CHILDREN'S HEALTH and the ENVIRONMENT

A European meeting

SANSEPOLCRO (AR) ITALY – 15TH–17TH NOVEMBER 2024

INTERNATIONAL SOCIETY OF DOCTORS FOR ENVIRONMENT ISDE

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PROGRAM

Time	Sessions	Speakers
First Day – November 16th, 2024		
09.00 AM	Opening of the conference	R. Romizi
09.15 AM	Institutional greetings and opening remarks	M. Neira
Session 1. Environmental risk factors for children's health		
09.50 AM	Climate crisis impact on children's health	L. Reali
10.20 AM	Electromagnetic waves: possible negative influences on health	F. Belpoggi
10.50 AM	**Discussion**	
11.40 AM	Environmental contamination by drugs and personal care products: the exposome project	V. Murgia
12.10 AM	Environmental hazard characteristics of chemical substances: persistence, bioaccumulation, mobility, biodegradability	S. Valsecchi
12.40 AM	**Discussion**	
Session 2. Risks for children from chemical contamination		
02.30 PM	Environmental contamination from pesticides	R. Alleva
03.00 PM	Environmental contamination from PFAS	V. Cordiano
03.30 PM	**Discussion**	
04.10 PM	Planetary pollution from plastics and good practice strategies	M. G. Petronio
04.40 PM	Health risks from substances with endocrine-disrupting activity	S. Bernasconi
05.10 PM	**Discussion**	
05.30 PM	Environmental risk assessment: striking a balance between human and environmental needs	E. Giovagnoni
06.00 PM	Discussion and closing of the session	
Second Day – November 17th, 2024		
Session 3. Foods as a factor of environmental exposure to harmful substances		
09.00 AM	Materials and objects in contact with food: potential risks	M. R. Milana
09.30 AM	Agroecology and the health of the population and the environment	G. Tamino
10.00 AM	Contamination of drinking water by emerging pollutants: Best practices for mindful usage	L. Lucentini
10.30 AM	**Discussion**	
11.20 AM	Final considerations and closing remarks	

FIRST DAY

INTRODUCTION

Dr. Roberto Romizi opened the event by thanking all participants, and the physicians, who supported this initiative for dialogue and exchange on the environmental impact on children's health.

Children's health is the primary indicator of population health, and children, in particular, can be seen as **"health ambassadors"**, serving as a starting point for changing behaviours and regulations.

The objective of the meeting is facilitating interactions between foreign and Italian paediatricians within the framework of European Policies on topics such as **Climate and Energy, Air and Water Quality, Circular Economy and Waste Reduction, and Health and Food Safety**. As is now well known, **23% of deaths worldwide and 26% of deaths among children under 5 are attributable to modifiable environmental factors**.

The issue of the environmental impact on children's health is a central theme in history of ISDE. Over the years, hundreds of initiatives have been carried out at local, national, and international level. **The aim has been the promotion of laws that aim to lower the threshold values of tolerability for specific pollutants, taking into account more vulnerable populations such as children**.

Legal limits are typically calculated for adults, but children, as growing organisms, may have entirely different susceptibilities!

The main objectives of the meeting are:

1. **Raise awareness** about the impact of the environment on children's health;
2. **Promote research** and develop new strategies to protect children's health;
3. **Facilitate the exchange** of knowledge and best practices;
4. **Provide tools and resources** for action;
5. **Translate initiatives into concrete actions** to improve children's health.

Dr. Romizi emphasized the importance of continuing, as paediatricians, to carry out **scientific and advocacy activities** at the European level.

Dr. Neira then delivered a message directly from the **29th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP29)** in Baku, Azerbaijan (November 11–22). She reaffirmed that human health occupies a significant space within discussions on climate change, which has a profoundly negative impact on children's health.

SESSION 1.
ENVIRONMENTAL RISK FACTORS FOR CHILDREN'S HEALTH

Moderators: L. Reali and F. Romizi

1) Speaker Dr. Reali

Dr. Reali introduces her topic titled: *Climate Crisis Impact on Children's Health*, emphasizing that plastic pollution represents the greatest threat to human health, particularly for children. Environmental pollution caused by excessive human activities is responsible for spreading toxic substances into water, air, and soil.

In 2023, the World Health Organization (WHO) estimated that by 2050, 250,000 additional deaths per year would occur due to malnutrition, diarrhoea, malaria, and heat stress. At the time, the term "climate crisis" began replacing "climate change" to reflect the growing urgency. A recent 2024 systematic review by Weeda, underscores that *children are more vulnerable than adults to climate change-related health threats,* with air pollutants having significantly weaker adverse health effects compared to temperature[1]. The interplay of climate change and air pollution is progressing much faster than projected for 2050, suggesting a worse scenario than previously anticipated.

The 2024 *Lancet Countdown* highlights the lack of data on children's health, limiting the capacity to address the disproportionate impact of climate change on marginalized groups such as indigenous peoples, women, children, people from minority ethnic backgrounds, and underserved communities. Paediatricians should prioritize education in this area and advocate for governmental action.

Artificial intelligence is also cited as a significant contributor to water and air pollution. The *Lancet Countdown* further elaborates on the complexity of climate change effects, referencing heatwaves, malnutrition, and the impact of fossil fuels on children's health. Estimating the health consequences of wildfires remains challenging. Notably, 2024 is confirmed to be the hottest year on records (Copernicus, 07/11/2024). Rising temperatures increase forest fires, which elevate particulates in the atmosphere.

UNICEF, in a 2021 report, stressed the importance of understanding children's vulnerabilities to effectively combat climate risks. The *Children's Climate Risk Index* offers a global overview of children's susceptibility to climate change impacts, enabling targeted actions for high-risk groups.

Dr. Landrigan, in 2011, already noted that *children are at greater risk than adults due to physiological, metabolic, and behavioural differences*. Key factors include poor thermoregulation, developmental vulnerability, higher exposure per body weight, longer life expectancy (increasing cumulative exposure), dependence on adult decisions, and limited adaptability to temperature extremes.

Concerning heat-related illnesses, *children are particularly vulnerable*:

- When playing outdoors during peak heat hours or engaging in sports are at greater risk;
- Infants and toddlers, lacking robust thermoregulation, face heightened danger;
- Homes without air conditioning exacerbate these risks.

Climate change exacerbates respiratory illnesses and allergies by increasing airborne allergens like pollen, often carried more efficiently by particulate matter (PM 2.5). Indoor pollutants like smoke and mold further compound risks, starting as early as the prenatal stage[2].

Climate change also impacts water quality, promoting gastrointestinal diseases and infections. Toxic algae, often stinging or poisonous, pose a particular threat to children playing near contaminated waters.

Regarding vector-borne diseases, warmer climates foster mosquito proliferation, and increased rainfall creates breeding grounds for vectors. Children, spending more time outdoors, are more prone to bites from mosquitoes, ticks, and other vectors.

Food security is another critical area affected by climate change. Issues of food quality and quantity vary globally, with 20% of Italian children impacted (Reali et al.). Social and economic disparities increase vulnerability to diet-related diseases like Haemolytic Uremic Syndrome (HUS) or complications from *E. coli* infections. Unsafe food supply chains in Italy exacerbate the problem. The three global priorities are undernutrition, obesity, and micronutrient deficiencies[3].

Mental health climate-related anxiety, depression, sleep disorders, phobias, and post-traumatic stress disorder are also affected. They become prevalent among children exposed to natural disasters or extreme weather. Resilience factors such as living conditions, family and social networks, and school support systems influence their ability to cope.

Paediatricians can play a key role by focusing on:

- Training and Research;
- Information dissemination;
- Advocacy;
- Collaboration with health and environmental agencies[4].

Health systems, paradoxically, contribute significantly to greenhouse gas emissions. Strategies such as reducing healthcare's carbon footprint, digitizing clinical records, optimizing energy use, and adopting sustainable alternatives to conventional medical supplies are vital[5,6].

Philipsborn's *A Paediatrician's Guide* (2021) advises primary care paediatricians to screen for climate risks and social determinants of health. Recom-

mended reading includes the American Academy of Paediatrics paper, *Climate Change and Children's Health: Building a Healthy Future for Every Child*.

In conclusion, Paediatricians have long identified climate change, environmental pollution, and plastic waste as significant health risks for children. Urgent, integrated action involving governments, families, and communities is necessary to address this crisis.

2) Speaker Dr. Belpoggi

Dr. Belpoggi then took the floor to discuss her topic: *Children's Health and Electromagnetic Fields (EMFs)*.

From an epidemiological perspective, there is limited data on the effects of electromagnetic waves on children. However, behavioural changes have been observed, such as the shift in children's play habits since electronic devices became integral to daily life, raising concerns about the uncontrollable nature of these technologies. One particularly worrisome finding is that **exposure assessments demonstrate the average radiofrequency (RF) energy deposition is twice as high in the brain and up to ten times higher in the bone marrow of the skull in children compared to adults**. This raises the hypothesis of a potential association between EMFs, including low-frequency (electricity) and RF emissions (e.g., from mobile phone antennas), and childhood lymphomas and leukaemia.

Additionally, **repeated studies have shown that mobile phone exposure negatively impacts sperm quality in males, both in animals and humans**.

Regarding RF exposure, in 2011, the **International Agency for Research on Cancer (IARC)** classified RF-EMFs as *"possible carcinogens for humans"*. Brain tumours and vestibular schwannomas (also known as neurinomas) have been linked to extensive mobile phone use[7,8].

Dr. Belpoggi continued by presenting results from two *in vivo* rat studies conducted simultaneously by the **National Toxicology Program (NTP)** and the **Ramazzini Institute (RI)**. These studies aimed to investigate the effects of near-field (1.9 GHz and 0.9 GHz) and far-field (1.8 GHz) RF exposures, respectively. The RI study placed rats in four completely shielded rooms to minimize non-uniform field effects caused by reflections and interference. Rats were housed in wooden circular structures with a central exposure device, each accommodating at least 400 rats. Identical devices provided varying RF intensities. The experiments began on the 12th day of pregnancy and continued throughout the lifespan of the rats.

For the RF study, the **Specific Absorption Rate (SAR)** was limited to 0.1 W kg, equivalent to human exposure. Dr. Belpoggi emphasized that the SAR of mobile phones should not exceed 2 W/kg for head and trunk use and 4 W/kg

for limbs. In the EMF study, RF exposure (1.8 GHz) lasted 19 hours per day, starting from the 12th day of pregnancy until natural death.

The results of both studies revealed similar findings:

- **Brain:**
  - A significant increase in malignant gliomas and glial cell hyperplasia in male rats (NTP study);
  - A slight, non-significant dose-related increase in malignant gliomas in female rats (RI study).
- **Heart:**
  - A significant dose-related increase in malignant schwannomas and Schwann cell hyperplasia in male rats (NTP study);
  - A significant dose-related increase in malignant schwannomas in males and a slight, non-significant increase in Schwann cell hyperplasia in both male and female rats (RI study).

Together, these findings strongly suggest an association between EMF exposure and rare tumours, such as schwannomas. While EMFs are not powerful carcinogens, the observed increase in rare tumours is statistically significant.

The **protection factor (F)** calculated on the basis of the RI results averaged 5–7 V/m for the electric field.

In her **2021 STOA (EU EPRS) final assessment**, Dr. Belpoggi confirmed that **FR1 frequencies (450–6000 MHz) are likely carcinogenic to humans**, while **FR2 frequencies (24–100 GHz)** currently lack adequate studies on non-thermal effects. FR1 frequencies are also likely to impair male fertility and may have similar effects in females. They could potentially affect the development of embryos, fetuses, and newborns.

A recent **2024 WHO report** states that exposure to RF-EMFs from mobile phones *likely does not increase the risk of brain cancer in adults*. However, Dr. Belpoggi highlighted that a more cautious interpretation would recognize the limitations of epidemiological studies, which cannot definitively establish a causal relationship between RF-EMF exposure and cancer risk. Therefore, the **precautionary principle** should be applied.

The **Ramazzini Institute** has conducted campaigns on the effects of mobile phone use in schools across Bologna. Additionally, a study in Tuscany (2016–2019) involving 168 secondary school students revealed that children are more concerned about the health effects of mobile technology than their parents. Only a small percentage of parents advised their children against using mobile phones, often perceiving them as addictive but failing to acknowledge their potential biological effects, such as cancer risk.

DISCUSSION

The discussion was initiated by Dr. Belpoggi, who highlighted that **5G technology has been promoted as a solution to reduce radiofrequency exposure**, primarily due to its shift from an "umbrella" structure to a more targeted design. However, this technological advancement has also significantly increased the frequency of emissions, warranting greater caution regarding the use of 5G devices.

Dr. Belpoggi also emphasized the need to explore the link between **electro-sensitivity**—a condition widely reported in Italy but currently officially recognized only in France—and the development of tumours, which she described as the ultimate manifestation of genetic modifications. Further research, particularly focusing on **biomarkers**, is essential to deepen our understanding of this association.

She underscored the importance of minimizing children's exposure to electromagnetic radiation by adopting simple, practical measures. For example:

- Downloading cartoons onto a phone and disconnecting it from the internet before allowing children to watch;
- If that is not possible, replacing screen time with activities such as drawing or reading books.

Dr. Belpoggi pointed out that **the highest levels of electromagnetic radiation exposure occur on trains**, where readings can reach up to 40–50 V/m. For long train journeys, she recommended choosing **"silent zones"** to reduce exposure.

3) Speaker Dr. Murgia

Dr. Murgia, Member of the Executive Committee (ISDE Italy), presented a detailed report on **water and soil contamination by pharmaceuticals and personal care products (PPCPs)**. She began by referencing a 2019 statement from the European Commission that highlighted the growing environmental risks posed by pharmaceuticals, particularly their role in antimicrobial resistance, which also threatens human health.

PPCPs, classified as **emerging contaminants**, including chemicals traditionally unmonitored in the environment, found in water, soil, and air. These encompass personal care products (e.g., fragrances, perfumes, sunscreens), pharmaceuticals for human and veterinary use, livestock chemicals, preservatives, sweeteners, additives, and diagnostic agents. Their capacity to **induce physiological effects at low doses** and their persistence in the environment make them particularly concerning. Even with degradation processes, their high consumption and continuous release render them "pseudo-persistent".

A 2022 global study by Wilkinson et al. painted a stark picture, revealing that **pharmaceutical pollution affects 258 rivers across 104 countries**. At 25.7% of sampling sites, at least one Active Pharmaceutical Ingredient (API) exceeded safe levels for aquatic organisms or raised concerns about antimicrobial resistance. Adding to the problem, the pharmaceutical market is projected to double by 2030.

Studies by Distefano et al. (2022) and Cappelli et al. (2022) have drawn connections between commonly consumed medications (e.g., antidepressants, NSAIDs, and antibiotics used during the COVID-19 pandemic) and their presence in wastewater. Many substances, including **sulfamethoxazole** and **fluconazole**, regularly prescribed even for children, exceeded the **Predicted No Effect Concentration (PNEC)**—the threshold below which no harmful effects are anticipated.

Dr. Murgia also emphasized **endocrine disruptors**, chemicals that interfere with hormonal systems, including fragrances, disinfectants, steroids, and non-steroidal pharmaceuticals. She reported behavioural disturbances in wildlife (e.g., birds, insects, fish, frogs, and mussels) exposed to contaminated environments. This contamination begins in the soil and accumulates up the food chain, with humans and other large animals at the top. The use of diclofenac in veterinary medicine has led to a severe decline (34-95%) in Asian vulture populations, as vultures feeding on carcasses with diclofenac residues suffer fatal acute kidney failure. A notable indicator of pharmaceutical contamination is the **platypus**: one individual at Brushy Creek in the U.S. ingested the equivalent of half a human dose of antidepressants daily.

Personal care products, containing preservatives, colorants, sweeteners, and surfactants (surfactants) that are persistent, bio accumulative, and can act as endocrine disruptors, altering the hormonal systems of aquatic organisms, further compound the issue.

They can disrupt wildlife reproduction, development, and behaviour, and may indirectly harm human health through the food chain. **Chemical mixtures**, such as those involving EE2 and SLS, have amplified adverse effects even at environmental concentrations, as demonstrated in studies on mussels[9].

The release of active pharmaceutical ingredients into the environment not only damages ecosystems but also poses cascading risks to human health by threatening vital **ecosystem services**, such as the roles that soil microbial communities play in regulating diseases, climate, water, nutrient cycling, and food production[10].

Dr. Murgia stressed the importance of addressing the rise of **antibiotic-resistant infections**, which were responsible for an estimated 10,762 deaths in Italy in a single year[11]. A study by Symochko et al.[12] isolated 389 dominant bacterial strains from various ecosystems; 57 of which were resistant to antibiotics, with levels of antibiotic resistance exceeding 70%.

To mitigate the environmental impact of PPCPs, Dr. Murgia called for action across the **pharmaceutical life cycle**:

- **Preventive measures:** Develop sustainable drugs (green chemistry), prioritize prevention over treatment, reduce unnecessary prescriptions and packaging, and prescribe eco-friendly medications with the same therapeutic efficacy;
- **Palliative measures:** Improve wastewater treatment capacity, design facilities that effectively remove pharmaceuticals, and enforce the collection and recycling of expired or excess medications.

She recommended to doctors to prescribe only necessary medications, exploring non-pharmaceutical options when possible. Provide clear instructions for correct medication use and regularly reassess the need for ongoing treatments. Avoid prescribing medications unlikely to be used and consider starter packs with limited doses. Prioritize environmentally friendly drug formulations with equivalent therapeutic effects, consulting reliable databases for guidance. Promote health education on proper medication disposal and engage in advocacy for environmental health initiative.

She urged also pharmacists and veterinarians to avoid unnecessary prescriptions, choose environmentally conscious treatments, and advocate for **environmental health interventions**.

In conclusion, Dr. Murgia cited an Italian pilot study by ISDE and CNR-IRSA on the biodegradability, toxicity, and bioaccumulation of pharmaceuticals and healthcare-related chemicals.

A study that served as the basis for a broader one, led by ISDE Italy in collaboration with the Water Research Institute (IRSA) as part of the National Biodiversity Future Centre (NBFC) project, funded under the PNRR Next Generation EU program, is underway. The study will analyse 300 pharmaceutical-related compounds (e.g., active ingredients, preservatives, sweeteners, colorants) in 100 Italian water samples. Data on persistence, toxicity, and bioaccumulation will be collected from the literature, and experimental ecotoxicity studies will be conducted for substances lacking data. Results will be organized into technical sheets, ranking potential environmental risk using a scoring system. These sheets will be accessible to healthcare professionals via a dedicated website.

She closed her presentation with a reminder that **humans are guests on this planet** and should strive to live in harmony rather than dominance over the natural world.

4) Speaker Dr. Valsecchi

The increasing prevalence of chemical substances in modern industries and daily life has prompted growing concern over their environmental and health impacts. Dr. Sara Valsecchi, a researcher at the Water Research Institute (CNR,

Italy), has presented an in-depth exploration of these risks at the ISDE conference. Her focus spans the critical aspects of persistence, bioaccumulation, mobility, and biodegradability, as well as the broader regulatory frameworks guiding chemical safety.

Chemical hazards are complex and multifaceted. The Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) regulation established in 2006, a pivotal European initiative, exemplifies efforts to manage the risks associated with chemical production and use.

REACH governs the production and use of chemical substances and evaluates their potential impact on human health and the environment. Under REACH, a substance is classified as hazardous based on criteria including **toxicity, persistence, bioaccumulation, mobility, long-range transport (LRT), ozone-depleting potential, and carcinogenic or mutagenic properties**. However, as Dr. Valsecchi's work highlights, addressing these risks requires not just regulation but also a nuanced understanding of how hazardous chemicals interact with ecosystems and human health.

Key Hazard Characteristics

- **Toxicity** encompasses both acute (short-term) and chronic (long-term) effects, ranging from physiological disruptions to severe outcomes like carcinogenicity and mutagenicity. REACH considers both human toxicity and ecotoxicity (impact on ecosystems). Toxicological assessments often involve model organisms, but human studies, particularly occupational epidemiology, provide crucial insights.
- **Bioaccumulation and Biomagnification** occur when individuals exposed to trace amounts of contaminants in water, air, or food accumulate high concentrations of substances in their bodies over time. Bioaccumulation refers to the buildup of substances within an organism, while biomagnification describes how these concentrations increase as they move up the food chain. These processes are particularly concerning for chemicals that resist metabolic breakdown, such as long-chain PFAS compounds.
- **Persistence** describes the inability of a substance to degrade through microbiological or abiotic processes. It is a measure of how long a chemical remains in the environment before degrading. Substances with high persistence, such as Persistent Organic Pollutants (POPs), resist natural breakdown processes, leading to their accumulation in soil, water, and air even at long range distance. Over time, persistent chemicals can surpass environmentally safe concentration levels, posing risks to both ecosystems and human health.
- **Mobility** determines how easily a chemical moves through soil and water systems. Chemicals with low retention, often due to low log Koc values, can infiltrate aquifers and spread across vast distances. Dr. Valsecchi cited ex-

amples of short-chain PFAS compounds, which are both persistent and mobile, making them particularly challenging to contain. These chemicals often evade traditional remediation efforts, infiltrating drinking water supplies and ecosystems alike. The coexistence of multiple hazardous characteristics within a single chemical molecule or across a class of chemical molecules can amplify their detrimental effects, leading to significantly heightened risks and highly hazardous outcomes. For example, some PFAS that are persistent, mobile or persistent and subject Long-Range Transport (LRT) in addition to bio accumulative and biomagnificable, can be environmental pervasive.

- **Pervasivity** of Chemicals refers to the widespread presence and penetration of chemical substances into various environmental compartments such as air, water, soil, and living organisms, often beyond their point of origin. It underscores the capacity of certain chemicals to infiltrate and persist across ecosystems due to their physical and chemical properties. Examples of highly pervasive chemicals include Persistent Organic Pollutants (POPs) like DDT and PCBs, and PFAS (Per- and Polyfluoroalkyl Substances), which are resistant to breakdown and found globally, even in remote regions like the Arctic. Immediate action is required to mitigate the impact of persistent pollutants and to address their complex and far-reaching effects on ecosystems and human health.

Dr. Valsecchi emphasized the importance of a **precautionary principle** in addressing chemical pollution, given its widespread and long-lasting effects. The principle's application is particularly relevant for emerging pollutants, where the full extent of risks may not yet be known. Efforts to mitigate the risks posed by hazardous chemicals are shaped by a combination of **international agreements and EU-specific regulations**. Key initiatives include:

- **Geneva Convention (1979);**
- **Montreal Protocol (1987);**
- **Aarhus Convention (1998);**
- **Stockholm Convention (2001);**
- **Paris Agreement (2015);**
- **EU Regulation 2023/707 and EU Regulation 2024/573 on fluorinated gases.**

Concluding Thoughts

The environmental hazards posed by chemical substances are profound, multifaceted, and often intertwined with global systems. Addressing these challenges requires a holistic approach that incorporates rigorous scientific analysis, robust regulatory frameworks, and proactive precautionary measures. Dr. Valsecchi's presentation serves as a vital reminder of the importance of understanding and mitigating these risks to safeguard ecosystems and human health.

SESSION 2.
RISKS FOR CHILDREN FROM CHEMICAL CONTAMINATION

Moderators: E. Uga and M. T. Maurello

5) Speaker Dr. Alleva

Dr. Alleva, a biologist and Vice-President of the Emilia-Romagna and Marche Biologist Order, began her presentation titled **"Environmental Contamination from Pesticides"**, addressing the widespread impact of pesticide residues on ecosystems and human health. In 2020, one or more pesticides exceeded thresholds of concern at **22% of monitoring sites** in rivers and lakes across Europe. A 2019 study revealed that **83% of agricultural soils** contained pesticide residues, with **58% of the samples** showing multiple residue mixtures. However, the **combined effects of pesticide mixtures** remain insufficiently studied.

A large-scale biomonitoring study (2014–2021) across five European countries found that **84% of participants** had at least two pesticides present in their bodies. Children consistently showed **higher pesticide levels** than adults, underscoring their vulnerability.

Human exposure to pesticides occurs through **air, food, and water**. For children, exposure begins in utero, as the maternal womb is their first environment. This highlights the significance of **transgenerational transmission**: studies have correlated **obesity and breast cancer risks** between grandmothers and grandchildren.

Pesticides affect the gut microbiota and increase the risk of **neurodevelopmental disorders in children**.

- **Parron-Carrillo et al. (2024)** investigated 4,830 children exposed to pesticides over 11 years in Almeria, Spain. Living in regions with high pesticide use was associated with increased prevalence of neurodevelopmental disorders. Prenatal diagnoses showed chromosomal abnormalities, while perinatal diagnoses revealed preterm births, and postnatal assessments identified brain damage[13].
- In Valencia, another study linked dietary intake of legumes and cereals to exposure to pesticide metabolites, such as **organophosphates (OPs)** and **pyrethroids (Pyr)**, detected in 85% of urine samples.

In the French ELFE cohort, hair analysis of 18,143 children identified **159 pesticide biomarkers**. Significant variations were observed based on sex and region, with girls showing higher levels of pyrethroid parent compounds and boys showing higher metabolite levels.

Fruits are among the foods most treated with pesticides. During pregnancy, frequent fruit consumption (>18 times/week) was associated with higher urinary levels of **dialkyl phosphate metabolites** such as DMP, DMTP, and DETP.

The 2022 EFSA report on pesticide residues in food revealed that:

- **48.6% of samples** analyzed contained detectable residues;
- **32% of samples** contained more than one pesticide;
- Apples (18.6%), strawberries (17.5%), peaches (16.9%), tomatoes (14.2%), and lettuce (12.4%) were among the most frequently contaminated foods.

Organic foods had lower contamination rates but were not completely residue-free. For instance, **6.1% of organic samples** tested in 2022 contained pesticide residues, with copper compounds being the most common. A study by **Agboola et al**[14]. in Cyprus found that consuming organic food significantly reduced biomarkers of lead and cadmium exposure in children.

Dr. Alleva proposed several strategies to reduce pesticide contamination and mitigate its health effects:

Agricultural Practices

- Reduce reliance on **chemical pesticides** through sustainable agricultural practices.
- Choose **local or ancient crop varieties** that require minimal chemical treatments.

Food Handling and Preparation

- Wash and peel fruits and vegetables to remove only surface pesticides.
- Scrub firm produce (e.g., melons and root vegetables) and discard outer leaves of leafy greens.
- Avoid ultra-processed foods that may increase exposure to contaminants.
- Trim fat and skin from meat and fish to reduce pesticide residue accumulation.

Dietary Interventions

- A **fiber-rich diet** supports gut eubiosis and helps mitigate pesticide toxicity.
- **Polyphenol-rich foods**, and fermented food rich of lactobacilli, positively modulate gut microbiota.
- Correcting **iron deficiencies** can reduce pesticide toxicity.
- **Probiotic supplementation** may help counteract the harmful effects of pesticides[15].

In conclusion, Dr. Alleva emphasized the need for integrated measures combining sustainable agriculture, informed food choices, and dietary interventions to minimize pesticide exposure and its associated risks.

6) Speaker Dr. Cordiano

Following, Dr. Cordiano took the floor to enhance the topic of **Poly and Perfluoroalkyls substances (PFAS)** that, we know, are persistent, bio-accumulative and toxic (PBT) substances; have environmental half-life of degradation of centuries or millennia and t1/2 in humans from a week to >9 years; are resistant to any degradation (chemical, thermal, radiation, biologic and metabolic); can be released into the environment during the entire life cycles from raw materials extraction to production in chemical plants or manufacturing of their end-life in waste treatment plants and have been found in the most "pristine" area of the planet (Artic, Antarctica, Everest, Mexican desert). **PFASs** are defined as **fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it)**, i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–) is a PFAS, (OECD, 2021).

PFAS have affected every aspect of modern life, from the culinary art to the aerospace industry, e.g. non-stick cookware and firefighting foam. PFAS are present, also, in medical devices, such as tubes and catheters, wound bandages, non-adherent dress and medical tapes.

Of the pharmaceuticals approved and used globally between 1954 and 2021, **360 would be included under the broadest definitions of PFAS, including but not limited to antidepressants, cardiovascular health medications, and COVID-19 treatments, and over 500 more are in late-stage clinical trials**.

About PFAs toxic effects, mechanistically, these are primarily mediated by their binding to proteins, nuclear receptors and membranes, such as Peroxisome Proliferation Activated Receptors (PPAR)[16].

The main PFAs pathways of human exposure are:

1. **Oral** [drinking water, diet (lower levels in vegans and vegetarians, higher levels in anglers, fisher workers and farmers, at higher risk: eggs, freshwater fishes)],
2. **Inhalation** (workers, outdoor and indoor air, people residing near hotspots, children and pets) and
3. **Dermal** (cosmetics, workers) (EFSA, 2020).

Young children may experience higher PFAS exposure than adults, because children exposed to PFAs via various pathways, including breastfeeding, ingestion of contaminated food, water, dust, and soil, and hand-to-mouth contact with indoor surfaces[17].

Dr. Cordiano reported also the **levels of evidence on the association between exposure to PFAs and following diseases/health outcomes**, according to

National Academies of Sciences (Engineering, and Medicine 2022) that could be applied to people exposed to high PFAs level such as factory workers:

- **Sufficient evidence:** decreased antibody response (in adults and children), dyslipidaemia (in adults and children), decreased infant and fetal growth, and increased risk of kidney cancer (in adults);
- **Limited or suggestive evidence:** increased risk of breast cancer (in adults), liver enzyme alterations (in adults and children), increased risk of pregnancy-induced hypertension (gestational hypertension and preeclampsia), increased risk of testicular cancer (in adults), thyroid disease and dysfunction (in adults), and increased risk of ulcerative colitis (in adults).

What can the doctor do when in front of a patient with these clinical characteristics?

- If after blood exam, **PFAs level <2 ng/mL;** it is sufficient **usual standard of care**,
- If it is higher (**2-20 ng/mL PFAs level**), the doctor will assess on a case-by-case basis, encouraging **PFAs exposure reduction** if a source has been identified, especially for pregnant patients.

Recent studies in children and adolescents show association between PFAS and:

1. **Glycolipid metabolism:** There was a positive association between PFAS and TC and LDL, and a negative association between PFAS and HOMA-IR in children and adolescents[18].
2. **Increased susceptibility to liver injury in children with prenatal exposure:** Meta-analyses of human studies revealed that higher ALT levels were associated with exposure to PFOA, PFOS, and PFNA. PFOA exposure was also associated with higher aspartate aminotransferase and gamma-glutamyl transferase levels in humans[19],
3. **Severity of nonalcoholic fatty liver in children:** The odds of having nonalcoholic steatohepatitis (NASH), compared to children with steatosis alone, was significantly increased with each interquartile range (IQR) increase of PFOS and PFHxS[20].

Dr. Cordiano reported the study[21], that confirmed a correlation of high number of deaths associated with high PFOs exposure.

In conclusion, Dr. Cordiano reported **some tips to mitigate your PFAS risk:**

1. Check your drinking water for PFAS;
2. Avoid PFAS in food and kitchen supplies;
3. Reduce PFAs around the house and in clothing;
4. Avoid PFAS in cosmetics (nail polish, eye makeup), lotions, dental floss, products for personal and home hygiene;
5. Read labels with PFAs in mind;

6. Reduce plastics in hospital and office;
7. Reduce unnecessary non-sterile items (gloves, packaging, single-use items);
8. Join us in the fight for a PFAS-free world.

DISCUSSION

The discussion begins with the request for updates on the consumption of fermented foods, including kefir. Dr. Alleva provides a positive response, emphasizing that fermented products are generally more digestible. She also highlights the importance of paediatricians reminding parents to encourage frequent handwashing among children, who are increasingly exposed to pesticide residues. Additionally, she stresses the need to discourage the use of glyphosate and to enhance awareness, communication, and education in the field of pesticide management.

Regarding PFAS, most contamination from these substances originates from water, food, and cosmetics. Currently, no established safety limit exists, underscoring the hope for a shift in the approach to studying these chemicals.

7) Speaker Dr. Petronio

After the discussion concluded, the session resumed with Dr. Petronio's presentation on plastic pollution. She highlighted those plastics, if were comparable to a continent, would be the fifth-largest global source of CO_2 emissions (1.5 billion tons per year), after China, the United States, India, and Russia. Plastics are responsible for wide range of damage to human health, ecosystems, and economies, with impacts arising at every stage of their lifecycle—from the extraction of coal, oil, and gas to recycling and final disposal. Plastics are now pervasive across all environments, including aquatic systems, soil, and the atmosphere. The six most common polymers are high- and low-density polypropylene (HDPE, LDPE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), and polyethylene terephthalate (PET).

Microplastics (MP <5 µm) and Their Distribution

- **Environmental Behavior:** MPs (including nanoplastics <0,1 µm) have been found to evaporate from the ocean surface, enter clouds, and eventually return to Earth through precipitation, contaminating even remote mountainous regions.
- **Primary Exposure Pathways:**
  1. **Ingestion:** MPs have been detected in many foods, among vegetables, the smallest in carrots and the largest in lettuce. Particles are mainly ingested through water in plastic bottles, which contains over 3 million MPs per liter[22]. According to Schiano et al.[23], MPs also contaminate honey and bees, likely due to MPs released into the fair from synthetic fabrics. Canga et al[24]. reported alarmingly high MP counts in tea bags (14.7 billion MPs per bag) and coffee capsules;

2. **Inhalation:** A systematic review by Landrigan et al.[25] detailed exposure to airborne MPs higher indoors than outdoors. Neonates had the highest calculated dose, followed by age children, and pregnant women. Indoors, MPs can be generated by simple daily activities such as snipping, tearing with hands, cutting with knives, twisting manually, or simply opening plastic objects. Outdoors, a relevant source is represented by the tires of larger and heavier vehicles such as SUVs, but also fabrics, paints, compost and sludge spread in agriculture;
3. **Dermal Contact:** MPs are transferred to the skin through daily products such as cosmetics and creams. Both monomers and additives, plastics such as bisphenol A, phthalates, and perfluoroalkyl compounds can pass through the skin.

Plastic in the Human Body

MPs have been found in urine, semen, and faeces; they can be transported from the blood to all organs. They are phagocytized by cardiac tissue, intestine, testicles, ovaries, and the brain in greater concentrations than in other organs; Jenner LC et al. found them in all regions of the lung (especially polypropylene and polyethylene terephthalate). Their presence in the placenta and human milk is of concern, and therefore fetus and infant exposure.

Health Impacts of Plastics

- **Physical Effects:** As solid particles, MNP are phagocytized by macrophages, which are activated and the inflammatory reaction starts, which can cause: irritation, gastrointestinal disorders, asthma, bronchitis, impaired respiratory function, susceptibility to infections, impaired immune system, changes in fluid viscosity (mucus, saliva).
- **Endocrine Disruption:** The PERSUADED study on Italian children aged 4–11 found that 100% of participants excreted phthalates, and 76% excreted bisphenol A (BPA) in their urine. Children exposure included frequent use of single-use plastics, prolonged interaction with plastic toys, and heating food in plastic containers.
- **Carcinogenic Risks:** Research by the Institute of Bioimaging and Molecular Physiology (IBFM, 2024) found that acute and chronic exposure to polystyrene particles increases colon cancer risk. MNPs act as vectors for contaminants, including DDT, heavy metals, and dioxins, amplifying their toxic effects—a phenomenon described as the “Trojan Horse” effect.
- **Developmental Impacts:** Ghassabian et al.[26] identified an association between prenatal exposure to plasticizers, such as monoethyl phthalate (mEP), and lower volumes of total gray matter at 10 years of age, with a reduction in IQ that persists until adolescence in both sexes.

- **Epigenetic Effects:** Studies on microRNAs (miRNAs) suggest that plasticizer interactions can disrupt miRNA-mediated regulation, leading to genotoxic and oncogenic responses. These disruptions may alter signalling and metabolic pathways linked to hormonal and cellular processes.

Biological Effects

- Plastics facilitate the formation of biofilms, which are ideal habitats for antibiotic-resistant bacteria, with Vibrio spp. being the most abundant genus identified[26]. MPs can thus deliver microorganisms to tissues and protect them from the immune system by promoting infection, they can disperse pathogens at a distance and once ingested they can modify the composition of the intestinal microbiome because they can transport pathogens and also pesticides and fungicides.

Environmental and Societal Impacts

- **Recycled Materials:** Lowe et al.[27] noted that recycled materials, such as paper and construction products, often contain higher concentrations and a wider range of harmful chemicals than virgin materials.
- **Biodegradable Plastics:** Many biodegradable plastics fail to degrade significantly in marine environments, even after three years, and do not meet ISO biodegradability standards.

Regulatory and Advocacy Efforts

- **European Regulation:** EU Regulation 2023/2055 limits the use of intentionally added microplastics in products like cosmetics, scrubs, and glitter. However, transitional periods for compliance range from 4 to 12 years.
- **Italy's Infringement:** Italy faces infringement proceedings for failing to comply with the EU directive on single-use plastics, particularly its preference for biodegradable single-use plastics.

Dr. Petronio concluded by sharing examples of awareness campaigns conducted by ISDE (Doctors for the Environment) in collaboration with organizations such as Legambiente, WWF, Medicina democratica, Greenpeace, aiming to reduce plastic pollution and its harmful effects.

8) Speaker Prof. Bernasconi

Professor Bernasconi opened his presentation by defining **endocrine disruptors (EDs)** according to the World Health Organization (WHO): *"Chemical substances or mixtures that alter the function of the endocrine system and consequently cause adverse health effects in intact organisms, their progeny, or subpopulations".* The first indications of such substances date back to the 1950s, with initial reports by veterinarian Roy Hertz, followed by WHO's involvement in the early 2000s.

A recent study by Woodruff et al.[28] emphasized that fewer than 5% of the approximately 350,000 chemicals registered globally have undergone sufficient health risk assessments. Most countries lack mandatory testing for chemical hazards or transparency regarding their use. The most significant **endocrine-disrupting chemicals (EDCs)** for human health include **bisphenols** such as BPA, BPS, BPF, and BPB, commonly found in:

- **Food packaging**;
- **Thermal receipts**;
- **Everyday goods** (e.g., plastic dinnerware, polycarbonate plastics);
- **Dental materials** (e.g., fillings and sealants);
- **Medical devices** (e.g., contact lenses, catheters, neonatal incubators, and haemodialysis machines).

In recent years, there has been growing concern over health risks from EDCs in **feminine products** (e.g., facial creams, cleansers, body washes, and perfumes) identified as primary sources of endocrine disruptors[29]. Other sources of EDCs, particularly **PFAS**, include **polishes, paints, leather tanning products, non-stick cookware, carpets**, and **firefighting foams**[30]. These chemicals are volatile and persist in water, soil, and air, making them ubiquitous pollutants.

Bernasconi referenced a study by Annamalai et al.[31], which revealed that indoor environments often exhibit higher levels of contamination than outdoor settings, highlighting the critical need for environmental education in schools.

Routes of Exposure

EDCs are absorbed primarily through **inhalation** and **ingestion**. Galvez-Ontiveros et al.[32] demonstrated the presence of significant BPA levels in the **nails, saliva, and urine** of 22 children.

Mechanisms of Action

Bernasconi discussed the findings of Besaratinia et al.[33], which detailed the molecular mechanisms of EDCs, particularly their effects on:

- **Hormone receptors** (e.g., PPARγ, a key transcription factor in adipogenesis, as studied)[34];
- **Epigenetic modifications** influencing gene expression and physiological pathways;
- **Circadian rhythm interactions**, as highlighted by Bottalico et al.[35] EDCs are also implicated in **metabolic disorders**, particularly liver-related conditions[36].

Neurological Impacts

Paediatricians are especially concerned about EDCs' effects on neurodevelopment. Thaddeus et al. (2015) reported that EDC interference disrupts neuron

communication, growth, and migration. By mimicking hormones, EDCs activate receptors throughout the cell, altering genomic and non-genomic responses. Neurons also contain neurotransmitter-specific receptors in synaptic regions, which EDCs can affect, influencing electrical and chemical signalling.

Woodruff et al.[28] outlined several adverse health outcomes associated with EDC exposure, including **infertility, diabetes, cancer**, and **asthma**. Catalan et al.[37] emphasized the interplay between genetic predispositions and environmental exposures in determining individual susceptibility.

Addressing Inequities and Policy Recommendations

Bernasconi stressed that exposures to EDCs are higher in **low-income** and **communities of colour**, exacerbating health inequities. Risks are particularly severe during **fetal and early childhood development** and with **simultaneous exposure to multiple EDCs** at low doses. He advocated a **precautionary approach** to policy formulation, highlighting the need for comprehensive chemical safety testing and public health protections.

Clinicians play a vital role in guiding patients to reduce exposure but require policy changes to establish stricter regulations. Bernasconi proposed developing a **paediatric network** in collaboration with ISDE, with the following goals:

- Providing families with resources like the **Paediatric Environmental Health Toolkit**;
- Organizing training courses on environmental health for medical and nursing schools;
- Creating shared **position papers** for advocacy at national and EU levels;
- Promoting **multidisciplinary paediatric research**, including the identification of specialized centres such as **Paediatric Environmental Health Specialty Units (PEHSUs)**.

In conclusion, Professor Bernasconi urged clinicians and policymakers to adopt proactive measures to mitigate the health threats posed by EDCs, emphasizing the critical need for coordinated global efforts to protect vulnerable populations.

9) Speaker Dr. Giovagnoni

To conclude the first day of the conference, Dr. Giovagnoni, President of Assosubamed, began his address with a thought-provoking question to all participants: *"How can we remain healthy in a sick world?"* He proceeded to introduce **Assosubamed**, an organization focused on the production of medical devices utilizing therapeutic substances at **non-pharmacological, non-immunological, non-metabolic action** (e.g., barrier effect, lubrication, osmotic or physiological modulation of biofunctions).

In this context, natural substances, among others, can be used to develop innovative therapeutic products that are effective and safe. This group of medical devices based on substances will be specifically referred to in the intervention.

Dr. Giovagnoni referenced Article 2 of the **MDR 2017/745**, which defines a medical device as:

> *"Any instrument, apparatus, appliance, software, implant, reagent, material, or other article intended by the manufacturer for human use, alone or in combination, for purposes such as diagnosis, prevention, monitoring, prediction, prognosis, treatment, or alleviation of disease; investigation, replacement, or modification of the anatomy or a physiological or pathological process or state, and which does not achieve its principal action through pharmacological, immunological, or metabolic means, although such means may assist its function."*

Dr. Giovagnoni highlighted the expanding market for such medical devices, emphasizing the growing awareness that *"our body is the first dumping ground!"* While much attention is given to packaging, the environmental and physiological impact of the substances within often remains overlooked.

A **2014 global review of pharmaceuticals in the environment**, commissioned by the German Ministry of the Environment (IWW, 2014), revealed that out of 713 pharmaceuticals tested, 631 were detected in the environment across 71 countries. These findings underline the pervasive contamination caused by pharmaceutical residues worldwide.

Dr. Giovagnoni reinforced the WHO's **One Health** concept, which emphasizes the interconnected health of people, animals, and the environment. Scientific evidence supports the notion that these systems share a common destiny, urging all human actions to consider their impact on other systems.

Physicians must integrate **environmental impact assessments** into their therapeutic decisions, enabling a **benefit-risk analysis** that considers not only the patient but also their ecological context. He emphasized that innovative therapeutic solutions based on **100% natural and biodegradable substances**—developed through advanced research platforms—can heal through physiological mechanisms while maintaining an appropriate benefit-risk balance for both individuals and the environment.

Dr. Giovagnoni urged the medical community to reconsider natural substances as tools for health, applying the principles of **evidence-based medicine (EBM)**. Physicians must evaluate not only the immediate effects of a prescription but also its long-term environmental impact. He called for a paradigm shift, ad-

vocating for an expanded risk-benefit assessment in alignment with the **One Health** framework.

Case Study: Natural vs. Synthetic Solutions

Dr. Giovagnoni cited a **2023 clinical trial** comparing a technologically advanced natural product for gastroesophageal reflux disease (**NeoBianacid**) to **20 mg of omeprazole** in 275 patients over two weeks. The natural product demonstrated efficacy comparable to omeprazole without altering the intestinal microbiota. Moreover, **biodegradation tests** conducted according to OECD guidelines confirmed that while omeprazole is not biodegradable, NeoBianacid degrades completely, becoming indistinguishable from mineral media.

He also highlighted **sucralose**, a non-biodegradable excipient commonly used in paediatric treatments, which accumulates in the environment. Paediatricians must deepen their understanding of the environmental behaviours of substances and explore natural alternatives that align with **One Health** principles.

Dr. Giovagnoni concluded by emphasizing that humanity now possesses the scientific tools to shift paradigms and identify non-polluting alternatives. He urged investment in research to rediscover the value of natural resources and make them available for sustainable healthcare. *"We must dedicate time and effort to bring the natural heritage back to light, putting it once again at the service of humanity",* he affirmed.

DISCUSSION

Dr. Alleva highlighted the importance of **raising awareness and providing education** about the consumption of **natural substances with endocrine-disrupting properties**, such as **soy**, which is a particular concern for gynaecologists when managing patients with **polycystic ovary syndrome (PCOS)** and **endometriosis**.

The participants emphasized the need to **educate the public about avoiding the use of recycled materials** for children through existing municipal awareness campaigns and to **teach children the importance of frequent handwashing** as a preventative measure.

Finally, they recommended implementing targeted initiatives directed at **medical professionals**, aiming to increase their sensitivity to this topic. These initiatives could include organizing dedicated **conferences and educational events** within medical associations.

SECOND DAY

SESSION 3.
FOODS AS A FACTOR OF ENVIRONMENTAL EXPOSURE TO HARMFUL SUBSTANCES

Moderators: S. Russo and L. Proserpi

10) Speaker Dr. Milana

The congress proceedings resume the following day with a presentation by Dr. Milana, former Research Director at ISS Rome, who provided a detailed overview of the potential health risks associated with materials in contact with food (FCM).

As we know, materials are always in contact with food, such as packaging/containers (bags, bottles, boxes, films, etc.); tools for domestic and industrial use (spoons, pans, blenders, robotic milkers, etc.); and kitchen or industrial worktops. Consequently, even children are frequently in contact with these materials. Dr. Milana's presentation is focused on the chemical risks posed by such materials. These FCM materials can be fully synthetic (e.g., PET, PE, PP, PA plastics, as well as metal, glass, and ceramic FCMs); synthetic plastics from renewable sources or microorganisms (e.g., PLA, PHAs); natural or natural-based FCMs (paper, wood, latex, stone, beeswax, etc.); or mixed materials, including synthetic plastics with natural-based additives (e.g., plastic combined with wood flour), PLA with nanosilicates, or "natural" materials treated with polymers (e.g., paper layered with plastic, wood with synthetic coatings).

Theoretically, perfectly inert materials do not exist. Materials may interact with the matrix they come into contact with (i.e., food), and the potential health risks can include the release of substances. But what is released? Components (molecules or atoms) that either migrate as they are or are formed through chemical reactions. These can either diffuse through the material (e.g., plastic, rubber), result from chemical interactions (e.g., from metallic surfaces or FCM degradation), or desorb from solid surfaces (e.g., paper, wood) and potentially be transferred to food.

However, Dr. Milana emphasizes that a hazard does not always equate to a risk. It is essential to ask: Is the substance released dangerous? How much food am I consuming? Am I a child or an adult? The risk from FCMs arises when a migrated molecule X expresses its hazard in a detectable toxic effect: a) a sufficiently high amount of X must migrate into the food, and/or b) the food must be consumed in a sufficiently high quantity.

The concept of risk assessment is summarized in Article 3 of the framework Regulation 1935/2004/EC, which states: "*Materials and articles... shall be manufactured in compliance with good manufacturing practice so that... they do*

not transfer their constituents to food in quantities that could: (a) endanger human health; (b) bring about an unacceptable change in the composition of the food; (c) bring about a deterioration in the organoleptic characteristics thereof". This risk assessment process includes migration/leaching/release from FCMs. The migration level depends on the nature of the migrant X, the nature of the FCM, and the nature of the food. However, migration can vary with contact conditions such as time, temperature, and contact surface area.

EU regulations on FCM safety recommend: Among all, to prevent consumer exposure to levels that may pose a risk. For plastic FCM prevention can be obtained by a list of authorized or banned substances; and/or minimizing potential migration (contact time and temperatures, type of food); and/or restricting or banning the use of certain substances/materials under specific conditions.

After this thorough introduction, Dr. Milana presents practical examples of widely used FCMs and their potential health risks to be prevented. For example, **cling stretch films**, commonly used at home, may carry the risk of migration of small plasticizers if these substances are used in high amounts to stretch the film. This was the case of the phthalates, for which the use is progressively dismissed, but in some formulation other plasticizers are used and the Regulation sets specific migration limit to be respected. Moreover, not all films are intended for contact with fatty (oily) foods. To prevent migration, attention should be paid to labelling instructions, as migration is controlled also by the intended use (e.g., not for fatty foods, not for microwaving).

Up until 2011, **baby bottles** were made from polycarbonate (PC), which released BPA due to degradation after repeated use. Consequently, PC was banned in the EU for baby bottles (2011) as a precautionary measure. Today, baby bottles are made from PES (polyethersulfone), Tritan (co-polyester), polypropylene, silicon, glass, or stainless steel, all of which do not contain or release BPA but must be used and cleaned according to the manufacturer's instructions and discarded when damaged.

Similarly, in the market durable **plastic plates for children** made from polypropylene or melamine. The former have good resistance to washing, low migrability, and are almost all microwave safe. In contrast, melamine plates should never be used in the microwave, even if not labelled as such. Melamine can deteriorate with repeated washing or use, continuously releasing formaldehyde and melamine.

Regarding **paper and board** products, such as kitchen paper, these are not all the same. Some are designed to adsorb (e.g., paper towels), while others are intended for contact with food (e.g., for fried foods or microwave use). Their composition varies, with adsorbent paper containing crosslinked resins to enhance wet resistance and additives that improve absorbency, and these substances are not necessarily suitable for contact with foods. **Pizza**

boxes are typically composed by three layers corrugated cardboard and often printed. In Italy, pizza boxes cannot contain recycled fibres to prevent the risk of migrating residues from recycling; they must be made from virgin paper. Not all pizza boxes are suitable for reheating pizza in the oven, and excessive heat may cause substance release.

The risk associated with **aluminium** (film, pans, trays) is the release of aluminium ions, which is increased by contact with salty and/or acidic foods, especially in liquids. EFSA recommends a tolerable weekly intake of 1 mg/kg body weight. Dr. Milana cites an ISS study on the frequency of aluminium FCM use in Italian population. Release tests for aluminium from widely used FCMs in 48 food preparation types (cooked, uncooked, stored) show that aluminium exposure from single-use FCMs contributes only modestly to increased aluminium intake, while aluminium exposure from pans being a significant source, particularly for young children consuming daily broths cooked in the same aluminium pan. In conclusion, it is essential to limit the habit of product loyalty (e.g., always cooking and reheating in the same brand of aluminium trays) and avoid intensive use of aluminium pans to cook for young children.

For **stainless steel**, the main risk is nickel migration for individuals who are allergic. **Ceramics**, a common material in kitchenware, may pose a risk due to the migration of lead (Pb), cadmium (Cd), and other metals such as cobalt (Co), copper (Cu), barium (Ba), antimony (Sb), zinc (Zn), and aluminium (Al). The risk increases with decorative ceramics, but this is not always the case. EFSA has assessed the effects of lead on children's IQ, and stricter limits are going to be introduced through a new regulation. It is important to discard or avoid using damaged ceramic products (e.g., cracked or creviced glassy layers).

As for **glass**, there currently appears to be no significant risk, although care should be taken with lids. The internal gasket of glass jars is plasticized to ensure airtight closure and microbiological safety but is designed for single use and it is advisable not to reuse them for homemade preparation (e.g., oily preserved foods, jams, etc.).

Regarding **non-stick pans**, quality is one the main key, and also price could be a useful indicator. Indication in the labels for home maintenance should be strictly followed.

As for **bio, eco-friendly, or so called natural FCMs**, in the market they are often presented as ecological alternatives to plastic, but unfortunately this is not always true. For example, some brands of **bamboo plates**, marketed as sustainable alternatives to plastic, are actually made of plastic with bamboo or other plant-based additives used only as fillers. Studies have shown increased migration of melamine and formaldehyde from such products. These are not to be confused with FCM made 100% from bamboo, that have the actual appearance as "ligneous" material.

In conclusion, Dr. Milana recommends the following good practices for safe use of FCMs:

- Verify the presence of the EU symbol (fork and glass);
- Buy in shops that are traceable and verify the presence of instructions of use in Italian;
- Follow the manufacturer's instructions for use;
- Read labels! For example, do not reheat food in pizza boxes or plastic FCMs if they are not suitable for microwaving; kitchen paper may not be always suitable for contact with food; discard deteriorated kitchenware (e.g., damaged ceramics, non-stick pans, etc.); and avoid using plastics with hot foods if not specified for that purpose.

11) Speaker Dr. Tamino

Dr. Tamino begins his presentation by discussing the **reductionist approach**, a widely used and analysed methodology. In linear systems, "the whole is equal to the sum of its parts", but this does not hold true for **complex systems**, where **emergent properties** arise, defining the system as a whole. As Stephen Jay Gould proposed, an integrated theory is necessary—one that considers selection at multiple hierarchical levels, from genes to organisms to species, to explain evolutionary patterns.

The greater the **biodiversity**, the more stable the ecosystem—an example of a complex system comprising organisms interacting within a specific environment. All matter used by living organisms is recycled through other organisms or deposited in terrestrial formations (soil, sediments, rocks, hydrocarbon deposits). Therefore, **nature's cycle does not generate waste but only reusable byproducts**.

Unlike natural processes, which are powered by solar energy, operate cyclically, and produce no waste or combustion byproducts, modern industrial processes burn fossil fuels, follow a linear trend, and generate pollution and waste (both material and energy losses). To boost productivity, agriculture relies heavily on fertilizers, pesticides, and machinery, consuming fossil fuels and compromising natural ecosystems and biodiversity. Dr. Tamino emphasizes the urgent need to change production methods in agriculture.

The concept of **environmental health** refers to an environment where ecosystems are balanced, resistant, and resilient. Dr. Tamino highlights that **we cannot achieve human health in an unhealthy environment**. If we desire a healthy environment, **agriculture must also be sustainable and healthy**.

He introduces two complementary holistic approaches:

1. **The Holistic One Health Vision**, which recognizes the interconnectedness of human, animal, and ecosystem health;

2. **The One Health Approach**, encouraging interdisciplinary collaboration among experts from various fields (e.g., epidemiologists, veterinarians, physicians) to enhance health outcomes for humans, animals, livestock, and wildlife.

Dr. Tamino advocates for a shift from **linear agriculture** to an **agroecological approach**. **Agroecology** applies ecological principles to food, fibre, and medicine production, focusing on sustainable management of agricultural systems. It is inherently multidisciplinary, integrating agronomy, ecology, sociology, and economics.

According to the **OECD**, agroecology studies the relationships between agricultural crops and the environment. Dalgaard et al. expand this definition to include the interaction of plants, animals, humans, and the environment within agricultural systems. Agroecology links science, practice, and social movements, aiming for **ecological, economic, and social sustainability** (Gliessman et al., 2016).

Both **Agroecology** and **One Health** are holistic approaches gaining traction globally. They aim to create a world where everyone has access to safe, nutritious food while safeguarding the environment. The **FAO** actively promotes these strategies, summarizing the benefits of agroecology in five points:

1. Boosts nutrition and health;
2. Integrates diverse types of knowledge;
3. Preserves natural resources and biodiversity;
4. Produces more with fewer resources;
5. Enhances the resilience of rural populations.

Dr. Tamino highlights the importance of **biodynamic and organic farming** as agroecological strategies. The absence of chemical products is not the objective but a **consequence of agroecology**, which pursues goals like:

- Supporting local communities by integrating natural resources into agriculture;
- Achieving higher crop yields and profitability than conventional methods;
- Promoting biodiversity and resilience to climate change;
- Reducing greenhouse gas emissions and mitigating climate impacts;
- Protecting soil health and avoiding water pollution from chemical inputs.

Organic agriculture ensures a holistic view of health and the environment. Epidemiological studies show the harmful effects of certain insecticides on children's cognitive development, even at current exposure levels. Such risks can be mitigated by consuming organic food, particularly during pregnancy and infancy, and by introducing non-pesticidal methods in conventional agriculture.

Organic crops also have lower cadmium levels due to different fertilizer usage and higher soil organic matter—critical for human health.

The excessive use of antibiotics in conventional animal farming drives **antibiotic resistance**, posing significant public health risks. Organic farming, with stricter antibiotic usage and disease prevention, can mitigate this issue, yielding substantial health benefits (EPRS, 2016).

Dr. Tamino concludes his presentation by encouraging the use of natural pest control methods, such as introducing **ladybirds** as an alternative to chemical insecticides. This shift exemplifies the alignment of agroecology and One Health principles, fostering sustainability and harmony with nature.

12) Speaker Dr. Lucentini

The final presentation of this congress was delivered by Dr. Lucentini, Director of the National Center for Water Safety, who addressed the **contamination of drinking water by emerging pollutants**.

Despite advancements over the past 30 years, environmental risk factors continue to account for over 1.4 million deaths annually in the European Region, with **air pollution** being the leading cause. Dr. Lucentini emphasized that **safe water** for human consumption entails not only the absence of harmful microorganisms and substances but also the presence of essential minerals and elements. Long-term consumption of demineralized water or water with very low levels of elements such as calcium and magnesium can negatively impact human health. A key message to be considered is that **bottled water is considered a consumer good**, whereas drinking water is a human right.

Dr. Lucentini highlighted the importance of addressing **re-emerging risks**, such as the potential contamination of drinking water with wastewater due to climate related extreme events. The focus remains on ensuring that materials and practices align with the objectives of the **Drinking Water Directive (2020/2184)**, which aims to guarantee access to safe drinking water. This involves minimizing the presence of harmful substances such as arsenic, ensuring they remain below hazardous levels. However, maintaining water purity remains a significant challenge due to the circulation of various chemicals.

Particular attention was given to the impact of water pollution on **children's development**. Epidemiological studies have identified arsenic, heavy metals, and pesticides in drinking water as **risk factors for adverse pregnancy outcomes**. Pollutants such as arsenic, uranium, lead, trihalomethanes, hexavalent chromium, cadmium, and nitrates pose serious risks to pregnant women and fetuses. Exposure to these pollutants has been linked to increased occurrences of **hypertensive disorders during pregnancy**.

The **REACH new drinking water directive as transposed by the Italian legislation (D.Lgs. 18/23), addressed by a national law** underscores the critical

importance of **catchment appraisals** and **source water quality monitoring** to safeguard water safety:

1. **Periodic catchment appraisals:** These identify chemical and microbiological hazards in source water, especially in response to changes in human activities in the catchment area or incidents affecting drinking water quality;
2. **Investigative source water monitoring:** This is carried out periodically, based on appraisal outcomes. It leverages existing monitoring programs under frameworks such as the **Water Framework Directive (WFD)**, the **Groundwater Directive**, and the **Environmental Quality Standards Directive (Directive 2013/39/EU)**.

Dr. Lucentini concluded by urging reflection on **PFAS (per- and polyfluoroalkyl substances)**, and the PFAS-related compound **trifluoroacetic acid (TFA)**, which cannot be removed from water through conventional treatment methods. He emphasized that **prevention** is the only effective strategy to mitigate water contamination and ensure that pollutant levels remain below thresholds that pose risks to human safety.

DISCUSSION

The discussion began with a question from the audience, regarding **health risks associated with silicone kitchenware**, such as baking molds. Dr. Milana responded by affirming that, to date, there do not appear to be contraindications for using silicone-based materials, provided their **quality**—often reflected in their price—is ensured. She recommended using **porcelain** for children, avoiding **product loyalty**, and reducing the use of **plastic wrap**. Additionally, she advised against coloured ceramics for children, limiting use to **white ceramics**, as coloured varieties may contain traces of **lead and cadmium**. Dr. Milana also cautioned about **stainless steel cookware**, noting that the acidity of foods can accelerate the release of **nickel** (now often replaced by manganese).

A question was raised about the feasibility of applying **agroecology** on a large scale to replace traditional intensive farming methods. Dr. Tamino emphasized that agroecology must be **regenerative**, adding that its success depends on **active consumer participation**. Consumers should engage with farmers rather than passively accepting the supermarket model, which diminishes direct relationships. He pointed out that industrial crop production creates significant issues; for example, fields used for **palm oil** or **rapeseed** cultivation result in environmental destruction and subsequent health problems for both the ecosystem and humans. Dr. Tamino underlined that agroecology is inherently a **political act**, representing a conscious choice. Policymakers must provide **equal incentives** to organic farmers as those given to conventional agriculture. He concluded by reminding the audience that **farmers are the stewards of the land**, and their practices shape both the environment and public health.

Finally, Dr. Lucentini addressed a question regarding the presence of **pharmaceuticals in drinking water**. He clarified that pharmaceuticals are **not currently considered an emerging risk**, as they are typically removed during water treatment processes. However, he shared encouraging news: the update to wastewater treatment regulations, previously dating back to 1991, now includes the introduction of **extended producer responsibility** for pharmaceuticals and cosmetics. This marks a significant step toward addressing environmental contamination at its source.

FINAL CONSIDERATIONS AND CLOSING REMARKS

The congress concluded with remarks from **Dr. Romizi**, who extended his gratitude to all the speakers and participants of the two-day event, confirming that the presentations will be made available on the **ISDE website**.

Dr. Romizi encouraged the audience to identify **new strategies for improving children's health** and emphasized two key takeaways from the event:

1. **Reducing or eliminating toxic substances** as a tangible outcome of the discussions;
2. **An appeal to COP29**, co-signed by ISDE and the association led by Dr. Reali.

He also highlighted **three educational projects** aimed at schools, available in digital format:

1. **Conscious use and disposal of plastic** – targeted at elementary schools;
2. **Drugs and the environment** – designed for middle and high schools;
3. **The environment is health** – an initiative promoting environmental awareness.

In addition, Dr. Romizi announced the development of an **ISDE position paper** addressing health risks associated with pharmaceuticals and personal care products.

Concrete Solutions

Dr. Romizi proposed practical steps that could be implemented both at the **community** and **political** levels:

Community-level Actions:

1. **Increase green spaces:** Establish more parks and gardens to encourage outdoor physical activity and improve air quality;
2. **Encourage renewable energy use:** Support clean energy sources such as solar and wind;
3. **Improve waste management:** Promote waste separation, composting, and the reduction of food waste, while avoiding incineration.

Political-level Actions:

1. **Stronger environmental legislation:** Enact laws to limit pollution and promote sustainability;
2. **Investments in research and development:** Fund projects aimed at developing clean technologies and innovative climate solutions;
3. **International cooperation:** Collaborate with other nations to address global environmental challenges.

Final Recommendations

Dr. Romizi stressed the importance of adopting a **One Health and Planetary Health vision**, promoting **strong alliances** to achieve shared goals, and uniting the **scientific community** in support of political initiatives. He urged the scientific world to take proactive steps in advocating for change.

The event concluded with Dr. Romizi's resonant slogan:

> **"All men are responsible for the environment. Medical Doctors are twice."**

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