles (welders and indirect exposed workers).

The study was developed in a industry plant, where production processes included sheet welding. Three different groups were considered for this study: A - welders, B - indirect exposed workers and C - control group (without exposure). Environmental exposure assessment and biological monitoring were performed. Samples were collected from 20 welders, 48 indirect exposed workers and 36 unexposed control subjects. Results from two weeks of sampling are presented in this work. Individual air samples were collected in two different moments to evaluate the exposure of workers from groups A and B to total and respirable welding dust. The three groups were instructed to bring an urine sample at Monday morning and at Friday end of the day. Concentrations of manganese (Mn), nickel (Ni), zinc (Zn), copper (Cu) and chromium (Cr) were determined.

Results from environmental assessment showed concentrations of Zn higher than the threshold limit value (TLV) for 5% of welders in what regards to total particles and 10% for the respirable fraction. For biological assessment, high levels of Cr, Cu and Zn were found for several welders, when results were compared to limits of reference and the control group, but also for some neighbors' workers. These results were related to the control measures applied in the workplace and unsafe behaviors adopted by workers. This study is still ongoing. Results after improve control measures in the working plant are being analyzed.

S6 PARALLEL SESSION 01

Children's exposure assessment to particulate matter in Lisbon metropolitan area

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The exposure to air pollution, in particular to particulate matter (PM), has several adverse effects on human health and may induce or aggravate vascular and respiratory diseases, especially in urban areas. Black carbon (BC) represents about 23% of the PM_{2.5} mass and it comes mainly from incomplete combustion processes, burning of biomass and cooking. The human exposure to air pollutants occurs in diverse microenvironments (MEs), where pollutants may originate from a wide variety of outdoor and indoor sources, and it depends on time spent in each microenvironment (ME) and activity performed. In this way, personal measurements are essential to assess the individual exposure, since it takes into account the time-activity patterns and it portrays the daily exposure to PM to which a person is exposed to. Children are considered a vulnerable group to the harmful effects of air pollutants because their defense mechanisms are still evolving and they inhale a higher volume of air per body weight than adults.

The aim of this work was to quantify the children's daily exposure to size-fractioned PM and BC, and to assess the contribution of each activity and ME to the daily exposure and inhaled dose. Nine children aged 7-10 living and studying in Lisbon metropolitan area were selected to carry personal monitors during 72h. Each child carried a trolley with equipment: a SKC Leland Legacy pump connected to a personal cascade impactor to collect the particles in different size ranges below 2.5µm, a micro-aethalometer AE51 that assessed BC concentrations and a GPS that registered the coordinates of the routes.

The average PM_{2.5} children exposure (19 µg/m³) was higher than those obtained in the nearest fixed urban background station (11 µg/m³), indicating the importance of assessing the personal daily exposure. The average exposure to PM₁, PM_{0.5} and PM_{0.25} was 14 µg/m³, 11 µg/m³, and 7.7 µg/m³, respectively. Time-activity pattern showed that children spent most of their time indoors, especially at home (55%) and in the classroom (22%), where they received 44% of the daily BC dose (Figure 1). Children spent only 5% of the daily time commuting, however the highest BC dose intensity was observed in this ME due to the high BC concentrations. Time series analysis of the BC concentrations showed high peaks in underground parking lots, during indoor candle burning and during charcoal grills.

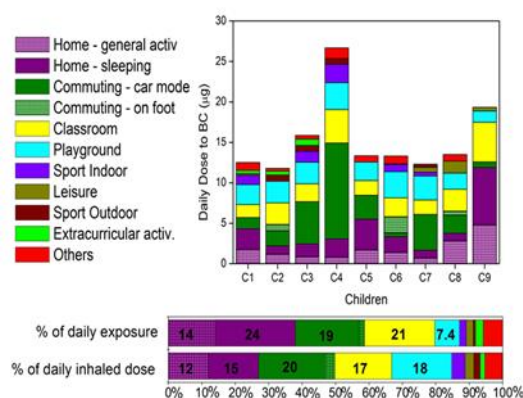


Fig. 1. Daily dose to BC of each child.

This study may be used to support the development of measures and policies focusing in the reduction of PM and BC concentrations in order to improve children's health and wellbeing.

Acknowledgements

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S6 PARALLEL SESSION 02

Portuguese consumer exposure to cosmetic products: risk assessment of ingredients in facial and body moisturizers

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The cosmetic industry launches thousands of products annually. Most chemicals are added to the cosmetic product in the form of preservatives and fragrances and some are classified as toxic and prohibited from being used as ingredients because they can cause cancer diseases, mutations, reproductive toxicity, and endocrine disruption. Cosmetic use has been associated with a number of adverse health effects on consumers, including various types of contact dermatitis and immune reactions (Barel et al., 2013). Intolerance derived from the use of cosmetics is a non-inflammatory response and is included in the group of sensitive or intolerant skins and is characterized by burning, itching, redness, but no visible skin changes, i.e. no clinical manifestations (Cockroach, 2002). Irritation derived from the use of cosmetics such as contact dermatitis is an acute or chronic inflammation of the skin that results from exposure to an exogenous agent and may lead to irritation or allergies (Barel et al., 2013).

However, due to the high number of retail outlets and the lack of information on the label, gap information regarding the cosmetic composition and the incidence of adverse reactions caused by a particular ingredient is a reality.

This study aimed to identify the main products and their ingredients of moisturizing creams products available in different Portuguese outlets facilities and related them to potential health effects based on their characteristics, identifying toxicity effects or hypersensitivity reactions to consumers were studied.

From 50 products collected from different outlets, an exhaustive list of the ingredients was surveyed. A standard name was assigned to each ingredient, adopted as the International Nomenclature for Cosmetic Ingredients (INCI) standard ("Skin Deep® Cosmetics Database | EWG,") at a color scale (green - without severity; yellow - moderate severity; red - high severity) followed by restriction of the ten ingredients most frequent with moderate severity and the five ingredients most frequent high severity.

Perfume, Dimethicone, Phenoxyethanol, BHT, Sodium Polyacrylate, Linalol, Potassium Sorbate, Sodium Benzoate, Limonene and Polyethylene Glycol-100 (PEG-100) were found to be the most commonly used ingredients that were described as moderate severity and Methylpropional Butifenyl, Methylisothiazolinone, Geraniol, Coumarin and

Propylparaben were the most frequent ingredients described as high severity. From collected products and the origin provenance, 21 were “low cost” and 29 “medium/high cost”. It can be seen that about 65% of ingredients classified as high severity become from “low cost” retail outlets. For ingredients classified as moderate severity 47% become from “low cost” retail outlets and the remaining 53% from “medium / high retail outlets.

Regarding the comparison of the number of ingredients classified as “medium/high cost” and “low cost” moisturizers, it can be seen that all contain risk ingredients, and their severity seems to be correlated with “low cost” cosmetics, moisturizers that feature lower, appealing and affordable prices.

S6 PARALLEL SESSION 03

Thermal environment analysis in nursing homes in the Atlantic climate

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Population aging is noticeable all over the world. With long-term care services in greater demand, the parameters of quality and comfort are presented as crucial factors for the well-being of the elderly. Along this line, elderly people are more prone to health problems related to temperature, thus, thermal comfort (TC) is considered one of the most significant health and related quality of life feature for this population. The determination of TC parameters involves: (i) design of spaces; (ii) well-being of users; and (iii) energy efficiency of building facilities (heating and cooling systems). The development of TC models is presently required in order to predict the thermal physiology and comfort of this susceptible population. This research is focused on assessing TC of 8 elderly centers located in the Metropolitan Area of Porto, a representative zone of the Atlantic Climate in Portugal. The measurement campaign takes place from February to December 2019, performing tests 3 times per season per participant institution, allowing a year-round analysis. To accomplish this study, the indoor thermal environmental parameters (air temperature, air velocity, relative humidity and mean radiant temperature), the outdoor conditions (temperature and humidity), as well as, the physical activity (met) and clothing level (cl), are being analyzed in 22 living and activity rooms of the selected elderly centers. This allows to calculate PMV (Predicted Mean Vote) and PPD (Predicted Percentage Dissatisfied) indices and subsequently, evaluate TC. Moreover, a detailed building characterization was performed by a walk-through survey including information such as: type of building construction (concrete, masonry); thermal isolation of the building envelope (type of windows and doors, the presence of weather stripping,); ventilation system (natural, mechanical, hybrid); types of indoor materials; use of gas burning appliances; evidence of dampness or mold; and ventilation practices (opened windows and doors); etc. For the purpose of comparing technical data with occupants' opinion, thermal sensation is also being assessed by interviewing the residents during each TC data collection, determining thermal sensation votes (TSV) as well as preference and acceptability levels through the ASHRAE scales. By now there are 160 questionnaires answered, expecting to reach up to 600 questionnaires total by December. This ongoing study is now on summer season monitoring, having already collected the spring and winter seasons data, both for the physical parameters and TSV survey. By way of example, preliminary PMV and PPD results of 6 elderly centers are shown in Table 1. Considering the recommended range of PMV values for

optimum thermal comfort (between -0.2 and +0.2), it is verified that only institution P07 presents the PMV value in accordance with this range of values. The upcoming data analysis will consider the application of environmental comfort models considering a longitudinal multi-criteria analysis (as seen in Figure 1). This approach of adaptative TC models for older people also offers the possibility of improving resident's life quality and saving buildings energy at the same time.

Table 1 - Average preliminary results per institution of PMV and PPD for the winter season

Institutions (code)	PMV	PPD (%)
P02	-0,44	9,68
P03	0,63	13,66
P04	0,49	11,46
P05	0,25	8,25
P06	-0,79	10,34
P07	0,05	8,47

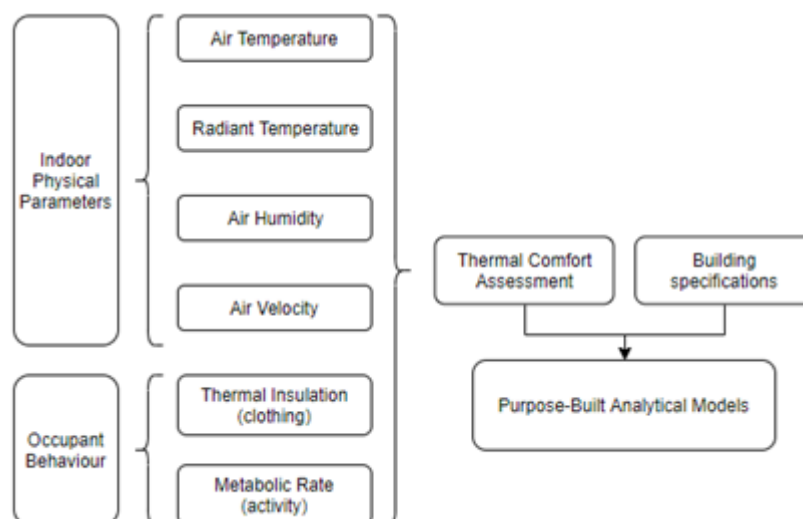


Figure 1 - Analytical Model Design Process

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S6 PARALLEL SESSION 04

The impact of indoor air quality on respiratory health of older people: spirometric and exhaled breath condensate assessments

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The health impact of environmental pollution has been recurrently studied over the last few decades, not only in a scientific research perspective, but also in the context of implementing public health policies. In terms of respiratory health, data available demonstrates that environmental exposure is the cause for the development and/or worsening of respiratory diseases, as chronic obstructive pulmonary disease, asthma, idiopathic pulmonary fibrosis and lung cancer. In a perspective of indoor air quality (IAQ), the elderly are a vulnerable population. On the one hand, as a consequence of the ageing process, they have a more compromised immune system; on the other hand, they also tend to spend more time confined to indoor spaces, due to possible limitations in their daily activities. In the Portuguese Geriatric Study of the Health Effects of Indoor Air Quality in Senior Nursing Homes we aimed to evaluate the impact of indoor air contaminants on the respiratory symptoms and biomarkers in a sample of elderly living in nursing homes.

A total of 269 elderly answered a health questionnaire, performed a spirometry and 150 out of these, collected an exhaled breath condensate (EBC) sample for pH analysis. All the procedures followed the ATS / ERS guidelines. Quality control was carried out taking into account the guidelines of these scientific societies; however, all spirometry was later validated, interpreted and reported by the team of researchers composed of physicians and Cardiopneumology technicians. The study included the evaluation of indoor air, in rooms and living rooms, by physicochemical agents: CO₂, formaldehyde, TVOC, PM₁₀ e PM_{2,5}; and by microbiological agents: total bacteria and fungi. External air was collected

to establish a reference in order to study the influence of the sources of contamination existent in the interior.

The socio-demographic data showed an average age of 81.9 ± 7.5 years and a majority (70.6%) of female elderly. The mean residence time in ERPI was 5.6 ± 5.1 years. 29.4% of the elderly were identified as having a respiratory disease. In terms of the impact of environmental exposure on biomarkers and respiratory symptoms, it was possible to verify that an increase in CO₂ exposure was associated with a decrease in FEF_{25%-75%} (-2.00; 95% CI: -4.00 to -0.03). We found that the exposure to bacteria is positively associated with the possibility of the elderly having a FVC decreased (-0.53; 95% CI: 0.87 to -0.20), and an increased FEV₁/ FVC (0.22; 95% CI: 0.08 to 0.37). The pH value decreased by exposure to PM_{2.5} (-0.04; 95% CI: -0.06 to -0.01).

In terms of environmental pollutants' impact on respiratory markers, the results of this work point to a close relation between the IAQ and a higher respiratory vulnerability and its main conclusions are in line with the evidence already available at the GERIA project.

S7 PARALLEL SESSION 01

Occupational Health: is there a place for nutrition promotion programs?

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Occupational Health is also responsible for valuing the workplace, as a privileged setting for health promotion and healthy lifestyles of employees. The implementation of workplace nutrition programs aims to promote healthier eating habits and increase nutritional literacy, with the vision of employees with a lower rate of absenteeism, healthier and more motivated.

This action research project pretends to describe the implementation of a workplace nutritional promotion program in the context of occupational health.

Since February 2017 was developed a nutrition action research project with a nutritional support program implementation to 443 employees. This program comprises 4 dimensions: 1) Nutrition Counseling - in multidisciplinary articulation with occupational health, psychology and medicine; 2) Workplace environment changes- intervention on the menus, food portions, nutritional and food quality; 3) Nutrition education and literacy – workshops and publications; 4) Other activities group-focused - promotion of fruit and vegetables, nutritional counselling for salt reduction, counselling for focus group-drivers). To target our interventions, the project had a first phase for self-reported data collection (anthropometric measurements, food habits and satisfaction with canteen menu and food supply on the bar and canteen). In the second phase we designed focus-interventions and collected data from each intervention.

In the first phase, we collected data from 320 employees predominantly male (60.9%) with 47±10 years. 47.0% of workers reported to have a disease diagnosed by the doctor and 27.0% reported to perceive to have a reasonable or weak health. According to BMI, 40.3% were overweight and 15.3% were obese, and male had higher BMI (U=6931.5; p=0.000).

About the satisfaction with canteen menu and food supply on the bar and canteen, 31,5% (n=101) of the workers made suggestions for the canteen menus such as improve the variety of options in the menu, improve the variety of vegetable/salads on the meal, have a vegetarian option, decrease the fried foods and increase fish options. A proposal was made to the company managers considering the nutrition balance and employees opinion, and its implementation is ongoing.

We also evaluated the fruits and vegetable intake. We concluded that 58.8% of employees fruit intake is below recommendations. The company started the “1 fruit per day” program, which provides fruit weekly to all workers. The 6 months program evaluation is ongoing.

In the first 6 months, we had a nutrition counseling adhesion of 44 workers and 50% maintain follow-up after 2 years. The main reason for the nutrition counseling was excessive weight (72.7%). In the first 6 months period, 50% had weight loss average of 1.7kg, 63.6% improved their food habits and 18.2% started weekly physical activity.

We organized 3 workshops for nutrition education: “*Food labelling*”, “*How to reduce salt in the diet*” and “*Healthy homemade lunches brought to workplace*”. We implemented knowledge pre-assessment and a final evaluation of acquired competences. Using a likert scale of 1-5 for employees acquired competences perception, we obtain an average classification of 4.4.

This is an ongoing project but we identify workers’ motivation, participation on the program and valorization of initiatives to adopt a healthy lifestyle. Employees and companies can benefit from this project.

S7 PARALLEL SESSION 02

Potentially pathogenic microorganism's sampling and detection in water thermal SPAs.

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Thermal bathing pools in spa centers have been increasing in Portugal. Considering that thermal water is not disinfected or treated, microorganisms such as *Staphylococcus*, *Pseudomonas aeruginosa* and *Legionella* sp. may grow in the indoor environment of these facilities and influence the health of users and staff. *S. aureus*, particularly methicillin-resistant strains and *P. aeruginosa* are well-known worldwide as a cause of numerous hospitalizations and deaths associated with extremely high mortality rates for invasive infections, while, several *L. pneumophila* outbreaks have been recorded potentially associated with severe pneumonia and Pontiac fever which is a severe public health issue. These microorganisms can spread through water vapor, making health care centers, such as SPA facilities, extremely susceptible to contamination.

This study aims to assess the presence of potentially pathogenic microorganism's namely, *S. aureus* methicillin sensible (MSSA) and resistant (MRSA), *P. aeruginosa* and *Legionella* in two thermal SPAs in Portugal.

Samples were collected in May 2019 according to the orientations from Health General Direction and the culture method described in ISO 11731:2017 was applied for the isolation of *Legionella* and estimation of their quantity in water samples.

Four water samples (1L for place) were collected from workers toilets showers and Vichy shower, filtered and the culture method for the detection of *Legionella* applied in the same day of sampling. For *S. aureus* and *P. aeruginosa* detection, samples were inoculated in Tryptic Soy Broth for 24h at 37°C and inoculated in non-selective Columbia blood agar and selective culture media plates Chromogen MRSA and Cetrimide Selective Agar, respectively. MRSA isolates were confirmed by immunologic assays.

In the analysed samples, it was not detected culturable *Legionella* species. On the other hand, we have identified MSSA and MRSA in the analysed samples 17,6% and 5.9%, respectively and a prevalence of 11.7% of *P. aeruginosa*.

Thermal spa environments can create extremely good conditions for the development of potentially pathogenic microorganisms, with associated antibiotic resistance mechanisms which can represent a health hazard for workers and users and became a public health

concern. It should also be taken into consideration that although negative results obtained in the *Legionella* detection, in future work molecular methods will be utilized in order to confirm these results. Nevertheless, effective monitoring must be done periodically, during all the year, to prevent the infection of users and staff.

Acknowledgments

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S7 PARALLEL SESSION 03

Is the sleep structure vulnerable to indoor air contaminants?

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Humans spend around one third of their life sleeping and it is well known that sleep plays a crucial role in human welfare and performance. In last decades, awareness of the impact of indoor air quality (IAQ) on health of buildings' occupants has greatly increased but the research has been focusing mainly on microenvironments where people carry out their activities during daytime. Studies focusing on a wider characterization of the sleep environment, namely chemical, physical and microbiological exposure, are still lacking. The present study aims to assess the effects of sleep environment in sleep structure.

A total of ten men following specific inclusion criteria: age between 25 and 40 years old, healthy individuals, non-smoking, without children below five years and without sleeping problems and whose households are within Grande Lisbon area, were recruited. An unattended polysomnography (PSG) was performed during 2 weeknights in a row. The second night PSG's results were used in order to minimize the first night effect. IAQ monitoring was based on a comprehensive multi-pollutant assessment where physical (temperature and relative humidity) and chemical (carbon dioxide, carbon monoxide, formaldehyde, volatile organic compounds, particulate matter – PM10 and PM2.5) were assessed through real time instruments. The microbiological (fungi and bacteria) assessment was carried out by active methods, such as using the Microbiological Air Sampler (MAS).

The mean age was 33.9±5.20 years. The results related to the heart rate (HR) showed that the standard deviation from the mean value increased in those participants that were exposed to higher levels of PM10 ($r_s=.573$; $p=.078$) and PM2.5 ($r_s=.650$; $p=.078$). During REM sleep, the HR acceleration and deceleration index increased with higher CO concentrations ($r=.673$; $p=.075$ and $r=.623$; $p=.086$). During the NREM sleep, a decrease in the pulse transit time was related to higher concentrations of CO₂ ($r_s = -.650$; $p=.068$). The respiratory rate was lower in those subjects that were exposed to higher levels of relative humidity, in both NREM ($r_s = -.658$; $p<.05$) and REM ($r_s = -.836$; $p<.05$) sleep. In opposition, during the REM sleep the respiratory rate increased when the temperature was higher ($r_s = .670$; $p=.092$). The increase of fungi concentration was associated to lower percentages of stage 2 of NREM (N2) sleep; this correlation was observed in the fungal concentration at the beginning of the night ($r_s = -$

.660; $p=.057$) and in the morning ($r_s = -.753$; $p=.019$). Both bacteria ($r_s = .752$; $p<.050$) and fungi ($r_s = .833$; $p<.05$) were related to higher rates of K-complex during the NREM sleep.

In this study, the increase in some parameters of indoor air quality and thermal comfort were associated to mild, but rather significant, changes in sleep parameters. The environmental characterization enables to understand the factors that may contribute to the degradation of sleep's quality. Deeper studies in a large sample will allow to better understanding the occupants' exposure during this representative period.

S8 PARALLEL SESSION 01

Smoking behavior and secondhand smoke exposure in higher education

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Tobacco use continues to be a serious public health problem as it is a major cause of preventable diseases and death. In addition, secondhand smoke exposure increases morbidity and mortality from coronary heart disease, lung cancer, respiratory infections, and other illnesses. Although (inter)national tobacco prevention policies, such as a ban on smoking in public places, the increase in taxes on tobacco products and the social education about the harmful effects of smoking, the recognition of the serious health consequences of smoking has been a slow process.

The purpose of this study was to assess the prevalence of active smoking and secondhand smoke exposure among college students, and their attitudes towards tobacco use.

This a cross-sectional study with a representative sample of college students ($n = 840$) in one university in Portugal. A validated self-reported questionnaire was administered to a proportional stratified random sample of first year ($n = 464$, 55.2%) and third year ($n = 376$, 44.8%) students during the academic year of 2018/2019. We evaluated associations between tobacco smoking, secondhand smoke exposure, attitudes towards tobacco use, and quit attempts among current smokers.

The results showed that 68.8% of the students surveyed were non-smokers, 11.2% were ex-smokers and 20.1% were current smokers (7.3% occasional smokers, 2.9% regular smokers and 9.9% daily smokers). Regular and daily smokers consume on average 8.43 cigarettes per week and 8.33 cigarettes per day, respectively. Most current smokers started smoking before 17 years (61.4%) and reported never having tried to quit smoking (59.7%). Only 34.4% of students reported (almost) never have been in enclosed spaces with smokers in the past 7 days.

Data analysis showed that tobacco consumption was higher in 3rd year compared to 1st year ($\chi^2 (2) = 8.260$, $p = .016$) and in students in the area of juridical and economic sciences compared with the remaining scientific areas ($\chi^2 (6) = 20.103$, $p = .003$). In addition, it was found that smokers are more exposed to secondhand smoke compared to non-smokers or ex-smokers ($\chi^2 (2) = 86,536$, $p = .000$). The current smokers and male student demonstrated more positive attitudes towards smoking compared to non-smokers or ex-smokers ($H (2) = 136.437$, $p = .000$) and female students ($U = 70827.500$, $p = .000$), respectively.

This study found that the prevalence of tobacco smoking among college students is similar to young adults in Portugal. Although most students showed negative attitudes towards tobacco use, the prevalence of secondhand exposure in closed public spaces is high. There

were statistically significant associations between tobacco consumption and academic year, scientific area of academic training and exposure to secondhand smoke. The level of attitudes towards tobacco is correlated with sex of the students, tobacco consumption, scientific area of academic training and exposure to secondhand smoke.

This study suggests an urgent need for socio-educational programs for counseling on smoking cessation. In addition, is also strongly recommended that, throughout academic training, students develop personal and social skills for dealing with the tobacco epidemic.

Children integrated exposure to chemical compounds in particulate matter

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Particulate matter (PM) in air is a concern due to the adverse effects it causes on human health at low levels of exposure and there is no evidence of a threshold below which no adverse health effects occur. There is an improvement with respect to emission control strategies of anthropogenic emissions, nevertheless, if the quantitative result of these strategies in health effects for specific toxic particle compounds is no well-known with respect to each one of the emission sources, the definition of the effective strategies can be jeopardized. Since humans spend more than 85% of their time indoors, this work assessed the integrated exposure to PM and studied the importance of the indoor sources. This work was developed in the framework of the LIFE Index-Air project (www.lifeindexair.net) and aims to quantify the children daily exposure and dose to PM chemical compounds.

PM was sampled in 40 houses, 5 schools and respective outdoor sites during 5 days each. Leckel MVS6 samplers were used to collect PM_{2.5} and PM_{2.5-10} that were characterized by X-Ray Fluorescence for the measurement of major and trace elements and by the Thermo-Optical Transmittance method for the determination of the organic and elemental carbon. The daily exposure for each child was assessed by integrating the results from the time-activity pattern with the concentrations measured in the different microenvironments (MEs).

Results showed that children, during the week, spent an average 56% at home, 27% in classrooms and 5% in commuting, indicating that the risk assessment should focus on indoor MEs. The daily exposure depended on the time spent in each ME and the concentrations in that ME. The measurements in all ME were always performed during the occupancy time, since the inclusion of no occupancy time underestimates the concentration relevant for personal exposure assessment. Home and school were the MEs where the children spent more time and together contributed to more than 70% to the daily exposure of each PM chemical compound (except for Ba and EC in PM_{2.5} and Ba and Cl in PM₁₀ where the outdoor contribution was more relevant). While most hours were spent in homes, the schools displayed the highest contributions for the exposure to the mineral elements (Al, Ca, Si, Sr, and Ti) that can enter in classrooms through the windows or be released from children's shoes especially after playing outside.

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S8 PARALLEL SESSION 03

Environmental Audits: an analysis prior to the participation of Portuguese schools in the ClimACT project

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United Nations defined sustainable development as a “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. With the aim to produce generation after generation of sustainably minded, eco-thinking and environmentally conscious people, Eco-Schools program was created and funded in 1992, being nowadays worldwide spread crossing the five continents. Eco-Schools act in two areas: 1) in the building infrastructure and operation; and 2) in the target public behaviour and eco-consciousness and environmental values. The aim of this study is to evaluate the Eco-Schools’ environmental and behavior performance through audits results analysis.

The Interreg Sudoeste ClimACT project (www.climact.net) intends promote the transition to a low carbon economy in schools and all educational institutions enrolled in the Eco-Schools program during 2015/2016 were considered, as a previous diagnosis to ClimACT. The following inclusion criteria were defined: (i) application of the environmental audit model proposed by Associação Bandeira Azul da Europa (ABAE); (ii) available data regarding mandatory topics. The database of the Eco-Schools platform was used to gather information on environmental audits. For the sociodemographic characterization, the information provided by the schools in the enrolment form in the Eco-Schools program was also considered.

This paper presents the results obtained from the analysis of environmental audits in Eco-Schools in Portugal. The environmental audits consider topics such as: waste, water, energy, outdoor spaces, biodiversity, organic farming, food, forest, sea, mobility, noise and environmental management. According the analyses a total of 1440 educational institutions, including private and public schools, and social solidarity private institution, involving more than 634307 students from different ages, since kindergarten, 1st cycle, 2nd cycle, 3rd cycle, high school, vocational education and higher education are in Eco-Schools program. Of those 1440 schools, 1132 performed the environmental audit according with the model proposed by ABAE.

The participation of Portuguese schools differs according the region of the country and the educational level. For almost all the regions, the kindergarten and the 1st cycle are the educational levels with higher participation in the program, being the levels of education that

were in the genesis of the Eco-Schools Program. The topics of energy, water and waste are the most significantly addressed in environmental audits because of their mandatory nature. These topics are also those that present a higher score, corresponding to an environmental performance more consistent with what is expected of a ClimACT' school.

S8 PARALLEL SESSION 04

Knowledge, attitude and practice of self-medication among college students

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Self-medication is the act by which a person, on his own account or recommendation from a third party, chooses and administers medicine to prevent, treat or cure a condition whose identity and severity is generally unknown. WHO is making clear the existence of a valid place for self-medication in developed societies, however, alert to the need to inform the population about the appropriate use of over-the-counter drugs, while a more educational aspect to health education. This is because the health consequences of this practice are numerous, depending on the type of medication and the sensitivity of each individual to them, for example, increasing resistance to certain types of medications or decreasing the efficacy of treatments for inappropriate use.

The present study was carried out to study the knowledge, attitudes, and practice of self-medication among college students. This a cross-sectional study with a representative sample of college students (n = 840) in one university in Portugal. A validated self-reported questionnaire was administered to a proportional stratified random sample of the first year (n = 464, 55.2%) and third year (n = 376, 44.8%) students during the academic year of 2018/2019. The use of selected classes of medicines for self-medication during the preceding one-year period was studied. The knowledge, attitudes and the total scores were calculated and compared among different subgroups of respondents. Age, gender, scientific area of study and year of the academic frequency of the respondents were noted.

The results indicate that self-medication is a common practice among university students, since over half the respondents (54.3%) had used some form of self-medication during the preceding year. Analgesics/anti-inflammatory (48.7%) were commonly used for self-medication, followed by vitamins/food supplements (26.4%) and antidepressants/sedatives/soothing/tranquilizers (13.9%). Self-medication is more common among female students (62%, $\chi^2 (1) = 18,348$, $p = .000$) compared to male students.

The level of knowledge about self-medication is 1.60 ± 0.936 , ranging from 0 to 3, and the level of attitudes towards self-medication is 4.33 ± 1.900 , a minimum of 2 and a maximum of 10, with the highest value corresponding to attitudes more negative. There was no statistically significant correlation between the level of knowledge and the level of attitudes.

The results showed differences between the practices of self-medication and the levels of knowledge about self-medication and attitudes towards self-medication ($U = 72177.500$, $p = .035$; $U = 72177.500$, $p = .035$, respectively). Thus, students who possessed a higher level

of knowledge and more negative attitudes towards self-medication were those that more self-reported practices reported.

This study showed that self-medication practices are very common among university students in Portugal. Factors such as sex, scientific area of study and year of the academic frequency, and self-medication knowledge and attitudes towards self-medication significantly influenced therapeutic classes used.

Given the results presented, it is recommended to increase knowledge about the adverse effects of over-the-counter drugs and to increase awareness about the importance of educational programs in this field.

POSTER SESSION

Fungal biomass detection on HVAC filters as good predictors for viable bioburden

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Heating, ventilation, and air conditioning (HVAC) filters have been successfully used to characterize the bioburden of indoor environments. This passive sampling approach uses the HVAC filters as integrated, long-term samplers of particle-bound contaminants, such as fungi and bacteria. Furthermore, fungal biomass detection as analyses approach of HVAC filters can be a useful methodology, since molecular based-studies have already linked bioburden to health outcomes. Thus, the aim of this study was to verify if fungal biomass can be a good predictor for bacterial and fungal counts in HVAC filters. One piece of HVAC filter with 2 cm² (1.4 cm × 1.4 cm) was collected in ten Primary Health Care Centers in Portugal, washed and seeded on: malt extract agar (MEA) supplemented with chloramphenicol (0.05%) and dichloran-glycerol agar (DG18) used for fungi, and tryptic soy agar (TSA) supplemented with nystatin (0.2%) and Violet Red bile agar (VRBA) used to assess the bacterial load. Fungal biomass detection from HVAC filters was performed by dd-PCR and was amplified in a Bio-Rad T-100 thermal cycler. The fungal biomass levels were all above the limit of detection (1 copy.2 µL⁻¹) and ranged from 3.7 to 7.51E + 05 copy.cm⁻². In addition, cultivable microbial counts obtained from HVAC filters on MEA, DG18, and TSA all produced positive correlations with the fungal biomass determination. The intensity of the correlations varies from moderate to strong according to the culture media used. Mycological counts on the MEA produce the lowest correlation ($r_s = 0.656$, $p = 0.021$), while those on the DG18 show the strongest ($r_s = 0.796$, $p = 0.001$) although the bacterial counts on TSA also demonstrated a good correlation ($r_s = 0.779$, $p = 0.004$). These results reveal that higher counts of cultivable microbiota (mold and bacteria) are related to higher fungal biomass in the HVAC filters. The results of the fungal biomass have revealed to be good predictors for both bacterial and fungal counts in HVAC filters. Of note, are the faster results obtained by this molecular approach, allowing earlier control interventions to protect patients and staff health in case of revealed contamination.

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Mycological contamination and cytotoxic evaluation of used cars' dust filters

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The results of trace element atmospheric deposition study in two regions of Central Russia based on moss and soil analyses are presented. The sampled territory included Moscow and Tver Oblast's. Epithermal neutron activation has enabled determination of up to 40 elements including heavy metals and rare earth elements in 170 moss and soil samples collected in the summer of 2014.

The goal of this study was to evaluate the local pollution sources and to reveal possible pollution hot-spots in the study area, as well as to conduct a comparative analysis of the present results and those from the previous moss survey in 2009. Multivariate statistical analysis has been applied to the obtained datasets. *Contamination factors* for selected elements and *ecological risk indexes* were calculated. The comparison of elemental concentrations in atmospheric deposition in different parts of Russia was carried out.

Keywords: Moss biomonitoring, soil, heavy metals, environmental pollution, contamination factor

Moulds in dietary supplements based on Maca (*Lepidium meyenii*)

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For the first time the moss biomonitoring technique was used to study trace element atmospheric deposition in the area affected by a ferroalloy (Fe-Cr) plant in the town of Tikhvin, Leningradskaya Oblast', to apportion its deposition patterns and to reveal previously unknown pollution sources located in and within the sampled territory. Moss samples were collected in the summer of 2011 from 36 sites evenly distributed over the Tikhvin District in accordance with the guidelines of the UNECE ICP Vegetation. A total of 35 elements were determined by means of epithermal neutron activation analysis at the reactor IBR-2 FLNP, JINR, Dubna. Multivariate statistical analysis was applied to characterize the sources of determined elements over the examined territory. *Contamination factors* (CF) for selected elements and *ecological risk index* were calculated using their concentrations for the Tverskaya Oblast' considered as a relatively unpolluted territory. The results obtained are compared to the data of the atmospheric deposition of trace elements in Central Russia and in some countries of Eastern Europe. Distribution maps of most hazardous element-pollutants over the surveyed territory created using GIS technologies are demonstrated. These maps show that the main source of contamination in the investigated area is Tikhvin ferroalloy plant. In the close vicinity of Tikhvin the highest content of Al, As, Co, Fe, Cr, Ni, and V in moss samples was observed. Factor analysis revealed that high content of these elements had one and the same source. In the 10 km zone around the town of Tikhvin the CF is 2 times higher than for the rest of the investigated territory. Maximum value of CF for Cr was determined in the close vicinity of the Tikhvin ferroalloy plant. The main source of contamination in the sampled area is the metallurgic plant in the town of Tikhvin. Another source is located close to the military aerodrome and metallurgic waste dump in the north of the investigated territory. In general, the investigated area is quite pristine in comparison with the other Russian territories.

Keywords: moss biomonitoring, heavy metals, atmospheric deposition, risk index

Volatile organic compounds in healthcare facilities – A study developed in primary health care centers in Lisbon, Portugal

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Chemical contamination is a reality in healthcare environment but unfortunately is rarely studied. However, if we consider that healthcare workers use a high diversity of products such as disinfectants, sterilizers, anesthetic gases, and much other is easy to recognize that workers and patients can be exposed to a complex mixture of chemicals. The aim of this study was to evaluate the presence of volatile organic compounds (VOCs) in Primary Health Care Centers (PHCC) located in Lisbon. Measurements of VOCs were performed in indoor (medical office, technical office, back office, front office, vaccination room, treatment room, warehouse/cleaning room, canteen, sterilization area and oral hygiene office) and outdoor premises of 10 PHCC with portable direct-reading equipment (Graywolf equipment, with photo ionization detector sensor). Additionally, and as an indicator of ventilation quality, carbon dioxide (CO₂) was also measured with the same equipment. The dataset obtained was analyzed in the statistical software SPSS for Windows, v23.0.

VOCs results ranged from 0 to 5 ppm and the treatment rooms were found to have the highest concentrations, followed by the cleaning rooms. Statistically significant differences were obtained between PHCC ($\chi^2(K-W)(9)=15611.855$, $p=0.000$) and a significant correlation in a positive direction was observed between VOCs and CO₂ concentrations ($r_s = 0.513$, $p=0.000$).

Results showed that VOCs are present in PHCC probably due to healthcare tasks (treatment room) and cleaning activities (cleaning room) that imply the frequent use of disinfectants and cleaning agents. Additionally, and considering the correlation obtained with CO₂, poor ventilation conditions are probably promoting the high concentrations obtained. Actions should be developed to substitute the products used (e.g. less volatile) and to increase the ventilation rates particularly in the areas where chemical products are used more intensively. Future research work must be developed to identify the VOCs in presence and to estimate the health effects that can be related with this exposure.

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Support or hindrance? The influence of indoor- vs. outdoor breaks on pupils' cognitive performance – preliminary results

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Background: While the beneficial aspects of breaks in schools are generally indisputable, there is still need for research on how different places contribute to the restoration of pupils' cognitive capacities. The project Green4brain addressed the question whether different in- and outdoor school environments help to improve restoration, psychological well-being and mental performance. The presented preliminary results focus on cognitive performance.

Subjects and methods: The study was carried out in cooperation with three Viennese schools, funded by the Austrian research programme "Sparkling Science" of the Austrian Federal Ministry of Education, Science and Research. Pupils were actively involved in the research project (e.g. via workshops and via exploring possible restorative rooms in their school) before participating as testers in the above-mentioned research about restorative effects of different in- and outdoor school environments: In a quasi-experimental setting 78 pupils (15-19 years) spent breaks in- and outdoor, with psycho-physiological variables being assessed before and after the break. All assessments (before and after the breaks) took place in the classroom. The break consisted of a 30-minute recreation period in two indoor conditions (classroom or typical break room indoors in the school building) or outdoor (outdoor school yard or public park considered as green spaces). The standardized measurements included assessment of restoration, well-being, and cognitive performance (d2-R Test of Attention; Hamasch 5-point test to assess figural fluency).

A General Equation Estimation was calculated over performance variables after the break, with results of performance variables prior to the break as offset variables; where appropriate, amount of measurement days were considered as additional factor.

Results: Results of selective attention (d2-R) show no significant difference in performance increases depending on the break environment. An insignificant tendency points toward that performance increases least in the break room indoors. The insignificant tendencies favour either the classroom condition resp. the outdoor condition, depending on whether school is considered as factor or not. Without considering school, outdoor conditions contribute to an insignificant ($p = .467$) performance improve (mean 23.62, SD 2.54) compared to classroom (mean 21.92, SD 2.88) and break room indoors (mean 19.58, SD 2.23). When considering

school, results insignificantly ($p = .149$) favour classrooms (mean 23.67, SD 3.47) over outdoor conditions (mean 22.61, SD 2.83) and break room indoors (mean 17.17, SD 2.54).

Also regarding figural fluency, no difference in performance increase could be found comparing indoor break rooms and outdoor conditions ($p = .594$). An insignificant ($p = .125$) tendency in favour of outdoor breaks exists when results are controlled for the (possibly overcorrecting) influence of schools.

Conclusion: Generally it can be concluded that effects of the surrounding environment, if existing, are too small to contribute significantly to a performance increase. Spending breaks in indoor break rooms, however, seems rather less favourable for cognitive performance. It is assumed that both classrooms, where pupils are trained to perform, and outdoor conditions might similarly contribute to performance increases.

Resistance profile of bacteria associated with diabetic foot infection at the Regional Military University Hospital of Constantine, Algeria

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Among diabetic complications are diabetic foot infections. It is a problem with heavy medical, social and economic consequences. The objectives of this three-month study in 2018 on diabetic foot patients were: isolation, identification of the causative organisms, and determination of their resistance profiles.

Of a total of 278 samples taken from 146 hospitalized patients, 70.86% were positive, 72.10% were poly-microbial. The male sex is more exposed to diabetic foot infection. 273 bacterial strains were isolated, with a prevalence of Gram-negative bacilli.

The species distribution shows a predominance of *Staphylococcus aureus*, 69% of which are methicillin-resistant. Isolated *Enterobacteria* show high antimicrobial resistance, 50 ESBL strains were isolated. The most isolated among them are *E. coli* and *Klebsiella pneumoniae*.

Control the spread of bacterial resistance seems paramount, and knowledge of culture and susceptibility results helps to tailor the choice of antimicrobial treatment. In addition to the therapeutic and monitoring means that are included in all diabetic education programs, there is a privileged place for hygienic measures and physical activity or sports.

Occupational exposure symptoms in healthcare workers

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Indoor air quality (IAQ) in health care facilities may influence health and wellbeing of healthcare workers, having a significant impact on their overall quality of life. Therefore, we aimed to assess the IAQ parameters in a major clinical setting, as well as to observe occupational health symptomatology in workers at that healthcare institution.

Data on 43 healthcare workers from a major Hospital Centre in Porto, Portugal, were analyzed. Self-reported work-related symptoms were assessed by questionnaire, and lung function and airway reversibility were assessed by spirometry. Indoor air measurements were taken in 5 different locations to assess the concentrations of total volatile organic compounds (TVOC), PM_{2.5}, PM₁₀, endotoxins, bacteria and fungi.

Assessed IAQ parameters are presented in Table 1. As expected, the surgery unit showed significantly lower concentrations in regard to microbiological parameters. Overall, the location with the poorest IAQ was the Hospitalization unit, which is a significant environment of exposure not only to healthcare workers, but also to hospitalized patients. Workers stationed at the outpatient clinic presented the highest complains, having reported the highest severity in dry and sore throat symptoms. Individuals working at the surgery unit showed more symptoms associated with exhaustion, such as conjunctivitis and macular edema.

These promising observations support the construction of generalized linear models to fully understand the impact of a major clinical setting IAQ on the workers occupational health.

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Table 1 – Measured IAQ parameters in the 5 different locations at the Hospital Centre. <L.D.: Value under the limit of detection.

IAQ	Emergency unit	Surgery	Day care centre	Outpatient clinic	Hospitalization unit
Bacteria in air (UFC/m ³)	312	<L.D.	127	299.60	478
Fungi in air (UFC/m ³)	22	<L.D.	166	630.40	550
TVOCs (µg/m ³)	86.8	80	71	94.40	4.50
PM10 (µg/m ³)	<L.D.	<L.D.	<L.D.	<L.D.	34
PM2.5 (µg/m ³)	<L.D.	<L.D.	<L.D.	<L.D.	22.50
CO (mg/m ³)	0.4	0.9	0.15	0.4	0.3
CO2 (mg/m ³)	1056	1142	1797	1446.80	1980
Temperature (°C)	23	19	22.50	21.00	22
Humidity (%)	44	56	40.50	55.80	54.50
Endotoxins (EU/m ³)	3.09	0.04	3.29	0.38	4.78

Alterations in iron regulatory protein profile expression in immature mice after perinatal exposure to cobalt chloride

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Cobalt chloride (CoCl₂) is the most commonly used agent for inducing chemical hypoxia in experimental models. Hypoxia alters iron (Fe) metabolism inducing changes in the expression of key Fe regulatory proteins which coordinate its uptake, storage and intercellular trafficking. The aim of the present study is to assess the alterations in iron regulatory protein profile expression in immature mice after perinatal exposure to cobalt chloride. Pregnant ICR mice were subjected to daily dose of 75 mg/kg body weight CoCl₂·6H₂O 2–3 days before delivery and treatment continued until day 25 after birth. The compound was dissolved and administered with drinking tap water. Age-matched mice obtaining regular tap water were used as a control group. Pups were sacrificed on postnatal days 18 and 25. Blood plasma/serum was collected and target organs - spleen, liver, kidneys, testes and brain were excised and processed for analyses. TfR1 and hepcidin were analysed in blood plasma and tissue homogenates of control and Co-exposed mice using commercially available ELISA kits (Elabscience Biotechnology Co., Ltd, China). Ferropotin expression in the target organs was studied by routine immunohistochemical technique. Assessment of Co and Fe content in the samples was performed using inductively-coupled plasma mass-spectrometry (ICP-MS) at NexION 300D (Perkin-Elmer, USA) after microwave digestion of samples in HNO₃ using SW-4 (Berghof, Germany). Perinatal exposure to CoCl₂ induced a significant accumulation of Co²⁺ in blood serum and tissues of the exposed mice. Iron metabolism was also affected resulting in elevated Fe content and altered expression profile of TfR1, hepcidin and ferroportin in the immature mice following Co administration. The observed protein expression was tissue- and time-dependent. The results demonstrate the impact of perinatal Co-exposure on iron distribution profile in blood sera and target organs of immature mice. The study also shows the effect of CoCl₂ supplementation on the expression of key iron regulatory proteins modulating Fe uptake and intercellular transport. The obtained data demonstrate the complex interplay between Co supplementation and Fe homeostasis.

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Comparative effects of salinomycin, deferiprone and meso-2,3-dimercaptosuccinic acid on proinflammatory cytokines levels in plasma and brain of lead-exposed mice

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Lead (Pb) is one of the most dangerous toxic agents released into the environment. The toxic metal ion impairs the biosynthesis of hemoglobin and damages the brain. Studies on animal models demonstrated that Pb-induced neurotoxicity is a result of the ability of Pb to trigger inflammation. It has been reported that Pb exposure elevated the levels of proinflammatory cytokines interleukin 1-beta (IL-1 β) and tumor necrosis factor – alpha (TNF- α) in blood sera of rats [1]. Overproduction of TNF- α by astroglia and microglia could destroy the blood-brain barrier in chronic lead intoxication. IL-1 β released by glia was shown to cause neurodegeneration in vivo [2]. Inflammation elicited by Pb was attributed to Pb-induced damage of kidneys, liver and testes as well [3]. Chelation therapy is a method for treatment of metal poisoning. Meso-2,3-dimercaptosuccinic acid (DMSA) is a clinically approved chelating agent for treatment of Pb-intoxications. This antidote however is not effective for mobilization of aged Pb deposits, thus more lipophilic antidotes to Pb poisoning are required.

In this study we compare for the first time the effects of salinomycin, deferiprone and DMSA on the proinflammatory cytokines levels in plasma and brain of lead-exposed mice. TNF- α , IL-1 β , interleukin-6 (IL-6) in the plasma and brain tissue homogenates were measured by enzyme-linked immunosorbent assay (ELISA), according to manufacturer's instructions. The levels of the proinflammatory cytokines increased in the order plasma<brain. Pb exposure elevated the levels of IL-6 and IL-1 β in the brain compared to the untreated controls. The concentrations of both proinflammatory cytokines in the brain of the mice, subjected to treatment with the chelating agents were lower compared to those for Pb-exposed mice. Histological analysis confirmed the ameliorative effect of the chelating agents on the brain function. The results presented in this study demonstrate the potential application of salinomycin and deferiprone as antidotes for treatment of Pb-induced neurotoxicity.

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References:

1. Seddik L, Bah TM, Aoues A, Slimani M, Benderdour M. Elucidation of mechanisms underlying the protective effects of olive leaf extract against lead-induced neurotoxicity in Wistar rats. J Toxicol Sci. 36(6) (2011) 797-809.
2. Zindler E, Zipp F. Neuronal injury in chronic CNS inflammation. Best. Pract. Res. Clin. Anaesthesiol. 24 (2010) 551-562.
3. BaSalamah MA, Abdelghany AH, El-Boshy M, Ahmad J, Idris S, Refaat B. Vitamin D alleviates lead induced renal and testicular injuries by immunomodulatory and antioxidant mechanisms in rats. Scientific Reports 8 (2018) 4853.

A public health unit as the driver of a local sustainability plan

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For the first time, our public health unit included climate change and sustainability in its agenda for 2019. Located in Amadora, a suburban area of Lisbon, Portugal, the unit belongs to a group of primary healthcare facilities comprised of seven buildings, nine general practice clinics, a pulmonary diagnostic centre, a mental health community team and other teams providing domiciliary assistance.

We created a task force responsible for designing a comprehensive plan for climate change awareness and sustainability efforts within our healthcare facilities in Amadora. Simultaneously, we applied to become the first Portuguese institution in the Global Green and Healthy Hospitals Network, with the aim of improving our sustainability plans and beginning a movement in Portugal for health to take a leading role in sustainability consciousness.

The plan has two main components: an educational side for healthcare workers to become increasingly aware of the footprint our local activity has; and a team responsible for reviewing our purchases and electrical and water consumption, in order to reduce our resource consumption. We also contacted the local hospital and city hall to make a similar sustainability pledge.

The plan will be evaluated after the first year of its implementation, in 2020. The evaluation will be based on the results of the educational interventions measuring knowledge, attitudes and behaviour by healthcare professionals as well as in the evolution of the consumption of resources by the whole institution.

It is widely recognised that public health is at the centre of both challenges and opportunities that climate change represents and given the estimated impact on population's health, public health professionals have the responsibility to intervene in both mitigation and adaptation efforts. This pilot project is the first in the country we know of that puts climate change as a priority health issue and as such is developed and driven by the local public health unit to create local change.

Daily trends of black carbon concentration in an urban-traffic station

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Particulate Matter (PM) represents a risk factor for human health, mainly due to the traffic emissions in the urban areas. Black carbon (BC) is produced by incomplete combustion of carbonaceous fuels and is considered a unique primary tracer for combustion as it has no non-combustion sources. It also affects the optical properties of the atmosphere and is recognized as the second most important anthropogenic forcing agent for climate change. The main objective of this study was to analyse the daily trends of the BC concentrations in an urban-traffic station during weekdays and weekends.

Methods: BC measurements were carried out at an urban monitoring station located near a high traffic road in Coimbra, Portugal. An Aethalometer model AE33 was used to collect and analyse aerosol carbonaceous particles continuously based on light absorption at different wavelengths and providing real-time data.

Results: Average BC concentrations were higher on weekdays (4.78 $\mu\text{g}/\text{m}^3$) than on weekends (3.97 $\mu\text{g}/\text{m}^3$), which can be attributed to high vehicular emissions on the working days. Results show that there is a daily variation in BC concentration (Figure 1) during weekdays and weekends that seem to be linked with traffic emissions throughout the day. On weekdays, the highest BC concentrations were registered during morning (8–10 a.m.) and evening hours (6–8 p.m.) which are related to rush hours traffic emissions. This study shows that BC concentration at this sampling site was highly determined by vehicles emissions, which can help to formulate air pollution mitigation policies.

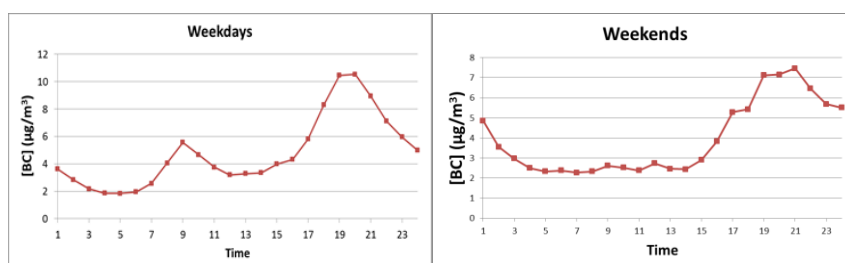


Fig. 1: Diurnal variation in atmospheric BC concentration during weekdays and weekends.

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Occupational noise exposure and cardiovascular diseases: A pilot study in a metalworking industry

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Exposure to noise is an important risk to human health. Despite that, its control in the occupational environment is only made considering the prevention of hearing loss. Portuguese law for this subject neglect the non-auditory effects, such as sleep disturbances, annoyance and stress, reduction of cognitive performance and cardiovascular diseases. Over the past years a great deal of studies was designed and developed to assess the influence of noise exposure, both occupational and environmental, on the cardiovascular system. The results are contradictory, while some report a weak connection or defend that workers bodies may be adaptive to noise, others connect noise exposure to hypertension, ischemic heart disease and higher risk of myocardial infarction. The aim of this study is to evaluate the effect of occupational noise exposure on the cardiovascular system. The study took place in a metal treatment and coating factory with 75 workers, both male and female, of whom 71 agreed to participate. Two groups of workers were defined: 1. Exposed to noise (workers directly involved in the production process), and 2. Non-exposed to noise (administrative activities and similar). Noise measurements were performed using three sound-level meters class 1 (Brüel&Kjær, models 2250 and 2260). To ensure the accuracy of the measurements, recordings were preceded by the calibration of the sound-level meters with the respective acoustic calibrators class 1 (Brüel&Kjær, model 4231). The measurement protocol was established according to the ISO 9612:2009. Regarding worker's cardiovascular health, several methods were used. Firstly, standard 12-lead electrocardiogram was performed, using the electrocardiograph ELI 150 by Mortara Instruments and following the AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram. Blood analysis were also done, measuring various cardiovascular related parameters. Finally, the participants were asked to fill in 3 questionnaires: I. Sociodemographic data, II. Cardiovascular risk assessment, III. Noise exposure. The data collected will be managed and analyzed using the software IBM SPSS 23rd version.

The processing and analysis of the data will involve descriptive and inferential statistics. The normality test will be applied and, according to the result, parametric or non-parametric tests will be used to analyze the association between relevant variables. The study was approved by the Ethics Committee of the National Institute of Health Dr. Ricardo Jorge and all the

participants provided the informed consent forms. Preliminary analysis of noise exposure showed, as expected, higher levels in the production sector. The cardiovascular risk is predicted to be higher those individuals exposed to noise, evidenced by variations in the analysis and eletrocardiographic abnormalities. Therefore, this study is expected to provide some evidence for the non-auditory effects of noise, more specifically the cardiovascular effects, and to promote discussion of the subject in order to take these effects into consideration while trying to control noise exposure.

Evaluating the levels of Endotoxins in health care facilities

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Endotoxins are biologically active lipopolysaccharides (LPSs) produced by the most external layer of cellular walls of Gram-negative bacteria, and are present ubiquitously in the environment. Endotoxin levels are related to the occurrence of Gram-negative bacteria and acute health effects like dry cough and shortness of breath, decrease in lung function, fever reaction and malaise, dyspnea and headaches have been described as occurring upon endotoxin exposure as well as chronic health effects caused by the inflammatory response within the airways. Although many studies have already associated endotoxin exposure, especially in workplaces, to airways disease, a threshold limit value for occupational exposure has not been set yet, and the only available reference is from the Dutch Expert Committee on Occupational Safety (DECOS) that recommends a health-based occupational exposure limit (HBROEL) for endotoxin of 90 EU /m³ over an 8-hour period. Nevertheless, this limit has been subject of some criticism as it was established based on human volunteer exposure challenge studies and not workplace studies, and therefore, may understate the adverse effect of lowest concentrations of endotoxin. Environmental monitoring is usually performed by sampling airborne dust and subsequent analysis by the *Limulus* Amebocyte Lysate (LAL) assay. This study aims to assess the levels of endotoxins present in different areas of a Central Hospital in Porto, Portugal, to determine the occupational exposure risk, as well as to compare two sampling methods: sampling on glass fiber filters with air pump following the European Standard (2003) EN 14031 and sampling by vacuumed dust. Fifteen air samples and 5 dust samples were obtained. Endotoxin levels varied between 0,07 and 6,46 EU/m³ (air samples), and between 5,72 and 23,0 EU/mg of dust, and the Nursing Room and the Operating Room presented the highest levels, respectively.

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Self-disinfecting surfaces – developing an antimicrobial paint

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To avoid contamination and consequent infection propagation on surfaces, several innovative strategies have been developed recently. Surface modification/functionalization is one of those procedures allowing to obtain anti-adhesive or antimicrobial properties on different materials. This approach has several advantages over conventional disinfection techniques like the constant process of activity reducing the antimicrobial charge immediately after contact with the surface or the possibility of room disinfection with no need to remove people from there [1,2]. Also these surfaces have antimicrobial activity so they actually kill the microorganisms oppositely to most detergents used [3].

In this work we tested and validated an antimicrobial paint to be applied in areas with high propensity for infection spreading, such as healthcare facilities, schools, daycare centres or even some public spaces. This new paint incorporates a patent-pending substance that confers the paint wide-range antimicrobial properties.

Paint's antibacterial efficacy is being evaluated using the international standard ISO 22196 [4] against some bacteria responsible for hospital acquired infection such as *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Clostridium difficile*, and some multi-resistant strains of *Pseudomonas aeruginosa* and *Acinetobacter baumannii*. The antifungal activity will be tested against *Aureobasidium pullulans*, *Aspergillus niger* and *Penicillium sp* using standard test method ASTM D3273-16 [5].

OECD guidelines for *In Vitro* Skin Irritation: Reconstructed Human Epidermis Test Method [6] and *In Vitro* Skin Corrosion: Reconstructed Human Epidermis Test Method [7] are being followed to guarantee the absence of toxicity for this new formulation. Genotoxicity is being tested with the comet assay [8] and micronucleus assay [9], and MTT for cytotoxicity.

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References:

- [1] Sifri CD, et al., Am J Infect Control 44, 1565–1571 (2016).
- [2] Boyce JM, et al., Am J Infect Control 42, 326–328 (2014).

- [3] Hasan J, et al., Trends Biotechnol 31, 295–304. (2013).
- [4] ISO 22196, Measurement of antibacterial activity on plastics and other non-porous surfaces (2011).
- [5] ASTM D3273, Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber (2016).
- [6] OECD GUIDELINE FOR THE TESTING OF CHEMICALS-In Vitro Skin Irritation: Reconstructed Human Epidermis Test Method (2015).
- [7] OECD GUIDELINE FOR THE TESTING OF CHEMICALS-In vitro skin corrosion: reconstructed human epidermis test method (2016).
- [8] Reisinger K, et al., Mutat Res Gen Tox En 827, 27–41 (2018).
- [9] Dahl EL, et al., Mutat Res Gen Tox En 720, 42–52 (2011).

Is it safe to consume backyard pig meat in the north of Portugal?

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Trichinellosis is a zoonotic disease caused by the larvae of *Trichinella* spp. nematodes. Infection occurs in many species of wild carnivorous but also some omnivorous such as wild boars and domestic pigs. Human can be infected by eating raw or undercooked meat from infected animals. The symptoms of trichinellosis in humans vary, but in heavy infections patients may experience difficulty coordinating movements and have heart and breathing problems. The risk of infection is associated to eating habits, culture and tradition. In the north of Portugal, pigs are a biological and cultural heritage, as for centuries they have been an ally of the rural world, playing a very important role in human diet, through sausages and other gastronomic dishes. In this way, knowledge about food safety in this species is fundamental. Trichinellosis is an emerging zoonosis and recently led to the issuance of new directives by the Directorate General of Food and Veterinary, regarding its detection on boars for human consumption as it is already mandatory to pigs at slaughterhouses, but nothing is known in Portugal about the prevalence in home slaughtered pigs.

The aim of this study is to assess the presence of *Trichinella* in backyard pigs slaughtered at home from northern Portugal. For this purpose we collected muscle samples (diaphragm) from pigs to be tested using the magnetic stirrer method according to the Commission Regulation 2015/1375. Muscle samples were collected from animals between 6 months and 6 years, both sexes, from indoor and outdoor systems and most of them had as purpose the production of typical sausages. All 34 samples were negative, suggesting that regarding the presence of *Trichinella* the consumption of homemade pigs is safe. Nevertheless, it should be advised that food inspection is necessary, even in animals slaughtered at home or in cultural parties. This awareness should be extended to hunters. Moreover, the correct cooking of meat and meat products should be also advised. This is an ongoing study.

Methodology of Safety Coordination Inspections applied to telecommunications

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The Safety and Health at Work occupy an increasingly prominent position in our society and the Risk Assessment (RA) assumes, in the entire process, a decisive role which gives it a central importance in the preventive approaches, namely in regard to accidents at work and occupational health problems.

The purpose of this investigation is to develop a methodology to be applied to construction/upgrading of mobile telecommunication infrastructures of the telecommunications company under study that will permit to analyze the factors that might interfere with the safety of the company workers in the construction phase, in order to allow an appropriate planning of inspections of the Safety Coordination at Construction (SCC), due to the index of the risks that the job presents.

At the sample level, it was composed by 344 Safety Procedures Sheets (SPS) in a universe of 1221. All were targeted by the RA according to the methodology developed in this investigation and of those, 134 represented the construction sites inspected by the SCC. The prevalence of the SPS were analyzed in the index of the risk in result of the Inspection Priority (IP) obtained and of the Nonconformities and Critical Control Points, according to the corresponding indexes.

The existing differences were investigated between the real inspections - concluded - and the theoretical with higher IP, due to the adoption of the new methodology - at the level of the sample and the universe. It was concluded that the lack of a methodology of analysis and RA can affect, significantly, an adequate and efficient action at the level of prevention, due to the dispersion of what would be expected and what actually happened.

This investigation allowed to develop and attest a risk management tool, truly applicable and adapted to the reality of telecommunication, which will be very important in improving the safety and health conditions and also the control of risks in the protection of the most exposed workers.

Indoor Air Quality in Homes for the Elderly

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The problem of indoor air quality (IAQ) has motivated the interest of the scientific community and the general public. The elderly care homes are spaces with specific features, where the guarantee of healthy working conditions is fundamental to the well-being of the workers and the elderly.

The aim of this study was to evaluate occupational exposure of workers to indoor air pollutants in nursing homes.

The sampling was non-probabilistic and for convenience regarding the type and technique, respectively. The sample consisted of 4 interior spaces (living room, bedroom, laundry and kitchen) of 8 nursing homes located in the Center Region of Portugal and 155 workers with an average age of 44.95 years (standard deviation of 10.99 years). The data was processed using the IBM SPSS statistical software version 25.0. The interpretation of statistical tests was performed based on a significance level of $p=0.05$, with 95% confidence interval.

We notice that in some nursing homes the recorded average concentrations of carbon dioxide, volatile organic compounds and particulate matter with diameter <10 , exceeded the threshold of protection, being that concentrations, on average, higher in homes located in urban areas.

In this regard, efforts need to be made to develop methodologies for the determinants and constraints of air pollutants that interfere with human health, which could create effective tools in the field of public health, contributing to the development of policies for air quality. In the same way, it is necessary to establish control programs and prevention of the consequences for the health of the occupants of these environments.

Air quality in Lisboa – city diagnosis

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In response to a growing concern about the permanent improvement of the quality of life and the environment of cities, integrating a strategic vision and a clear ambition to make Lisboa one of the best cities in the world to live in, the city is the protagonist to new environmental challenges. In Lisboa, the main local source of NO₂, PM₁₀ and PM_{2.5} is road traffic. The daily cycle follows variations in traffic, the highest values being observed during rush hour in both traffic and background stations.

Apart from road traffic, there are other local sources of some importance, such as aviation and shipping, residential and services emissions.

The natural topography of Lisboa and the complexity of its urban layout, leads to the accumulation of pollutants from road traffic. In several areas the streets act as valleys, whose sides formed by the walls of buildings cause phenomena known as "street canyons".

Despite significant improvements in recent decades there are still few problems related to air pollution impacts on human health and ecosystems, particularly at the level of PM₁₀, O₃ and NO₂.

From experience accumulated over the last decade on the management and evaluation of air quality, it is clear that an integrated approach with the articulation of policies and measures between different levels of government is needed.

The National Strategy for Air (ENAR2020), has four main objectives:

- achieve the emissions and air quality targets by 2020;
- achieve the limit values established by law, recommended to improve air quality for 2020 and 2030;
- outline the way to achieve long-term air quality objectives recommended by WHO;
- align all measures with the national climate policy, addressing air pollutants and greenhouse gas effect simultaneously.

The ENAR2020 will be a reference framework for the development of future Plans for Air Quality Improvement, thus enabling effective integration between the measures on local, regional and national levels.

Lisboa has been developing its data integration platform (Lisboa Intelligent Management Platform - PGIL), allowing it to integrate diverse data sources, create decision support analytics and make this information available to a wide range of users internal and external to the municipality. In the context of innovative projects, the European Sharing Cities program, aimed at monitoring the city in areas such as energy efficiency, smooth mobility, renewable energy and smart buildings, should be highlighted.

In 2019 a procedure will be launched for the acquisition of monitoring services for air quality, noise, traffic and meteorological parameters, in the "sensing as a service" modality, for integration into the PGIL, and subsequent monitoring of the evolution of quality indicators decision support.

Total water reuse in vehicle washing systems – a step to a sustainable use of water

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Wastewater generated from carwash contributes effectively to environmental pollution due to the presence of oil and grease, suspended solids, metals and surfactants. Carwash generates a high amount of wastewater according to the type of car wash system^[1]. The quantity of water used in washing is very high between 50 and 900 L/vehicle^[2]. Water recycling provides a great method to manage the station's environmental friendly to minimize the drinking water consume by wastewater reuse.

The present work aims to evaluate the efficiency of pollutants removal from vehicles washing wastewater in a case study, Transportes Gama station, located in Seixal. The station has a compact treatment plant, built by Ecodepur^[3], with: primary sedimentation, flotation, biological treatment, secondary sedimentation, sand and activated carbon filtrations (Figure 1).

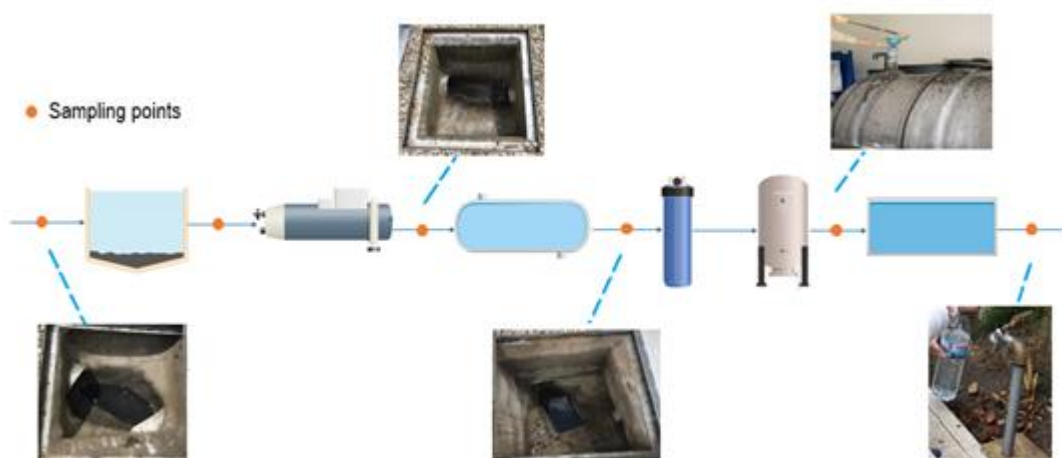


Figure 1. Sampling points in the wastewater treatment plant

The ultimate objective of this work is to optimize treatment plant operation for pollutant removal, savings of energy and added reagents. This practice of water reuse is in line with the European Water Savings Objectives (EU Water Framework Directive) by reusing water in industry whenever possible.

The efficiency of each operation and process was evaluated by several parameters: pH, temperature, chemical oxygen demand (COD), total solids (TS), total suspended solids and metals (Zn and Cu). To evaluate the enzyme effect in the efficiency removal of all parameters two arrays we done, the first with 30 L/week and a second with half of enzyme volume added. The results show that the COD and metals are within the limits of the national legislation for wastewater discharge in both tests. The main costs of wastewater treatment plant are energy and enzyme addition for biological treatment process. In the first assay the treatment plant presents a total efficiency removal of 96.3% for COD, 61.1 for TS, 80.4 for Cu and 81.5 % for Zn. It was verified that the enzyme volume reduction had a small effect in the total removal efficiency with 95.6, 58.1, 76.5 and 73.9% for COD; TS, Cu and Zn respectively, but represents a saving of 3,900 €/year.

Most of the treated wastewater is reuse in the vehicles washing, which represents a wastewater discharge near zero, in this way it possible to contribute for sustainable use of water.

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References

- [1] Moazzem, S.; Wills, J.; Fan, L.; Roddick, F.; Jegatheesan, V. Environmental Science and Pollution Research. 2018, 25, 8654–8668.
- [2] Grup Fundació Ramon Noguera, Consorci Life MinAqua (Universitat de Barcelona, IQS, Aqualogy and GUREAK), Glam Comunicació. Good practices guide for car wash installations. September 2016, 1, 13.
- [3] ECODEPUR® DEPURWASH Sistema de Tratamento e Reciclagem de Águas de Lavagem.

ExpoLIS – Assessment of human exposure to air pollution to change the way people move in cities

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Air quality is a major concern in many cities worldwide as pollutants have demonstrated to have significant impact on human health. Efforts have been made to monitor air quality in several cities. However, the static monitoring stations that have been deployed in urban areas have high acquisition and maintenance costs, which limits the number of installations, and thus, the area coverage. Very little is known about the spatial distribution of air pollutants in urban environments and there is a lack of accurate urban air pollution maps. Low spatial resolution is sufficient for ambient background monitoring but inadequate to assess personal exposure to air pollution and health risks. This problem can be overcome by the usage of large quantities of low-cost sensors in wireless networks leading to an increase of the coverage area and spatial distribution of the monitoring systems, especially if mounted on mobile platforms. The deployment of sensor nodes on vehicles enables the automated collection of large, spatially resolved data sets. Mobile air quality monitoring systems allow high spatial resolution across large areas and are a solution to derive fine-grained air pollution road maps.

ExpoLIS is developing an air quality exposure sensing system, composed by a network of sensor nodes, to be deployed on public transportation (buses) in order to obtain the real-time air pollution distribution in urban areas. The project takes advantage of concepts like big data analytics and internet of things, and is a step forward into the smart city ideology. The implementation of the ExpoLIS system will be conducted in Lisbon to demonstrate its applicability to assess the exposure to air pollutants in different commuting modes, to support urban planning policies, environment scientists and transport companies by generating massive air pollution data sets and to provide a health-optimal routing service to the population.

The air pollutants under study are particulate matter (namely PM_{2.5} and PM₁₀), carbon monoxide (CO) and Nitrogen dioxide (NO₂). Furthermore, temperature and relative humidity are also measured. Table 1 shows the brands and types of sensors used.

Table 1. Details of the sensors used.

Parameter	Model	Brand
Particulate matter	OPC-N3	Alphasense
CO	CO-B4	Alphasense
NO ₂	NO2-B43F	Alphasense

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Mercury exposure through fish consumption in Portugal – Need of Public Health Interventions

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In Portugal, fish consumption has a significant role on daily diet. The Portuguese consume an average of 61.5 kg of fish per person/year, being the country with higher consumption in the European Union, and in the world, after Korea (78.5 kg per person/year) and Norway (66.6 kg per person/year).

It's well known that fish is rich in omega 3, which has valuable effects on adults and children, since that benefits in multiple ways our health.

However, human exposure to the most toxic and abundant form of environmental mercury (Hg) occurs mostly through fish consumption.

Accordingly with European regulation, the maximum allowable value of mercury in fish for consumption is 0.50 mg/kg and 1.0 mg/kg for predatory fish.

Considering the above, the aim of our work was to compare the Hg values reported in Portuguese food in scientific publications with the European reference values.

Additionally, the values found will be used to estimate exposure and the health effects for specific population groups, such as pregnant women and unborn child.

A detailed literature search of PubMed will be performed using various combinations of corresponding descriptors and free text terms such as Hg, fish contamination, food and Portugal. To restrict the results, the search will be limited to studies published in English from January 2000 up to and including June 2019. Additional inclusion criteria will be, studies with quantitative data of Hg contamination in food from Portuguese markets.

This study will deliver relevant information to support Public Health interventions related with population education and counseling. Additionally, this exploratory study will allow identifying which are the research needs for Portugal concerning the exposure to Hg and the related health effects.

Quality Indicators for Water Reuse in Lisbon – Real-Time-qPCR Detection of Enteric Viruses

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Demand for water reuse is increasing worldwide, whether by necessity in developing countries or by environmental objectives in developed countries. An efficient and sustainable hydric resources management allows non-potable uses for treated wastewater such as irrigation, industrial processes, firefighting, recreational or municipal services.

Besides the existence of heavy metals, chemicals, hormones and endocrine disruptors in treated wastewater, it is still necessary to deal with the potential presence of resistant pathogens, many of which are not tested or included in current standards or legislation designed for water quality assessment. These microorganisms include virus, bacteria, protozoa and helminths, responsible for a significant number of potentially dangerous pathologies. Current wastewater treatment processes may not completely remove enteric viruses, even with adequate residual disinfectant concentrations. UV technology has been used regarding water reuse, but the apparent ability for some microorganism to repair DNA/RNA damage allows the reactivation of their capability for reproduction and infection. Hence, one of the major public health issues focuses on the possibility for highly infective pathogen transmission through treated wastewater - a regulation revision is therefore of the utmost importance.

In this work, wastewater samples were collected at a WWTP in the Lisbon district, at 3 different stages – untreated affluent, effluent with secondary treatment and effluent with tertiary treatment. A procedure based on the ISO/TS 15216-2:2013 for quantitative detection of Hepatitis A and Norovirus I (NovI) and II (NovII) in water samples was established. Common microbiological and some physical and chemical indicators were also performed for comparison.

Enteric virus (NovI/NovII/HepA) were detected in the 3 different WWTP stages samples: untreated wastewater (100/100/20%); secondary treated effluent (47/73/13%) and tertiary treated effluent (33/20/7%). These results indicate that risks to public health still remain, although Fecal Indicator Bacteria indicators were close to zero.

Presence of Endocrine Disruptors in Portuguese Diet

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Food contamination is a global problem that can have a massive impact in human's health ^[1]. In Portugal, the consume of food is majority based on the Mediterranean diet including dairy products, meat, fish and eggs, vegetables, cereals, fruits and water ^[2]. However, sociodemographic and economic changes justify the recent changes in the Portuguese food habits and patterns ^[3]. Many of these newly introduced alimentary products are stored inside of plastic packages that can have in their composition bisphenols (BPS) and phthalates (PTH), well known due to their proprieties as endocrine disruptors (ED) ^[4]. The concern is due to the fact that these substances can migrate from the package to the food resulting in human exposure to these contaminants ^[5]. Considering that exposure to ED occurs essentially through diet, it is important to refer that the group with higher risk are children whose ages range from 2 to 6 years old since they have a relative highly consumption of food and water in comparison to adults and because their reproductive, nervous and immunity system are still in development ^[6].

The aim of this study was to determine, through a review, the presence already reported of BPS and PTH in food available in Portuguese markets. A detailed literature search of PubMed was carried out using various combinations of corresponding descriptors and free text terms such as ED, food, Portugal and others. To restrict the results, the search was limited to studies published in Portuguese and English languages from January 2000 up to and including May 2019.

After the papers search it was concluded that in Portugal does not exist reported studies about BPS and PTH presence in food products commercialized in Portuguese markets neither biomonitoring studies in Portuguese people. Therefore, it should be done studies in Portugal to understand the levels of contamination in food and people exposure due to the adverse effects that ED have in human health ^[7].

Vectors and vector-borne diseases – knowledge and practices of the Portuguese ruminant farmers

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Portugal is known for the Mediterranean climate and ecological conditions favorable to the development of a considerable number of vectors, which are a problem for the animal and public health. The main disorders caused by these agents are the transmission of diseases to ruminants and human, food and environmental contamination by chemical residues used in their control, resistance to parasiticides and economic losses on the farm, resulting from the production breakdown, animal disease and treatment costs. Thus, the implementation of strategies to combat arthropod vectors is crucial to reduce the impact on animal and public health, and it is important for farmers to know about ectoparasites to effectively apply their control measures.

The objective of this study is to evaluate the knowledge and practice of ruminant farmers about vectors and vector-borne diseases in Portugal. For this purpose, a questionnaire constructed by Rocha (1995) and adapted by Rocha *et al.* (2006) and Amaral *et al.* (2012) has been applied to 136 ruminant farmers at national level. The Statistical Package for the Social Sciences, version 24 (IBM SPSS 24) was used in the statistical analysis of the data, and tests such as the chi-square and Spearman correlation coefficient were used. Most respondents are over 46 years of age, have a fourth year of schooling and have small farms, their animals have access to pasture, and the main objective of production is self-consumption.

Farmers (92.6%) found arthropod vectors in ruminants, but 45.6%, 69.9% and 27.2% did not recognize the role of the vector as an agent of transmission of disease to ruminants, other animals and human, respectively, and 27.2% did not perform any prevention measure against ectoparasites. Most farmers are unaware of usual body locations of vectors found in ruminants, and do not observe them in their animals. Most are unaware of the diseases that vectors can transmit to the animals (55.8%) and to human (33.1%), except for tick fever. Although the farmers associate tick fever with the tick vector, most are unaware of the real cause of the disease (94.1%), as well as the symptomatology in the animals (50.7%).

The respondents are aware of the occurrence of injury caused by arthropod vectors (66.2%), however the majority can only mention a concrete example of such damages. Most of the

farmers do not have a solid knowledge about arthropod vectors and the vector-borne diseases, and 84.6% do not have a protocol for ectoparasites prevention. However, only 52.2% of the farmers would like to receive information on tick fever, through family doctors and veterinarians. It is therefore important to make veterinarians aware of the need to inform farmers about the risk of vectors for animal and public health, as well as to advise them on the best way to proceed to prevention protocols and / or to complement with other control measures appropriate to each farm. Greater communication between human and animal health professionals and the farmers in a One Health perspective is needed.

Dicrocoeliosis – are we neglecting this zoonosis in Portugal?

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Dicrocoeliosis is caused by *Dicrocoelium dendriticum* a wide parasitic fluke that usually infects the gall bladder and bile ducts of herbivores such as sheep, goat, cattle and also humans. The infection occurs as a result of oral ingestion of ants infected with metacercaria, by eating unwashed raw vegetables, but false infections may occur after consumption of undercooked animal liver. Reports of human dicrocoeliosis are increasing, mainly due to the expansion of dry desertified habitats and the increase in anthelmintic resistance. Most of the recent case report are from immunocompromised patients and are reported sporadically in various parts of the world, nevertheless, there is no data regarding the disease in humans in Portugal. The aim of this study was to assess the risk of exposure to *Dicrocoelium dendriticum* estimating the environmental contamination with *Dicrocoelium* eggs in rural areas of the north of Portugal. For this purpose we collected faecal samples from ruminants from the 5 districts of Portugal and analysed by coprology using Mini-FLOTAC and natural sedimentation techniques. A total of 884 samples were collected, 645 from sheep and goats and 239 from cattle. In 36 (4.1%) *Dicrocoelium* eggs were found.

The prevalence was higher in sheep and goats (4.9%) than in cattle (1.7%) which may be explained by the most usual grazing system in sheep and goats as well as the more frequent anthelmintic resistance in these animals. There is a risk of exposure to this infection in the north of Portugal. These animals live in rural areas and some of them cross all the villages every day to achieve the grazing pastures, so the level of environmental contamination with faeces contaminated with these eggs should not be neglected, namely because these regions are also producers of a lot of vegetables for human consumption, even if for self-consumption. Thus, veterinarians should aware farmers for the need of assessing the need of deworming their animals and work together with doctors in food safety education with a view for prevention of animal and human cases of dicrocoeliosis, in a One Health perspective.

Safety assessment of the new bioactive compound deflamin, extracted from *Lupinus albus* seeds, through the analysis of its cytotoxic and genotoxic properties

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Colorectal cancer (CRC) is the third most common cancer worldwide, displaying to be highly metastatic and mostly resistant to anticancer treatment. Especially due to its high incidence in young people and the lack of adequate treatment CRC is imposing an increasing health risk for future generations. Since the death of most colon cancer patients is due to metastatic disease, rather than the primary tumors itself, the mechanisms in the metastatic progression of CRC are insensitively being studied. Subgroups of matrix metalloproteinase's (MMP's), especially gelatinases (MMP-2, MMP-9) have been identified to be highly involved in the metastatic process, which makes them a useful drug target.

On the other hand experimental, epidemiological and clinical studies have shown that the consumption of legumes significantly reduces the incidence of several tumor types, including CRC. These effects are generally associated with the inhibitory action of legume seeds on matrix metalloproteinase's (MMP). MMPs play a key role in cellular homeostasis due to their ability to initiate, enhance or down-regulate signal cascades, involving cell growth, inflammation, cytokine and growth factor release. Overexpression of MMPs results in matrix degradation and is strongly associated with cancer cell invasion and metastasis. Deflamin is a novel matrix metalloproteinase inhibitor (MMPI) extracted from the seeds of *Lupinus albus*, which exhibits anti-inflammatory properties, particular at the gastrointestinal level and has been pointed as a promising cancer preventive agent. It shows especially high inhibitory activity against MMP-2 and MMP-9. This makes deflamin a great candidate to become a valuable anti-inflammatory nutraceutical agent, as well as a useful asset in the treatment of inflammatory bowel diseases (IBD). However potential secondary adverse effects must be avoided and for that purpose, an early evaluation of its potentially toxic effects to human cells is needed.

This work is aimed at contributing to the safety evaluation of deflamin through the analysis of cytotoxic and genotoxic properties of the purified deflamin and a *Lupinus albus* extract in

Caco-2 cells. Furthermore, its bioavailability and transport via a Caco-2 monolayer system are tested to get further insights in possible uptake scenarios in the human intestine. The cytotoxic effects are analyzed by assessing cell viability (MTT assay), following Caco-2 cells exposed to a concentration range (5-640 µg/ml) of the pure deflamin or the extract during 24, 48 and 72 hours. Genotoxicity is assessed by the alkaline comet assay and the cytokinesis-block micronucleus assay. The effects on the intestinal barrier are analyzed by measuring the transepithelial resistance (TER) in a differentiated Caco-2 monolayer upon apical exposure to deflamin or the extract and its transport across the membrane.

Preliminary data suggest that neither the pure nor the extract display cytotoxicity in the tested concentration range. The results of the Genotoxicity studies will be presented and discussed in light of the future application of deflamin as a chemopreventive agent, ensuring the absence of adverse side effects.

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Contribution for the DNA barcoding of Portuguese mosquito species

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Arboviruses - viruses transmitted by arthropod vectors - can account for 70% of the emerging diseases in the 21st century and are invading new areas in the world affecting both humans and animals. Mosquitoes are amongst the most important biological vectors of infectious pathogens that cause some of the most deadly and emerging diseases worldwide, such as malaria and dengue. Mosquito identification is the first step for the monitoring and surveillance of arboviruses. Traditionally, species are identified based on their morphological characteristics, but this method can be time-consuming, requires specialist knowledge and may not be able to identify damaged specimens or distinguish sibling species. Several molecular methods for the identification of mosquitoes have been developed over the last years to overcome the limitations of morphological identification. One of the most widespread methodology used for species identification is DNA barcoding that involves the use of small gene segments as the Cytochrome Oxidase I (COI) gene, which has been recognized as the global standard for biological identification. Several recent studies have been using this methodology to identify mosquitos. Barcode of Life Database (BOLD) is an online platform that hosts validated sequence records of many animal species, including COI sequences of mosquitoes. The identification of a mosquito sample is attained by comparing the sequence of the amplicon with the sequence data deposited in this database or in NCBI Genbank. Portuguese vector surveillance national programme (REVIVE), is in place since 2008 and has identified 25 species of mosquitoes. These mosquitoes have never been subject to DNA barcoding and there are only a reduced number of mosquito COI sequences from Portuguese origin in genetic databases. In this work we obtained the COI sequences of 21 Portuguese mosquito species, confronted the results of morphological identification of adult mosquito specimens with the results of DNA barcoding, and a reference data set was established. The sequences obtained were then used for phylogenetic placement, for validation and benchmarking of phenetic classifications.

With this study, we aimed to establish a comprehensive DNA barcode library for the Portuguese mosquito fauna. This can help improve current vector surveillance programs. We hope to contribute also for the detection of hidden diversity among mosquito species.

Gluten labeling in non-packaged food sold in catering businesses: the importance of cross-contamination and good manufacturing practices

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The incidence of food allergies has been increasing in recent years and among food allergens, gluten has been identified as a major public health concern. Because there is no cure for gluten allergy, its avoidance is the best strategy to allergic individuals. Recently, non-packaged foods sold in the catering businesses were required by law to declare allergens. However, since gluten can be unintentionally introduced into food due to the cross-contamination and non-compliance of good manufacturing practices, improper label declaration may occur. The aim of this study was to assess the potential (cross-) contamination of foods with gluten due to the shared activities with utensils/equipment and the non-compliance of good manufacturing practices. Samples of non-packaged foods (n=35) and surfaces of utensils and equipment (n=50) were collected in four kitchens belonging to a collective catering company. ELISA kits were employed to perform the gluten analyses.

In general all food samples have gluten, including garnish, salads and soups in which would not be expected to find this allergen. This suggests that gluten-free products are susceptible to cross-contamination, probably due to the unsystematic activities developed in these establishments and the non-strictly compliance of good manufacturing practices. However, the concentration of gluten in most foods was <20 ppm, which allows classifying them as gluten-free. Likewise, in all surfaces traces of gluten were found. Nevertheless, although cleaning is not absolutely effective in removing gluten, this process can reduce its content to significantly lower levels. In conclusion, for the proper labeling of gluten in non-packaged food sold in catering business, periodic training programs and routine supervision should be applied to ensure that procedures are being carried out effectively. It is also crucial the regular food testing and the assessment of the effectiveness of sanitation to ensure that cross contamination are not occurring at levels of risk.

REVIVE – Portuguese network for arthropod vector surveillance in public health

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Vector-borne diseases are emerging or re-emerging in Europe because of a complex interaction between travel, trade and environmental factors that favor the introduction, establishment and dispersal of arthropod vector species and transmitted pathogens. The distribution and density of vector populations is a key factor for the occurrence of vector-borne diseases outbreaks, and for this reason entomological surveillance in public health is nowadays a necessity and should be a priority. Mosquito-borne diseases such as Zika, chikungunya, dengue and yellow fever are currently of global importance and a major challenge to Europe due to the continuously expansion of vector mosquitoes, such as *Aedes albopictus* and *Aedes aegypti*. Autochthonous cases of Crimea-Congo hemorrhagic fever, a tick-borne viral zoonosis, were recently reported in Spain and its vector tick *Hyalomma* spp. is a species that is also established in Portugal. New Phleboviruses are being isolated from sandflies vectors (*Phlebotominae*) and preliminary studies indicate that these may be pathogenic for humans and have importance in public health.

As a response to these new challenges, as also to comply with the International Health Regulations (IHR) concerning vector surveillance and control, it is crucial that the European member states implement surveillance programs for arthropod species of public health relevance, which should be part of a global plan for risk assessment and management of vector-borne diseases. In Portugal, a vector surveillance national program — REVIVE (REde de Vigilância de VEctores) — has been operating since 2008 under the custody of the Portuguese Ministry of Health. The REVIVE is responsible for the nationwide surveillance of hematophagous arthropods which provide systematic collection of arthropod vectors from several geographic regions and generate useful ecological data on species distribution and density of mosquitoes, ticks and sandflies. The main objectives of REVIVE are: 1) to determine species diversity and abundance; 2) to survey exotic/invasive species, namely *Aedes aegypti* and *Ae. albopictus*; 3) to screen mosquito-borne pathogens in environmental samples; 4) to survey airports, ports and other entry points according to IHR.

The REVIVE methodology is based on a strategy of collection ranging from monthly to biweekly or even weekly arthropod vectors sampling. Mosquito and sandflies field collections run from May to October each year. Tick collection and mosquito monitoring at entry points (airports, ports and border regions) take place from January to December, the last according to the guidelines for the surveillance of invasive mosquitoes in Europe. In the laboratory, species identification, pathogen screening and data analysis take place throughout the year. Activity reports are published annually, and an open workshop is organized to assess the progress of REVIVE. The REVIVE contributes with baseline information and updated data for vector control setting capacity-building at regional and national level for a timely and effectively response to vector-borne diseases outbreaks.

Ingested nanomaterials- effects of titanium dioxide in human cells

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Nowadays, the consumer products containing nanomaterials (NMs) are numerous. Among these, titanium dioxide nanomaterials (TiO₂) are the most frequently applied, used as food additive, pharmaceuticals, toothpastes and many more. The wide commercialization of consumer products containing TiO₂ contributes to a substantial increase of human exposure to this compound, which is worrying for public health, since the existent studies generated contradictory results about TiO₂ safety. The fact that NMs are dependent of the context (surrounding matrix) can contribute to explain the contradictory results reported in the literature. Furthermore, it has been hypothesized that NMs physicochemical properties may define bio-nano interactions, which suggest that NMs with the same chemistry but with different shape, diameter, length, surface charge or functionalization may lead to different toxicities (Louro et al., 2019).

This work aimed to assess whether the secondary physicochemical characteristics of three different TiO₂, i.e., the characteristics after the digestion process, produce different biological effects in intestinal cells.

The three NMs were obtained from the Joint Research Centre, Ispra, Italy (NM-102, NM-103 and NM-105), and display different charge, size and crystal structure, coated and uncoated, as characterized by the producer (Rasmussen et al., 2014). An *in vitro* digestion process was used to mimic human digestion (Brodkorb et al., 2019) and the resulting product was used for cytotoxicity assessment in a human intestinal cell line (Caco-2), in comparison to undigested NMs. In addition, cellular uptake was investigated using confocal microscopy.

Preliminary results did not evidence a differential biological effect between the three NMs. Following 24h of exposure of Caco-2 cells, all the digested NMs behaved similarly at the concentrations tested (0.14 – 14.3 µg/ml) showing no cytotoxic effects. Likewise, no cytotoxic effects were observed upon exposure to undigested NMs. However, the results showed the nuclear localization of one NM, NM-102, suggesting that it may interact with the genome in cells exposed to this TiO₂.

Ongoing studies will confirm the subcellular localization of the NMs in exposed intestinal cells and will investigate their genotoxic effects in relation with the secondary properties.

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References:

- Brodkorb, A., Egger, L., Alminger, M., Alvito, P., Assunção, R., Ballance, S., et al. (2019). INFOGEST static in vitro simulation of gastrointestinal food digestion. *Nat. Protoc.* doi:10.1038/s41596-018-0119-1.
- Louro, H., Saruga, A., Santos, J., Pinhão, M., and Silva, M. J. (2019). Biological impact of metal nanomaterials in relation to their physicochemical characteristics. *Toxicol. Vitro.* 56, 172–183. doi:10.1016/J.TIV.2019.01.018.
- Rasmussen, K., Mast, J., Temmerman, P. De, Verleysen, E., Waegeneers, N., Steen, F. Van, et al. (2014). Titanium Dioxide, NM-100, NM-101, NM-102, NM-103, NM-104, NM-105: Characterisation and Physico- Chemical Properties. doi:10.2788/79554.

Impact of big forest fires in the air quality of nearby cities

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The effect of smoke from forest fires in human health is often overlooked. Most forest fires occur far from the large cities and during the summer. In Portugal and Europe, their existence in summer is undeniable and the importance given to these fires has been demonstrated through the reinforcement of the European Civil Protection Mission to coordinate fire-fighting and other emergencies in Europe.

Unfortunately for Portugal, 2017 was one of the most tragic years in terms of fires. Not only because of the burned area, but also because of the victims that the fires of 17 June and 14 October caused. These fires lasted for a few days and the biomass burned caused tons of CO₂ and particles to be emitted into the atmosphere. Particles from forest fires contribute significantly to the decreasing of air quality and have negative impacts on the health of populations. The direct relationship between the concentration of airborne particles (PM₁₀ and PM_{2.5}) and mortality rates, due to respiratory and cardiovascular diseases, is known. With global warming these phenomena of intense fires due to heat waves may intensify. The severity of the effect of fires on air quality is dependent on factors such as: extent of fire, duration, type of vegetation burned and atmospheric conditions. It is therefore important to evaluate the population affected by the decrease in air quality due to fires. This assessment shall take into account the population density of the fire zone, its vicinity and also the areas where the wind carries the particles produced in the fires.

In order to estimate the effects of the large fires of 2017 in the surrounding cities, the air quality data, namely in terms of particles, provided by the QUALAR network in Portugal, were analyzed. For each of the great fires of 2017, Pedrogão Grande and Leiria, the data of the surrounding air quality stations were evaluated. The data were compared with the average values of the year and previous years.

Concerning the major fires of June and October 2017, it was found that the levels of particles in all the surrounding air quality measurement stations (Ervedeira, Coimbra, Fundão, Chamusca and Lourinhã) exceeded the permitted limits. The station of Ervedeira, near Leiria and the focus of the fire, even reached the particle concentration of 1000 µg/m³ on 16 October. These values are maintained for a few hours or days, depending on the meteorological conditions, especially the predominant wind.

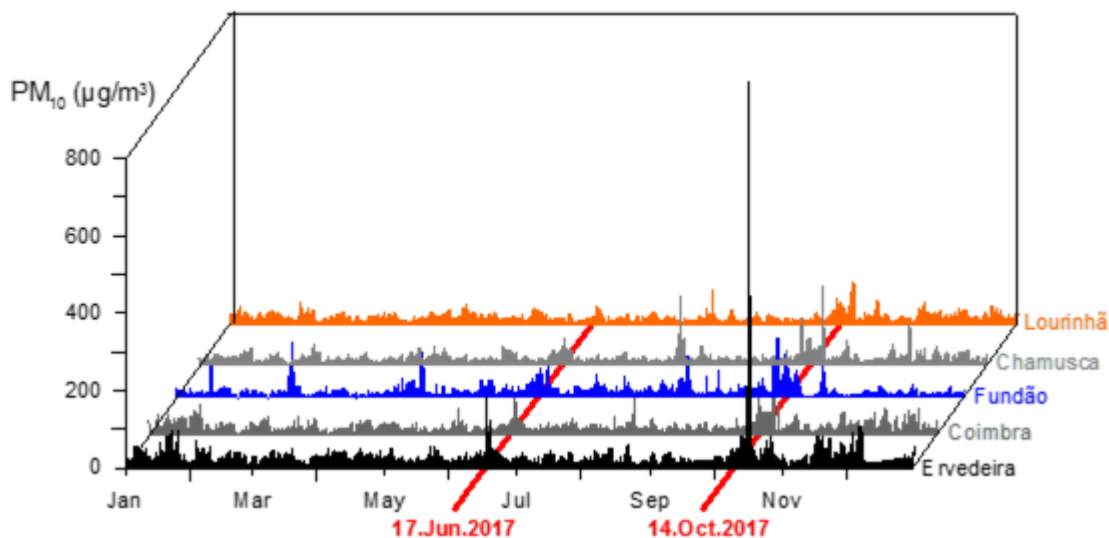


Fig. 1 – Air Quality data from stations around the places of the fires.

The data show that fires cause a decrease in air quality in neighboring cities and their effects can be felt at great distances. Because they occur typically in the summer, when ozone levels are also high, we have a combination of several adverse factors for the sensitive population: children, the elderly and respiratory patients. Measures to combat and mitigate fire should also include this component of environmental health that is especially relevant to the sensitive population and to the firefighters themselves.

Occupational exposure to wood dust: a review

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Introduction: In general all industries throughout production processes have shown the existence or potential of various professional risks, be they physical, ergonomic, mechanical or chemical. This last risk will be the focus of the study, since this industries process, use and handle wood or timber, release dust, classified as a chemical risk factor.

Exposure to wood dust or particles is intrinsically linked to the development of several Health pathologies, including respiratory problems such as asthma and oncological diseases such as lung cancer, adenocarcinomas and pharyngeal cancer.

It should be noted that wood dust form wood-based processing and production, such as carpenters and the furniture industry, have been classified since 1995 by the International Agency for Research on Cancer (IARC) as a human carcinogenic group 1, based mainly on nasal cavity and paranasal sinus cancers. It is important to note that the Scientific Committee on Occupational Exposure Limit (SCOEL) of the European Union indicates that exposure to 0,5 mg /m³ causes pulmonary symptoms, such as acute or chronic respiratory diseases, occupational asthma and reduced lung function.

Objective: The main objective of this study is to carry out a systematic review to evaluate the association between Occupational exposure to wood dust and the development of respiratory and oncological diseases.

Methodology: The methodology used to carry out this bibliographic review was performed based on the Prisma Statement review methodology. For the use of this methodology, keywords were selected, starting with a more generalist “Dust Wood”, the other a little more specific, such as “Occupational exposure to wood dust”. Both keywords were searched on three platforms, Scopus, Science Direct and Web Science, thus defining a criterion of exclusion, that the articles to be analyzed were published between 2014 and 2019, which considered only articles published in scientific journals and drafted in English.

Results: After the application of the methodology described above, only twelve (12) articles were selected for deeper analysis, sine those fulfilled the predefined requirements, such as studies related to wood dust exposure, arising from professional activities, as well as the potential development of pathologies.

Conclusion: From the study, we can conclude that there is evidence that Occupational exposure to wood dust contributes to an increased risk of developing pathologies, especially DNA damage and respiratory system pathologies, since particles with a diameter of 5µm or less are trapped in the lungs and risk of adenocarcinomas is increased.

Air Emission Control Systems for Cruise Ships in the Port of Lisbon

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According to Portuguese's Statistics in 2017, the tourism in Portugal raised as well as the number of passenger ships that entered the maritime ports. The Port of Lisbon itself had an increase of 3.1% compared to 2016.

An European Federation for Transport and Environment study (2019) states that, in 2017, 47 large-scale cruise ships have emitted about 10 times more SO_x in the European Exclusive Zones than more than 260 million car passengers in Europe. It has considered Lisbon as the 6th European city most affected by SO_x and particulated matter pollution, in a list of 50.

The pollution's increase seems inevitable as long as this maritime transport uses fossil fuels as a source of energy, having impacts at the environment and population's health.

In order to reduce these emissions, Decree-Law 170-B/2014, which transposed into national law the Directive 2012/33 (EU), require ships at berth in Community ports to use fuel containing no more than 0.1 % Sulphur, alternative fuels such as LNG or alternatively a technology that can reduce emissions to an equivalent level.

There are various types of Exhaust Gas Cleaning Systems (EGCS). Scrubbers can be used as an alternative to low sulphur fuels. Four different types of scrubbers are available: Seawater scrubbers or open loop, utilize untreated seawater to neutralize the sulphur from exhaust gases; freshwater scrubbers or closed loop utilize freshwater in a closed system and the exhaust gases are neutralized with caustic soda; hybrid scrubbers give the possibility to either use closed loop or open loop technology and dry or wet scrubbers do not use any liquids in process but exhaust gases are cleaned with hydrated lime-treated granulates.

The Port of Lisbon's Administration prohibited the use of open Loop scrubbers since, there is a direct transference of the pollutants contained in the gaseous effluents to the washing waters (sea water).

Thus, the study sought to understand how ships entering the Port of Lisbon comply with the established regulations, as well as the systems installed to control and monitor these emissions and discharges. After an in-depth bibliographic review, a checklist was developed in order to identify the important points to be observed in visits on board cruise ships.

With this, it could be concluded that the cruise ships choose:

- Not to make changes on board, only shifting the fuel to a more refined one, with a lower sulfur content compared to the heavy fuel oil. This option has been checked mainly on smaller or older ships;
- Install EGCS pollution control equipment (Open Loop, Close Loop, Hybrids) approved according to the IMO Guidelines as an alternative method of compliance.

The choice of technology to minimizing the pollution emissions takes into account the ship age, the routes, the investment cost as well as the space available for the installation of this type of systems and sils being allowed in port.

The option for EGCS - Open Loop is the most frequent, because the initial investment cost is lower. When these equipments are installed, pH, PAH, turbidity are monitored in the discharge waters and the gas emission is carried out using gas analyzers and SO₂/CO₂ ratio calculations. However, it has been found that emissions from other equipment as boilers, or incinerators (not allowed in port) aren't controlled.

Water consumption of tap water vs. bottled water: the vision of the youngsters

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Water is a scarce and an essential resource. It is needed in everyday life and affects the well-being of each individual. The absence of liquids throughout the day causes dehydration, affects the cognitive performance and health. Proper water consumption depends on variations in gender, climate and level of physical activity. The water consumption, both in quantity and quality contribute to a healthier and more balanced life.

The water supply sector in Portugal had positive developments, having an extensive water supply system with good water quality provide clean and safe tap water. In spite of the availability of cheap and good quality tap water, the volume of mineral water sales in 2018 had a positive result of 0.02 %, compared to the same period last year (APIAM, 2019, Mercado de águas minerais e de águas de nascente: Ano 2018).

The choice of bottled water consumption has negative economic and environmental impact. The total energy required per liter for unit bottled water consumption is higher than per liter tap water treatment and distribution. Besides that, most of bottles are not recycled and the improper storage and the manufacturing process of bottled water would also harm its consumers. Elevated temperatures are responsible for the release of antimony from polyethylene terephthalate plastics used for water bottles and almost all bottles showed signs of microplastics (Mason et al. 2018, Synthetic Polymer Contamination in Bottled Water)

In order to promote environmental sustainability, the European Commission in the new proposal to amend the Directive 98/83/EC (The Drinking Water Directive) encourage the general public to carry reusable water bottles and increase the location of free refill points as well as discouraging the use of water put in single use plastic bottles. Moreover has the objective that all plastic packaging on the EU market will be recyclable by 2030 and the consumption of single-use plastics will be reduced (A European Strategy for Plastics in a Circular Economy, 2018).

This study analyzed the factors that affect the water consumption habits in two school (one public and one private) in Carnide, an Eco parish in Lisbon with a questionnaire surveys. The questionnaire was organized to enable the student's characterization, to identify water

consumption habits and the factors that lead to the choice of tap water or bottled water at home, at school and outside the home.

The questionnaires were applied to 869 students from 2nd to 12th grade. The students came from the private school, 51 % and 49 % were from the public school. The students were 56 % females and 46 % males. The ages were between 7 and 20, with a mean age of 13.61 years and a standard deviation of 2.84. The distribution by ages and years are represented in Figure 1 a) and b) respectively.

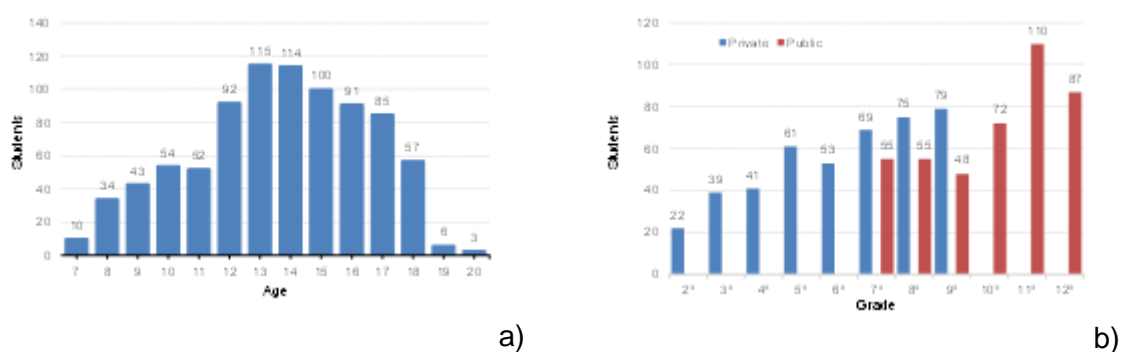


Figure 1 - The distribution by: a) ages and b) years

There are no major differences in the consumption habits of the two schools. The biggest difference was found in the answers to the questions "How much water do you drink?" and "When do you drink water?". However it is verified that this difference is not due to the type of school but to the ages. When comparing the responses by age range the difference is zero. It appears that the older are more aware of the need to drink water.

A majority of students choose to drink water in WC (43.7 %) or fountains (51.0 %), or bring a bottle with water from home (22.2 %). However there are a significant consumption of bottled water with environmental consequences. The main reason that cause dissatisfaction with tap water is organoleptic (taste and odor). In order to encourage students to drink water from fountains instead of WC or bottled water, it is necessary to implement a good network of fountains in schools and to provide for their maintenance.

Foodborne outbreak of gastroenteritis in a school caused by diarrheal toxin-producing *Bacillus cereus*

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Introduction: Foodborne diseases are a major public health concern and an important cause of morbidity and mortality globally. Food safety is especially important in schools since children are more susceptible to illness complications. *Bacillus cereus* is a gram-positive bacteria that grows well in food after cooking and cooling (<48°C) and it normally causes a mild disease of short duration. On the 1st of February 2016, the local Public Health Unit was contacted by the head teacher of a school reporting the absence of several students, teachers and other employees due to the same gastrointestinal symptoms (vomiting and diarrhea).

Methods: The school building was visited that day by the environmental health technician who identified the company responsible for the food preparation and delivery and obtained the details of the previous days menu. The food preparation site and the auto-control system based on the HACCP principles were analyzed. There was an active search for unreported cases on other schools supplied by the same company. Epidemiological questionnaires were applied to students and adults and food samples were sent to the national reference laboratory (INSA) for analysis. No samples from cases were obtained.

Results: A total of 35 from the 71 inquired developed symptoms between 29 and 31st of January. The onset of symptoms in first cases started on the 29th January around 3pm, 3 hours after the last school meal. In most cases the symptoms lasted for 24-48 hours. Four additional cases were reported from another school served by the same company. The most reported symptoms were: vomiting (91%) and abdominal discomfort (83%). After visiting the site, it was found that the food was delivered around 11:30 am and the meals were served between 12 and 12:30 pm. Between delivery and serving, the foods were kept warm in water bath, but there was no temperature control. The food samples sent for analysis revealed the presence of *Bacillus cereus* ($1,8 \times 10^3$ CFU/g) and the diarrheic toxin on the sample taken from the roasted hake with carrot and peas rice meal, which was served on the 29th January lunch. **Discussion and Conclusion:** *Bacillus cereus* is the probable causal agent of the outbreak. The meal consisting of roasted hake with carrot and peas rice was most probably kept at varying temperatures which favoured microorganism multiplication. Inadequate food temperature control is one of the most frequent sources of food deterioration and subsequent food poisoning. Temperature control procedures should be reinforced by the company in order to decrease the risk of future foodborne illnesses.

Food waste management in Port of Lisbon

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Nowadays the international maritime industry is responsible for 90 % of the world commodities (ISC, 2019 <http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade>). The increase in international maritime transport contribute to rise the free circulation of people and good and consequently to spread of infections like spongiform encephalopathies in the European territory if certain precautions are not taken. Transport products of animal origin from third countries can present the risk of directly or indirectly spreading these infections. Food waste (FW) or catering waste (CW) containing animal products, can be a vector for disease transmission. The Commission Regulation (EU) No 142/2011 define “catering waste” as “*means all waste food, including used cooking oil originating in restaurants, catering facilities and kitchens, including central kitchens and household kitchens*” and Regulation (EC) No 1069/2009 classifies this waste into Category I.

For this type of waste all Member States shall ensure an adequate waste management: identify, collection, transportation and disposal, in order to prevent risks to public health. All Member States “*shall monitor and verify that the relevant requirements of this Regulation are fulfilled by operators along the entire chain*” and “*shall maintain a system of official controls in accordance with relevant Community legislation*” (Regulation (EC) No 1069/2009).

Following the requirements for this type of waste the main aim of this work was to observe/monitor the measures taken by the Port of Lisbon in the management of such waste and assess whether they are sufficient in vector control for disease transmission.

In Port of Lisbon all FW and CW originating from a ship coming from a “third countries” a port outside of EU was classified under Regulations (EC) No 1069/2001 as Category 1 material, the highest risk material. This material shall only be transported to a permitted thermal treatment or an authorised landfill facility by a vehicle or carrier approved. Disposal must be carried out immediately upon berthing of the vessel. Movement of this waste, FW and CW shall be covered by a valid consignment permit obtainable from the Competent Authority. In Portugal, the Directorate-General for Food and Veterinary (DGAV), is the Competent Authority.

Administração do Porto de Lisboa, S.A (APL) is responsible to ensure the proper way of handling (collection, packaging and transport) and elimination of Category I material

discharged by commercial ships, passenger's ships, merchant ships and pleasure crafts calling at Port of Lisbon.

The APL procedure for the handling, transportation and elimination of Category I material is as follows (Figure 1):

- 1- The shipping agent fills in the request for the waste collection from the ship.
- 2- If the quantity of FW and CW is different from zero and if it is a ship from a third country or a country which classifies the food waste as category I, the online platform issues the alert «Under the Regulation (EC) No 1069/2009» The waste operator and the APL, S.A., can see this alert and specific procedures for handling FW and CW will be adopted.
- 3- The APL, S.A., establishes the date, time and place of waste collection in the port terminals.
- 4- On the set date and time, the waste operator goes to the ship and collects FW and CW in a dedicated containers and transports to final destination (incinerator or landfill). This operation is accompanied by « the Guide to Monitoring of Animal By-Products », in addition to the usual documentation required in waste management and freight transport.
- 5- Reusable containers and all equipment that had contact with food waste are cleaned, washed and disinfected after each use in order to avoid cross-contamination.



Figure 1 - The APL procedure for the handling category I material

The APL procedure is effective and follows European regulations on FW and CW management from ships call coming directly from third countries, but does not have the capacity to detect all wastes classified under Category I. For example, if the ship last scale was an EU country but the food was purchased on a previous scale in a third country no alert is generated because the port procedure only takes into account the last scale. In this case the FW and CW should be classified, handling and disposal as Category I material in order to prevent contamination and disease transmission.

Evaluation of Employees Fruit Consumption and its relation with Body Mass Index

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The fruit intake in Portugal is below recommended levels despite evidence of the health benefits of regular consumption. Research indicates that there is an inverse relationship between fruit consumption and excessive weight. The workplace may be an ideal location for nutrition and health interventions, for example, in the context of occupational health, because of the potential health benefits for employees and associated decreases in absenteeism and sick leave. Employees spend a lot of their time at work which can represent a good setting for interventions to promote fruit consumption and weight control. The purpose of the present study was to evaluate the fruit intake status of employees and to examine the relationship between fruit intake and Body Mass Index (BMI).

From 443 employees, 320 answered to a self-administered questionnaire that included questions about anthropometric measurements and fruit and vegetables frequency consumption. Were obtained a employees sample with 47[Symbol]10 years, predominantly male (60.9%) and with a similar frequency of professional activity, with 41.3% of operational assistant and 37.9% of technical assistant. It was found a BMI average of 26.0[Symbol]4.8 kg/m² with higher prevalence of BMI≥25 kg/m² (53.6%) of which 14.4% were obese. A significant association between BMI and gender (p=0.000) was found and operational assistant had higher BMI (p=0.0004).

The results showed that 57.9% of employees had a daily fruit intake below the minimum recommended (<2-3portions) and 13.5% consumed at maximum once a week, but no relation was found with BMI. Fruit intake was higher in female (U=8443; p=0.027) and in employees with positions with higher education (p=0.015). Also was found that females had better food habits and who had higher intake of fruit also had better food habits such as cooked vegetables intake (rs=0.183; p=0.002), vegetable salads intake (rs=0.209; p=0.000) and soup consumption (rs=0.204; p=0.001).

With these study findings we can conclude that there is a lack of relation between fruit intake and BMI. We can also conclude that the fruit intake was below recommended and should be improved and there is a high prevalence of employees with excessive weight that should be controlled and reduced. The workplace is a good setting to develop a nutrition program to reach these goals.

Exploring the toxicity of cellulose nanofibrils in a lung epithelial cell line

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Nanotechnologies and nanomaterials (NMs) applications have been growing in recent years, bringing benefits to society but raising also some concerns about their safety to human health. Cellulose is a natural material that fits the global trend of sustainability: ecological, low cost, abundant and renewable nature. In particular, cellulose nanofibrils (CNF)¹ are forest-derived products with advantageous mechanical, optical and rheological properties, assuming a high industrial potential, e.g., in paper, food, pharmaceutical and biomedical industries. With the innovative applications expanding, CNF synthesis and production have increased, leading to concerns about occupational exposure, particularly by inhalation, or consumers exposure. The toxicity studies of other NMs, like multi-walled carbon nanotubes (MWCNTs), have had contributed to understand the nanofibres health effects on humans. MWCNTs have been reported to cause adverse effects *in vitro* and *in vivo*, such as DNA damage and oxidative stress². Because CNF show a high resemblance in terms of aspect ratio to MWCNT, our main focus is to identify if the CNF synthesized have a toxic potential.

This study aims to assess the safety of two types of CNF produced in a high pressure homogenizer with different pre-treatments (TEMPO-mediated oxidation and enzymatic hydrolysis) of an industrial bleached *Eucalyptus globulus* kraft pulp, through the characterization of its cytotoxicity and genotoxicity in human cells.

The CNF cytotoxicity was assessed using lung epithelial alveolar (A549) cells by two methodologies, the MTT and the clonogenic assay, whereas the genotoxicity was assessed by the cytokinesis-block micronucleus assay. Dose-range finding experiments were performed using the MTT (24h, 48h and 72h exposure) and the clonogenic (8 days exposure) assays, which revealed that both CNF were not cytotoxic at concentrations between 3,125 and 100 µg/ml. On the contrary, both CNFs were able to increase cell viability at the highest concentrations tested (50 and 100 µg/ml). This effect had been previously observed in the same cells exposed to CNF produced by TEMPO-mediated oxidation, but at the lowest concentration level³. The potential of the CNF to induce chromosomal alterations, either chromosome breaks or loss is being analysed through the micronucleus assay and the results will be presented.

Overall, this study is expected to uncover potential adverse outcomes of CNF to human health, in order to promote the design of safer CNF and CNF-based products that will allow a more sustainable and responsible industrial development.

References:

- 1) Gamelas, J., Pedrosa, J., Lourenço, A., Mutjé, P., González, I., Chinga-Carrasco, G., Singh, G., Ferreira, P. (2015). On the morphology of cellulose nanofibrils obtained by TEMPO-mediated oxidation and mechanical treatment. *Micron*, 72, 28-33.
- 2) Louro, H., Pinhão, M., Santos, J., Tavares, A., Vital, N., Silva, M.J. (2016). Evaluation of the cytotoxic and genotoxic effects of benchmark multi-walled carbon nanotubes in relation to their physicochemical properties. *Toxicology Letters*, 262, 123-134.
- 3) Ventura, C., Lourenço, A., Sousa-Uva, A., Ferreira, P., Silva, M.J. (2018). Evaluating the genotoxicity of cellulose nanofibrils in a co-culture of human lung epithelial cells and monocyte-derived macrophages. *Toxicology Letters*, 291, 173-183.

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Assessment of Aerosol Emission Sources in a Traffic Site Combining On-line and Off-line Measurements

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In urban areas evidences from epidemiological and experimental studies show that traffic-related air pollution has adverse effects on respiratory and cardiovascular systems. Urban air pollution accounts for 3% of mortality from cardiopulmonary disease and 1% of mortality from acute respiratory infections in children under 5 years, worldwide. Therefore, disease and mortality associated with vehicle emissions represent a substantial challenge in public health.

Source apportionment, using receptor models, is an essential tool to support the implementation of the European and Member States legislation on air quality and principally to reduce the impact of exposure to Air Particulate Matter (PM) on human health.

This work was developed in the framework of the Interreg Med REMEDIO project and aims to assess the aerosol emission sources in an urban traffic site, located in the outskirts of Lisbon. With that purpose, PM₁₀ and PM_{2.5} were collected in a sampling campaign conducted in the urban centre of Moscavide (North of Lisbon, Portugal). The filters were analysed by XRF for the determination of element concentrations. With the purpose of characterising ambient aerosols and assess the contribution of the main emission sources and processes leading to aerosol formation in the atmosphere, source apportionment was performed by applying the Positive Matrix Factorization (PMF) model. PMF allowed the identification and the quantification of the contributions to the aerosol from different sources.

Figure 1 shows that PM₁₀ and PM_{2.5} daily levels exceed the guidelines established by the World Health Organization (50 and 25 µg.m⁻³ for the 24-hour mean of PM₁₀ and PM_{2.5}, respectively). This indicates that mitigation measures should be implemented in the studied area in order to protect the population health. Source apportionment using PMF was used to investigate local and regional pollution events, with data from chemical characterisation of particles.

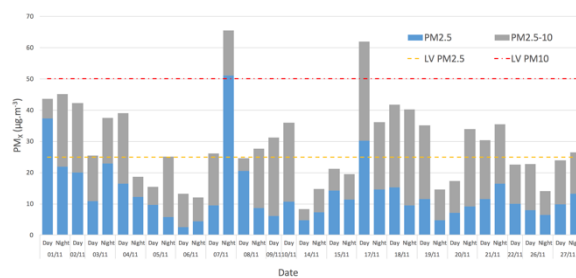


Figure 1. Particulate Matter (PM10 and PM2.5) daily variation in Moscavide.

Enteric viruses in surface water and drinking water samples from Portugal

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Human population growth and climate changes have increased pressure on the quantity and quality of the planet's water resources, either through over-exploration, extreme events or changes in the distribution and seasonal variation of pathogens. Currently, water-related infectious diseases are one of the main causes of morbidity and mortality worldwide. Enteric viruses, namely Enterovirus, Norovirus and Hepatitis A virus, are some of the major causative agents of disease. These viruses are mainly transmitted from food and contaminated water through the oral-fecal route and very resistant to the disinfection procedures of the Water Treatment Plants. Antibiotics are ineffective against viral infections and only a small number of antivirals are available. In this context, there is a growing need for an effective surveillance system for the detection and quantification of these pathogens in order to reduce their transmission. The objective of this study was to survey enteric viruses (Enterovirus, Norovirus Genogroup 1 and Hepatitis A virus) in samples of surface water and drinking water from the Lisbon supply network, by Real-time Reverse Transcription PCR (RT-qPCR) and evaluation of the infectivity of the positive samples from PCR in cell cultures. The study was carried out between January and May 2019, in samples of surface water from Tagus River and Albufeira de Castelo de Bode (Zêzere River), in drinking water of two Water Treatment Plants and at a sampling point in the city of Lisbon. The experimental procedures used were adapted from the American Method 1615 (EPA / 600 / R-10/181). The detection of enteric viruses was performed by RT-qPCR and the infectivity of the samples was analyzed by observation of cytopathic effects (CPE) induced in cultured Vero cells. RNA extracted from cultures (cells and supernatants) displaying CPE was subjected to RT-PCR with primers that target the viruses previously detected. Of the 26 samples analyzed, 15 were of drinking water and 11 of fresh water. Viral RNA was detected in 54.55% of the surface water samples and in 6.25% of the drinking water samples. The Tagus river presented the highest number of samples with detected viral RNA (four of the six samples analyzed). Nucleic acids of Enterovirus, Hepatitis A virus and Norovirus Genogroup I were detected both in samples from Tagus River and Albufeira de Castelo de Bode, the most commonly found being Norovirus Genogroup I. Some samples from the Tagus River induced total CPE in Vero cells. Although enteric virus RNA was detected in the two main water sources of the city of Lisbon, our results suggest that the Treatment Plants are efficient at eliminating them.

Development and validation of a tool to evaluate resilience performance in metalworking industry

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For several organizations, occupational risk management is focused on risk assessment, accident investigation and analysis, and implementation of control measures. Investigation and analysis of accidents is often carried out taking into account causation models, with the objective of identifying the causes and determining effective corrective measures to improve both current practices and risk control systems. This behavior of the organizations fits in the traditional perspective of safety, realized as the absence of unwanted events.

The traditional safety management approach begin to show itself unable to cope with the changes in the working context and unable to fully explain the accidents occurred within organizations. In view of this, arose the need to find new models. Resilience Engineering emerges as a new safety management paradigm that seeks to focus on the daily performance of organizations and ensure the necessary actions that enable the continuing evolution and growth of the systems. Assuming itself as a proactive approach, contrary to the traditional view of safety, it seeks to ensure that the number of successful results is as high as possible under the most varied conditions.

With this new paradigm, new methods and instruments have emerged to support in resilience assessment, such as the Resilience Assessment Grid (RAG). According this method, four abilities are necessary for resilient performance, called cornerstones of resilience: ability to respond, ability to anticipate, ability to monitor and ability to learn. RAG allows us measure how resilient the system's performance is.

Given the importance of Resilience Engineering for organizations, particularly for industries, there is a need to adapt existing instruments to different realities. The Portuguese metalworking sector is of particular interest, since the accident rate is still high and improvements to the risk management process are needed. Additionally, it is important to recognize the relevance of risk assessment and investigation and analysis of accidents processes for Occupational Safety & Health management in this sector.

In view of the above, this study aims to develop and validate a grid to assess resilience in the metalworking sector, which allows to determine the contribution of risk assessment and the investigation and analysis of occupational accidents for a resilient performance. For this purpose, a questionnaire was designed based on RAG assumptions. The first version of the questionnaire was developed by a team of four researchers and according to the current bibliography. In a second phase Delphi methodology was applied to find the final items to include in the grid. A team of 20 specialists were included, who analyzed the applicability and suitability of each item to the sector. In the following phase, the questionnaire will be applied to a sample of metalworking industries. The results will be presented at the congress. The authors believe that the application of this grid will contribute to the definition of strategies that helps the companies of metalworking sector to improve safety management.

Health Impact Assessment of a Paper Pulp Industry on Atmospheric Pollution

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The environment is one of the major determinants of human health quality. However, over the years, human activities had significant impacts on the environment resulting in negative consequences for the population.

In Portugal, in order to reduce the effects of projects on the environment and in human health, it was introduced the Decree-Law No. 152-B / 2017 of 11 December. This law refers to the impact assessment of a given project on air, water, soil, climate change and other components, and highlight the importance of considering the human health factor.

Health impact assessment (HIA) is a combination of procedures, methods and tools used to evaluate the potential health effects of a policy, programme or project. Using qualitative, quantitative and participatory techniques, HIA aims to produce recommendations that will help decision-makers and other stakeholders make choices about alternatives and improvements to prevent disease/injury and to actively promote health.

The aim of this study is to implement a methodology for Health Impact Assessment, specifically focused on air pollution. The case study concerns the assessment of the activities of a paper pulp industry and its direct and indirect impacts on the health of the surrounding population.

It is also intended to deepen the knowledge in HIA, in Portugal and to expand the application and use of this assessment in decision-making moments of the Environmental Impact Assessment. For the development of this HIA, a review of the relevant scientific literature, the collection and analysis of relevant data, a description of the population and human health elements that could be affected by the industry were carried out.

Single and binary mixture toxicity of ibuprofen and paracetamol to *Daphnia magna*

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Pharmaceuticals are a diverse group of compounds biologically active, produced to treat human and animal diseases. They enter the environment mainly in two ways, waste water effluent from human sources and agricultural runoff from veterinary treatments. As removal of a large number of pharmaceuticals from sewage treatment processes is not complete, mixtures of pharmaceuticals are discharged into the receiving waters in detectable amounts. The aim of this study was to assess the acute and chronic effects of paracetamol, ibuprofen and its mixture, at ecologically relevant concentrations in the freshwater crustacean *Daphnia magna*.

The acute toxicity tests followed the OECD standard guideline No. 202. Five concentrations, with four replicates, of paracetamol (PAR), ibuprofen (IBU) and its binary mixture, a control with M4 media and DMSO 0,1%, were tested. Five juveniles, less than 24h of age, were randomly assigned to each 100mL glass bottle with the different test solutions. For PAR 0.75, 1.5, 3, 6, 12 mg/L were used. IBU concentrations were 2.5, 5, 10, 20, 40 mg/L. Mixture tests were conducted using proportions of the respective LC50 of PAR and IBU: 25%PAR:75%IBU, 50%PAR:50%IBU, 75%PAR:25%IBU, 100%PAR, 100%IBU. Survival was determined at 24h and 48h of exposure. LC50 was determined by probit analysis. The chronic assay was adapted according to the OECD 211 guideline. After the 48h acute exposure, the surviving daphnids were transferred to fresh M4 medium, fed daily with *Chlorella vulgaris* culture 3×10^5 cell.mL⁻¹, at 20°C and 14h:10h photoperiod. Media was renewed very other day and daphnids survival and reproduction output was followed until day 22.

Both pharmaceuticals individually tested had a significant effect on *Daphnia* juveniles at 48h of exposure, LC50 values were 20 mg/L for ibuprofen and 6 mg/L for paracetamol which are in accordance with values found on previous research works. In the chronic test with ibuprofen, there was mortality at 5, 10 and 20 mg/L and the percentage of mortality was higher at the highest concentration, as expected. The total number of juveniles per female was higher at control and at the highest concentration of ibuprofen (20 mg/L). At concentrations 2.5, 5 and 10 mg/L, the total number of juveniles decreased and were of similar value. Age at first reproduction was similar at all the concentrations tested and was 12.3 days.

In the chronic test with paracetamol, there was mortality at all the treatments and varied between 13% at 1.5mgL⁻¹ and 19% at the other treatments. The total number of juveniles, was higher than the control at the lowest paracetamol concentrations and decreased at the highest concentration. In the mixture test, mortality was higher at IBU 100% and PAR75%:IBU25%. The total number of juveniles increased with increasing amount of paracetamol and was higher at the IBU100% treatment. Age at first reproduction increased one day in all the mixture treatments.

This study showed toxic effects of both pharmaceuticals paracetamol and ibuprofen alone and increased toxicity with their mixture on *Daphnia magna* survival and reproduction.

Determination of glyphosate bioconcentration in lettuce (*Lactuca sativa*) simultaneously exposed to cylindrospermopsin in a soil system

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Glyphosate has become the most widely used herbicide worldwide. The mode of action of this herbicide is linked to the inhibition of 5-enolpyruvylshikimate-3-phosphatase synthase enzyme, which blocks the plant's biosynthesis of aromatic amino acids.

In humans, recent studies suggest that glyphosate can be a potential endocrine disruptor and the *International Agency for Research on Cancer* (IARC) has classified it as probably carcinogenic (group 2 A). Besides the single effects, the interaction of glyphosate with other emergent contaminants that may occur simultaneously in environment can be highly expectable. Cylindrospermopsin is a secondary metabolite of *cyanoHABS* (*cyanobacterial Harmful Algal Blooms*) increasingly recurrent in freshwater. The presence of this cyanotoxin may have negative impacts in the water quality and ultimately in human health, mainly due to the consumption of contaminated water and food. Furthermore, recent studies have suggested that some cyanotoxins (e.g., microcystins) can change the membrane permeability of roots, resulting in changes in the accumulation rates of contaminants in plants. Since edible plants are exposed to a wide variety of substances through irrigation water, there is increasing concern in the potential adverse effects of the interactions between those substances when present simultaneously in a mixture, especially when this can have potential public health consequences. The aim of this study was to determine the bioconcentration of glyphosate in *Lactuca sativa* simultaneously exposed to cylindrospermopsin. In an experimental assay, lettuce plants were irrigated for 15 days in a soil system culture with 50 µg/kg of cylindrospermopsin-containing crude extract and 0.75 mg/kg of glyphosate. The concentration of glyphosate in lettuce plants (roots and leaves) and soil was determined by LC/MS-MS.

The results show that in soil system culture, at the described conditions, there is no bioconcentration of glyphosate in the edible parts of lettuce (BCF of 0.6, i.e., <1). However, interestingly, when plants were exposed to both toxicants in mixture the concentration of glyphosate assimilated by lettuce plants (roots and leaves) was much higher than in the exposure to isolated glyphosate (from 0.04 to 0.21 µg/g in roots and from below the LOQ to 0.84µg/g in leaves). This finding highlights the potential for the enhancement of glyphosate accumulation in plants due to their co-occurrence with cylindrospermopsin, and it underlines the importance of further research regarding the mechanism involved.

According to the results obtained regarding the concentration of glyphosate in soil, it can be hypothesized that it can be in part associated to the higher persistence of glyphosate in soil in the presence of cylindrospermopsin (0.45 µg/g in single exposure and 1.33 µg/g in the exposure to the mixture). Notwithstanding, it would also be important to develop these studies in other culture systems (e.g., hydroponic system), which can maximize the availability of the toxicants to the roots, once the adsorptive effects of soil particles and other plant substrates are not present to retain the toxicants.

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Heavy metals in seaweed for human consumption available in the Portuguese market

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Seaweeds consumption has been increasing in European countries, including Portugal. Several studies have shown that some seaweeds species have the ability to accumulate contaminants, namely heavy metals. In particular, the presence of heavy metals in these food products can have a negative impact on the human health, and thus a systematic control of this type of food should be mandatory. In this study, five heavy metals (As, Cd, Tl, Hg, Pb) were analyzed in 16 samples of 9 species of seaweeds available in the Portuguese market for human consumption, namely Hijiki (*Hizikia fusiforme*), Arame (*Eisenia bicyclis*), Kombu (*Laminaria japonica*), Wakame (*Undaria pinnatifida*), Dulse (*Palmaria palmata*), seaweed spaghetti (*Himanthalia elongata*), seaweed lettuce (*Ulva rigida*) and Nori (*Porphyra umbilicalis*).

Heavy metals content was determined by ICP-MS (inductively coupled plasma–mass spectrometry) after microwave-assisted acid digestion.

The results showed As as the most abundant heavy metal (30.1[Symbol]1.2 µg/g). By contrast, Tl was the lowest abundant, with contents below the method detection limit (0.003 µg/g) for almost all analyzed samples (10 out of 16). A high variability in the heavy metals levels was observed for the same species of different brands. For example, the As content in the seaweeds of the Wakame species ranged from 3.1 to 38.1 µg/g. The same was observed for Pb (contents ranging from 0.12 to 0.37 µg/g) and Cd (contents ranging from 0.24 to 0.43 µg/g) in the same species.

The present study stresses the need for a careful control of these products to ensure food safety.

Exposure of *Mytilus galloprovincialis* to diarrhetic shellfish poisoning toxin: food safety implications

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Throughout the world, toxins produced by algae are responsible for approximately 60000 human food poisonings yearly. Shellfish toxins cause damage to wildlife and have a negative economic impact on recreation, tourism and shellfish industry, being almost a worldwide phenomenon. Dinoflagellates such as *Dynophysis* and *Prorocentrum lima* are considered a primary producer of diarrhetic shellfish toxins, such as Okadaic Acid (OA) and Dinophysistoxins (DTXs), which can be accumulated in the tissues of the bivalves. Bioaccumulation process could increase the concentration of OA and DTXs at risky level, making bivalves unsafe for human consumption. On the other hand, bivalves represent a rich source of allergen which can be altered or potentiated by the exposure of the aforementioned toxins. Seafood allergy is a hypersensitive disorder increasingly recurrent in recent years worldwide, where fish and shellfish are among the most common culprits due to, proteins like tropomyosin (TM). Herein, we evaluated the changes produced in the content of allergens in mussels followed by accumulation process of DSPs. In this sense, the main objective of this study was the quantification of the shellfish toxins and TM present in *Mytilus galloprovincialis* after feeding with OA and DTXs producer strain of *P. lima*. The quantification of OA and DTX-1 was performed on (equipment, protocol) using a homogenized from two grams of gills and digestive glands. ELISA Kit (some specification) was applied to measure invertebrate TM. Analytical results based on LC-MS allowed to verify that accumulation only occurred in the digestive gland with values of 2144.9 to 12433.5 µg/kg of OA and from 699.5 to 4546.6 µg/kg of DTX-1, not registering any value for the gills.

The quantification of TM showed a decreasing trend after 5 days of *P. lima* exposure content of TM, ranging the amount values between 280.3 ppb to 428.5 ppb. The results could mostly be explained by the decreasing level of nourishment in diet but also may be affected by toxin accumulation. Shellfish toxins, specifically, OA and DTX-1, could be acting as a strong inhibitor of serine/threonine protein phosphatase which interact with actin-binding proteins in the regulation of actin polymerization, may cause effects on cytoskeletal structure and inhibit the actin-activated ATPase activity, leading to the decrease in TM content. Research in this area should be carried out since it is a matter of public health concern and there is a lack of information regarding this issue.

Sustainable and Active Ageing – Development and Application of SAVING Methodology

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SAVING project intends to develop research activities applying the best strategies and good practices regarding to the promotion of an active, healthy and sustainable ageing in relation to social, economic, environmental and pedagogic aspects. This project aims to create a Sustainable and Active Ageing Program named SAVING Program to promote the transition to a sustainable ageing in Elderly Care Centres (ECCs). SAVING Program is an ideal way for ECCs to embark on a meaningful path towards an effective and positive impact on the lives of old people, their families, ECCs staff and local authorities. Moreover, it is a massive opportunity not only to improve the ECCs environmental and physical conditions, but also to potentiate synergies with health, social and academic professionals/institutions that might open an easy and free channel between old people and societal opportunities. The project' methodology is based on three pillars: 1) the creation of SAVING Brigade; 2) the development of a database with the definition of several indicators regarding three strands (environmental, organization and physical activity); 3) the action plan. All this innovative methodology was built on a living-lab approach applied in one ECC, that was used as case-study.

The results showed that the creation of the SAVING Brigade allowed not only the increase of reflection and mutual learning, but also the creation of better conditions to face uncertainties and obstacles. Plus, the use of indicators supported the basic themes and enables comparison with other studies, between institutions or programs. Finally, the Action Plan acted as a tool for the development of previously defined strategies.

It is possible to conclude that the breadth of the concept of quality of life encompasses the physical health of the individual, their psychological state, their social relationships, their beliefs and the relationship with the characteristics of the context in which they are inserted. Therefore, Active, Sustainable and Healthy Ageing should be the goal.

Occupational exposure in Health care facilities

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Introduction: In several work settings, a high microbial exposure is associated to serious health effects. The aim of this review article is to assess and correlate the high microbial exposure in Health Care Facilities (HCF) to the serious health effects caused by this microbiota, in patients and in workers. For these reasons it's important to assess all the factors that influence the type and causes of contamination.

Materials and Methods: The search was made in PubMed, Web of Science and Scopus using descriptors such as Bacteria, Occupational Exposure and Health Care Facilities, limited by filters such as original article publish in English from January 2000 to April of 2019. This research lead to a total of 299 articles. After applied the exclusion criteria, 87 articles have been analysed and introduced in a table "State of the Art table" with the most reported health effects and contaminants.

Results and Discussion: According the results, the more common contaminants are *Pseudomonas* spp, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Mycobacterium tuberculosis* and *Escherichia coli*.

Once in the presence of this contaminants, some effects such as respiratory diseases (pneumonia), infectious diseases, intestinal infections and urinary tract infections can be observed.

Conclusion: With this analytical review method can be concluded the importance of the identification of the health effects for workers and patients concerning the exposure to microbiota in HCF and the priorities of intervention to reduce the exposure to microbiota and the subsequent health effects.

ORGANIZATION



Co-ORGANIZERS



SUPPORTERS

