



Inherited conditions (genetic predisposition) and Environmental factors for preparing Pregnancy

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OBJECTIVES

At the end of the module, the participants will be able to:

- 1 Recognise the main genetic and environmental factors affecting pregnancy and child health
- 2 Know the possible actions to be taken in order to have a correct lifestyle, in relation to the environment
- 3 Recognise the factors that generate the different types of pollution (air, environmental, food, electromagnetic) in the environment.



1. General description of ENVIRONMENTAL FACTORS and GENETIC PREDISPOSITION

1.1. Context. Description/definition of topic

We inherit from our parents the genes: the basic physical and functional unit of heredity. The genes are made by DNA “deoxyribonucleic acid” located in the nucleus of our cells, controlling the production of proteins in our body. The proteins are not only the basic bricks in the “construction” of the human edifice, they represent an important part of hormones, enzymes, neurotransmitters, etc. essentials for human development. The current belief was, until recently, that the development of the baby in womb is genetically determined by the DNA of parents. This would mean that our heredity – our genes - shapes completely our biology, our behaviour, our emotions. Fortunately, this is not the case. Other important inner and outer factors intervene also in human development influencing the activity of each of our genes.

Several decades ago a new paradigm called *Epigenetics* = “control above the genes” offered us the explanation. This means that environmental factors prevent us from becoming “genetic automatons” - the expression belongs to *Bruce Lipton*, cell biologist, the author of "The Biology of Belief". His studies showed that the brain of the cell is not the nucleus, as it was thought, but the membrane of the cell which is similar to a computer chip! The cell membrane is full of receptors for all sorts of stimuli:

- **the inner environmental factors:** the emotions, thoughts, behaviours which are converted in biochemical and electric signals acting on the receptors imbedded at the surface of our cells
- **the outer environmental factors:** all the information received from food, water, air, weather, seasonal and circadian cycles, toxins, social rituals and networks etc. The outer information enters inside our body system directly or through our perceptions and finally are converted in biochemical and electric signals acting on membrane receptors, too.

All these signals control the “genes expression”: the flow of information from nucleus to the protein “factory” in the cytoplasm. In fact, the environmental stimuli act as a switch influencing the physiology of the cell and the genes expression, turning them on or off. This process is known as gene regulation, taking part of normal development and also allowing cells to react quickly to changes in their environments.

What future parents should understand from this? The human development is directly influenced by gene regulation - accomplished by environmental stimuli. For the sake of their future child, they must understand that, starting from conception and prenatal period, everything matters: the air they breathe, the food they consume, the substances they manipulate, the thoughts, emotions and actions they undertake!

With awareness and responsibility parents can prevent even the action of unavoidable factors such as physical and psychological pollution!



In November 1973 the Council of the European Community defined the concept of the environment in these words: "the set of elements which, in the complexity of their relations, constitute the framework, the habitat and the living conditions of man, as they are in reality or as they are perceived". Man, like all living creatures, continuously interacts with the environment in which he lives, and the degree of healthiness of the environment also determines possible negative effects on his state of health.

Throughout our planet, the environment has been, and still is, strongly influenced by social and economic progress, as well as by technical and scientific progress in the last two centuries and especially in recent decades. Today's environment is therefore strongly conditioned and consequently polluted by all human activities, where pollution means "an alteration of the environment by polluting elements. It produces temporary discomfort, pathologies or permanent damage to life in a given area, and can put the area in imbalance with existing natural cycles. The alteration may be of various origins, whether chemical or physical".¹ The environment as we have seen is therefore a "set of elements" and, for a pregnant woman, the first element is represented first of all by the place where she lives, that is what we can define as the home environment and the place where she works, the working environment, secondly by the wider context in which the house is located, which can be an urban, suburban, a metropolis, a village, in the plain, in the mountains, etc.. and finally there is the social environment, which we can divide in real, i.e. the social context and the community in which she lives and the virtual one, which concerns all the interactions that the pregnant woman has with social networks, the media, and more generally with the media. All these elements constitute the set of situations that generate what we can define, in our context, the environment.

1.2. The impact of ENVIRONMENTAL INFLUENCE on pregnancy /mother/child health proved

Many scientific studies in recent years are increasingly showing how much environmental pollution causes serious damage to human health. Even the WHO estimates that one in four people worldwide die from causes attributable to living or working in unhealthy environments.² Of the entire population, children are also a particularly sensitive group; their growing organism is more susceptible to toxic and dangerous substances. Another particularly sensitive group is all growing organisms such as embryos and fetuses, and therefore, more generally, pregnant women. Indeed, during pregnancy, vulnerability to exposure to toxic agents can be particularly dangerous. The severity of the consequences of exposure to toxic agents depends on both genetic and environmental factors.

These toxic agents have different origins:

- air pollution, related to all toxic substances present in the air;
- environmental pollution, related to synthetic chemical substances released into the environment, such as waste or by-products of industrial, agricultural, incinerator activities, etc.;

¹ <https://it.wikipedia.org/wiki/Inquinamento>

² <http://www.who.int/mediacentre/news/releases/2016/deaths-attributable-to-unhealthy-environments/en>



- food pollution, related to contamination found in food and water and
- electromagnetic pollution, due to the expansion of telecommunications and technological development that have saturated the ether with electromagnetic radiation.

When a pregnant woman comes into contact with these substances, they can pass to the fetus through the placenta, risking affecting not only the health of the child but also the appearance of pathologies in adult life. Waring R.H., Harris R.M., Mitchell S.C., In utero exposure to carcinogens: Epigenetics, developmental disruption and consequences in later life, «Maturitas», vol. 86, 2016 pp. 59-63

1.3. The root of negative behavior – living in an unhealthy ENVIRONMENT. How the behavior starts in general

Behaviours that lead women to feel the negative effects of an unhealthy environment are mainly due to a lack of knowledge and awareness. In fact, little is yet known about the effects that toxic and polluting agents have on the development of the foetus.

1. Pregnant women should therefore choose carefully the environments and places to visit, avoiding the most polluted areas, rooms or dwellings with elements that are harmful to health.
2. She should also consume healthy, organic, contamination-free food. Lack of information and habit are certainly at the root of the problem, but it is not addressed properly even at institutional level. Governments and institutions, in fact, do not protect and do not inform society about the risks that pregnant women run when visiting this type of place.
3. When a couple decides to give birth to a child, they should reflect, among other things, on the quality of the environment (starting with the house in which they live) in which the woman will spend the nine months of pregnancy.
4. They should make sure that the woman has the opportunity to spend most of her time in healthy, serene situations, possibly in greenery in contact with nature, environments free from atmospheric, environmental, food and electromagnetic pollution;
5. They should also develop a balanced relationship with modern means of communication, thus avoiding unnecessary stress due to the countless negative inputs coming from the media.

2. Main researches/ studies concerning the ENVIRONMENTAL FACTORS and GENETIC PREDISPOSITION

2.1. Conclusions about negative aspects of future parents behaviors concerning ENVIRONMENTAL INFLUENCE and the impact on children health

The concept of "nature versus nurture" was introduced by Francis Galton, Charles Darwin's cousin, to indicate two factors, genetics and environment, strongly interrelated in health and disease: psychophysical well-being is the result of a balance between the characteristics of the genome and the environment in which the person grows and develops.



Particularly, children's health should be defined as the extent to which individual children or groups of children are able or enabled

1. to develop and realize their potential,
2. satisfy their needs,
3. develop the capacities that allow them to interact successfully with their biological, physical, and social environments.

Disruptions in genes can be caused by events before, during, or after conception and may produce disorders immediately or later in life. A parent can pass on a defective or abnormal gene or set of genes, a malfunction can occur during combination of maternal and paternal DNA, or exposure to an outside substance or condition can occur after conception that alters the genes in the fetus. Physical and social environments (e.g., family, community, school, culture) interact with and influence these biological processes. The home environment of a pregnant woman and a child has a profound effect on their well-being. Starting with intrauterine life, a problematic home environment can disturb the brain's stress-response system and interfere with healthy development. Blair C, Granger DA, Willoughby M, et al. Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Development*. 2011; 82(6):1970-8

Several studies have confirmed the actions of negative home environments during pregnancy and the first three years of life with a number of developmental problems, including:

(EARLY effects - at age THREE)

- poorer speech development at age three;
- subsequent behavioral problems;
- lack of school preparation;
- aggression, anxiety, and depression;
- impaired cognitive development at age three. Evans GW, Ricciuti HN, Hope S, et al. Crowding and cognitive development. The mediating role of maternal responsiveness among 36-month-old children. *Environment and Behavior*. 2010; 42(1): 135-148; Vernon-Feagans L, Garrett-Peters P, Willoughby M, et al. Chaos, poverty, and parenting: Predictors of early language development. *Early Childhood Research Quarterly*. 2011

(LONG-TERM effects)

- high school graduation at an older age;
- adolescent parenting;
- difficulty in finding employment and lower earnings of adults. Duncan GJ, Ziol-Guest KM, Kalil A. Early childhood poverty and adult attainment, behavior, and health. *Child Development*. 2010; 81: 306–325.; Pungello EP, Kainz K, Burchinal M, et al. Early educational intervention, early cumulative risk, and the early home environment as predictors of young adult outcomes within a high-risk sample. *Child Development*. 2010; 81: 410-426

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THE ROLE OF EPIGENETICS



Most of the research to date has focused on the critical role of epigenetics in mediating the effects of social experience and nutrition. Champagne FA. Epigenetic influence of social experiences across the lifespan. *Dev Psychobiol.* 2010;52:299–311 However, there is also compelling human and experimental evidence that prenatal environmental exposures to **endocrine disruptors***

(endocrine disruptors are chemicals that can interfere with endocrine (or hormonal) systems. These disruptions can cause cancerous tumors, birth defects, and other developmental disorders.^[4] Found in many household and industrial products, endocrine disruptors "interfere with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for development, behavior, fertility, and maintenance of homeostasis (normal cell metabolism)." Wikipedia, the free encyclopedia

and other environmental **xenobiotics***,

(xenobiotics are understood as substances foreign to an entire biological system, i.e. artificial substances; the term is very often used in the context of pollutants such as dioxins and polychlorinated biphenyls) Wikipedia, the free encyclopedia acting alone or in combination with genetic, nutritional, or psychosocial factors, adversely affect human development and health in childhood and possibly over the life course, and that a primary mechanism is epigenetic dysregulation.

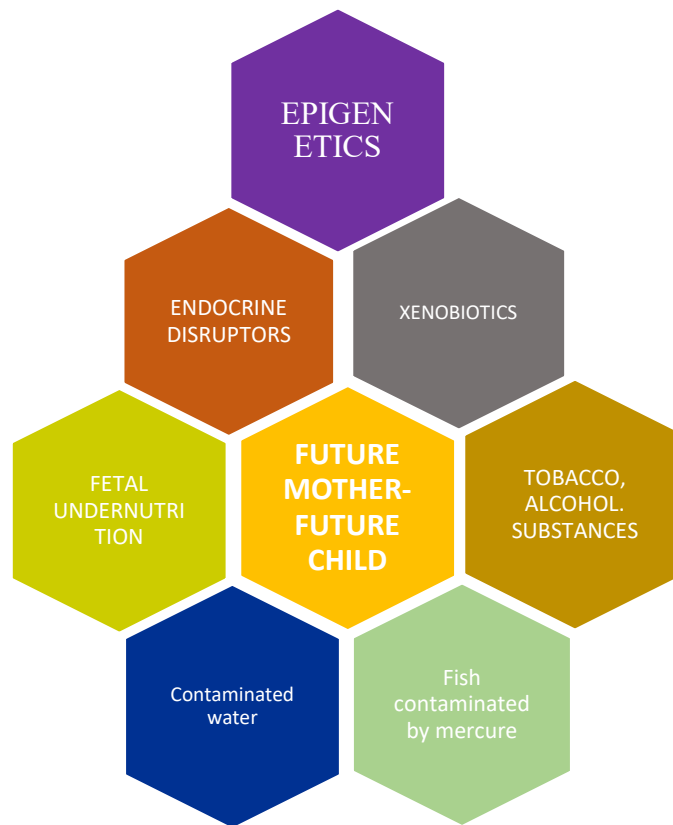
Because epigenetics programming determines the state of expression of genes, epigenetic differences could have the same consequences as genetic polymorphisms. McGowan PO, Szyf M. The epigenetics of social adversity in early life: implications for mental health outcomes. *Neurobiol Dis.* 2010;39:66–72. Moreover, there is experimental evidence that exposures during the prenatal window can influence disease risk transgenerationally through epimutations* *(epigenetic alteration - a heritable change that does not affect the DNA sequence but results in a change in gene expression)* in the germline* *(germline= the cells that form the egg, sperm and the fertilized egg, as well as the fertilized egg's future sperm or egg cells).*

The conclusion is that during prenatal period some environmental factors act on future mother and future child organisms, especially at the level of reproductive system. For a future baby girl, her ovaries and ovules are formed in her prenatal period, thus the reproductive function of the future woman depends on the way her mother lived during pregnancy!

Fetal undernutrition is believed to induce persistent changes in several metabolic pathways, but the exact mechanisms are only now being pieced together through a range of animal experiments and human measurement studies (Seckl, 1998; Barker, 1998).

Use of tobacco, alcohol, and illicit drugs also have harmful effects. Tobacco use during pregnancy is a major cause of fetal and newborn morbidity and mortality (small for gestational age, persistent pulmonary hypertension, sudden infant death syndrome, poorer intellectual functioning) (Nicholl, 1989; Golding, 1997; Day et al., 1992; Kline, 1987; U.S. Environmental Protection Agency, 1992; Bearer et al., 1997). Heavy drinking during pregnancy is the cause of fetal alcohol syndrome (FAS), the leading known cause of mental retardation (Abel and Sokol, 1987; Sokol, Delaney-Black, and Nordstrom, 2003). Maternal infant bonding appears to be key mechanism; a recent review of 23 articles showed that 14 found recognizable negative impacts

on maternal-child interactions among substance-abusing mothers, and three found a dose-response relationship with impact or an accentuation of impact related to continued substance use postnatally (Johnson, 2001). A recent review concluded that neural tube defects and small-for-gestational-age births are moderately associated with contaminated drinking water (i.e., trihalomethanes) (Bove et al., 2001). Oral clefts, cardiac defects, and complete nasal obstruction (choanal atresia) were found in studies evaluating trichloroethylene-contaminated drinking water (Bove et al., 2001). Food may also contain environmental teratogens. A well-known example is the epidemic of cerebral palsy that followed maternal consumption of fish contaminated with organic mercury in Minimata Bay, Japan (Harada, 1978).



2.2. Conclusions about positive behaviors concerning ENVIRONMENTAL INFLUENCE and the impact on children health

In recent years, WHO and UNICEF have increasingly emphasized the need for EARLY INTERVENTION to help combat health inequalities effectively and promptly. The scientific evidence available documents, in fact, how some relevant health problems of children and adults can be prevented by simple actions that can be carried out in the perinatal period and in the first years of life, both through the reduction of exposure to risk factors and the promotion of protective factors. In fact, preventable pathologies and events (first and foremost, congenital malformations, prematurity and low birth weight, infections, obesity, cognitive difficulties, developmental disorders, SIDS *Sudden Infant Death Syndrome, accidents) represent not only



an important share of mortality and death, but also an important part of the health of children and adults, morbidity of the first two years of life, but also a not insignificant part of morbidity at an advanced age.

Scientific research highlights how people's health is affected by numerous factors such as:

- genetic inheritance
- behavioural choices
- environmental exposures
- family relationships
- social contexts
- cultural aspects

Culture affects health in many ways:

1. One is by promoting daily activities and routines that reflect culturally defined goals and values that interact and influence developmental processes, inclusive of health (Gallimore et al., 1993; Rogoff, 1990). These routines can include, for example, health-promoting habits such as culturally prescribed foods and activities that provide adequate nutrition and caloric intake or patterns of mother-infant interaction (Harwood, 1992).
2. Culture also affects health by providing caregivers (and eventually children themselves) with an understanding of development and health: culture offers the context for defining what is a problem, explaining why the problem exists, providing possible treatments, and indicating who should respond (Groce and Zola, 1993; Harwood et al., 1999).
3. Similarly, culture also provides a framework for the use of home remedies. This growing body of empirical evidence also suggests that, because it is better understood how different internal and external influences plan the development of biopsychosocial pathways, more effective and appropriate prevention and intervention strategies can be designed, directed and implemented.

In recent years, researchers and important International Agencies, starting with UNICEF, have focused their attention on the so-called first 1000 days, ranging from conception to the first two years of life. Recovering the centrality of women and children and their skills in the birth path, the vocation to empowerment of actions, the system perspective, the need to connect services.

In the case of family genetic diseases, **PRIMARY PREVENTION** can only be implemented by avoiding pathological conception by people or couples at risk, while in the case of multifactorial diseases (e.g. some birth defects) primary prevention can be implemented in the pre- or periconceptual period, removing environmental causes.

Specific public health measures concern the promotion of correct lifestyles, avoiding exposure to teratogenic and genotoxic substances (drugs, environmental/professional xenobiotics, etc.), alcohol consumption and smoking, and encouraging healthy nutrition in fertile women.

Primary prevention must be promoted by strengthening:



- **pre-conception counselling** evaluation made by professionals to identify any medical problems that may worsen or complicate a pregnancy and to encourage future parents the adoption of healthy lifestyles
- **implementation of correct lifestyles** before and during pregnancy: healthy diet – healthy weight by addressing obesity, undernutrition or anaemia, quit smoking, eliminate addictions - alcohol, drugs, other substances , address mental and emotional problems etc.
- **dissemination of information** on the teratogenic, mutagenic and genotoxic potential of certain drugs and xenobiotic agents present in the environment and in food;
- **pre-conception genetic counselling** and **cascade genetic screening** on people potentially at risk for gene mutations;
- **periconceptual intake of folic acid** for the prevention of certain congenital defects;
- **regional health programmes** aimed at territorial medicine doctors and paediatricians of free choice, in order to make them actively involved in directing the population towards behaviours and practices useful to contain/reduce the risk of disease onset.
- **education before childbirth**, traditionally oriented towards practical aspects, has recently also focused its attention on the delicate phase related to becoming parents and the relapses on the emotional well-being of mom and dad and on the couple's relationship. A review (Dennis 2013), which includes 28 randomised controlled trials involving a population of nearly 17,000 women, points out that psychological and psychosocial interventions significantly reduce the number of women who have post-partum depression before or immediately after giving birth. Among the most promising interventions are the intensive and personalised home visits, carried out by professional, nursing or obstetric staff.
- **parental programmes**. The 2012 Barlow review (48 randomised controlled trials, 4,937 participants - at least 26 trials include children in the 0-5 age group) on the effectiveness of group programmes that train and educate parents to improve their psychosocial health shows that: parent programmes produce statistically significant improvements in various aspects of parental psychosocial health, including depression, anxiety, stress, anger, guilt, self-confidence and relationship satisfaction. With reference to the father figure, there has been a short-term but statistically significant improvement on the stress aspect. However, the data strongly encourage prevention policies to reduce early exposure to epigenetically toxic agents as a public health priority. Such policies could have both immediate and long-term benefits for human health, preventing diseases and developmental disorders in childhood, throughout life and also in future generations. Hanson MA, Gluckman PD. Developmental origins of health and disease: new insights. *Basic Clin Pharmacol Toxicol.* 2008;102:90–3

3. Recommendations (WHO) Examples of evidence based interventions

Genetic counselling

Predictive genetic testing is currently used mainly for untreatable conditions, such as Huntington's disease, or prenatal detection of serious genetic disorders such as cystic fibrosis. Prenatal tests are usually accompanied by an offer of termination of affected pregnancies. Genes



have now been isolated that are associated with potentially preventable diseases such as heart disease and cancer and with increased risk from smoking and obesity. This has raised the possibility of providing predictive information to many more people. Such information may eventually reduce disease by facilitating the development of better targeted and more effective treatment.

Informing people of their genetic susceptibility to disease may motivate them to change their behaviour to reduce their risks. However, changing behaviour is often difficult.

The expression of certain genetic characteristics depends on the environment in which they occur. Thus, gene expressions that lead to a disease in one context may not lead to a disease, or may result in a different disease, in another context (Holtzman, 2002). Inheriting a single copy of the hemoglobin S gene makes an individual resistant to malaria (Aidoo et al., 2002). However, inheriting two such genes gives the individual sickle cell anemia, a severe disease. Outside of malaria-endemic areas, sickle cell trait, the inheritance of one copy of hemoglobin S, has no known adaptive benefit and may be maladaptive. A single cystic fibrosis gene has been postulated to be protective against diarrheal diseases such as cholera, conferring a survival advantage to individuals who carry one copy of the gene (Rodman and Zamudio, 1991). However, individuals with two such genes have cystic fibrosis, a severe disorder with altered pulmonary and gastrointestinal function. Other examples of genes with positive influence also exist in given environments. The gene or genes that confer protection from cancer (Gonzalez et al., 2002; Reszka and Wasowicz, 2002) have been described.

Carrier screening and testing

Genetic tests are "analyses aimed at identifying the presence, absence or modification of a particular gene, chromosome, product of a gene or metabolite, indicative of a specific genetic mutation". They represent one of the most important translational results of genetic research in the clinical setting. The "traditional" classification of genetic tests includes diagnostic tests, tests to identify healthy carriers, pre-symptomatic tests, predictive tests and pharmacogenetic tests; The "extended" classification also includes phenotypic tests, lifestyle behavioural and orientation tests, nutrigenetic tests (which together were previously assimilated to predictive tests), tests to identify family relationships, ancestral tests, genetic compatibility tests (which together define genetic profiles mostly unrelated to diseases). However, compared to more than 1500 GWA studies (a genome-wide association study, also known as whole genome association study (WGA study, or WGAS), is an observational study of a genome-wide set of genetic variants in different individuals to see if any variant is associated with a trait) involving about 250 complex traits or diseases, only 10% of their heritability is now known on average, with few exceptions.

Appropriate treatment of genetic conditions

Actions to prevent diseases: Folic acid intake has a preventive action on: spina bifida, anencephaly, labiopalatoschisis, congenital cardiac, urinary, limb malformations. Breastfeeding protects against gastrointestinal and first respiratory tract infections as well as SIDS, obesity, cognitive and relational difficulties. Supine position in the cradle is related to a lower incidence of SIDS. Reading aloud prevents cognitive and relational difficulties, dyslexia.



Family planning

Perform a general and specialist medical examination (gynaecological for women and andrological for men). Consult a professional if there is any personal or couple psychological discomfort. Understand the physiology of ovulation. Maintain or adopt a healthy diet. Maintain or achieve an ideal weight, following a healthy diet and constant exercise. Do not smoke, avoid alcoholic beverages and coffee. Do not use drugs or doping agents of any kind. Adopt healthy sexual behaviour and consider testing for sexually transmitted diseases, including screening for chlamydia recommended for all women under 25 years of age. Stabilize any diseases present in one of the 2 partners, in particular: diabetes, hypertension, thyroid disease, heart problems. Avoid contact with pesticides. Congenital conditions are conditions of various types and nature that may already be present in the womb, or evident at birth or in the very first years of life. The most important are: Chromosomal abnormalities, genetic diseases, malformations, prematurity, poor prenatal growth, motor, intellectual or sensory disabilities. Planning pregnancy is an act of responsibility towards yourself, and above all the first and most important act of responsibility as future parents towards your children. This does not detract from the wonders of the affective relationship, but increases its intensity, and has a series of important implications on the psychological and physical health side. It helps the couple to make or strengthen a series of decisions that can improve their own health, that of the woman during pregnancy and especially that of the child to be born. The first weeks of gestation, in fact, are absolutely fundamental for a healthy development of the embryo, for this reason it is advisable to plan the conception. The pre-conception period is the ideal time to strengthen or begin to implement healthier behaviours - baby. All this will certainly allow for a more serene and healthy pregnancy.

Providing guidance and information on environmental hazards and prevention

Several epidemiological studies have shown an increased risk of miscarriages, stillbirths, foetal growth retardation, prematurity, infertility, poor semen quality, congenital abnormalities in relation to various types of toxic substances such as particulate matter, O₃, NO_x, pesticides, solvents, metals, radiation, contaminants (disinfection byproducts, arsenic and nitrates), persistent organic pollutants (POP's), bisphenol A, phthalates and perfluorinated compounds (PFOS, PFOA)... to name but a few. It follows from this scientific evidence that pregnant women should be aware of the importance of living in a healthy environment, as free as possible from all the factors that are at the origin of the different types of pollution. In particular, the place where pregnant women live should be free from: 1. air pollution, e.g. avoiding industrial areas or cities with high levels of smog; 2. environmental pollution, e.g. from landfills, factories or agricultural practices using synthetic chemicals, such as pesticides, fungicides, herbicides, etc. 3. food pollution, choosing food with care and attention, turning in particular to organic products, free of chemical pesticides and synthetic products and taking care that the water, which is drunk every day, is pure, i.e. free of any contamination; 4. electromagnetic pollution, thus avoiding living near repeaters or power stations, but also avoiding prolonged exposure to other electromagnetic sources such as mobile phones or wifi units.



Protecting from unnecessary radiation exposure in occupational, environmental and medical settings

Wireless and radio communications, power transmission or everyday devices - such as smartphones, tablets and laptops - expose us to electromagnetic pollution every day. The most recent studies have shown the relationship between electromagnetic pollution and health. Moreover, as Professor John Goldsmith has shown, exposure to Wi-Fi microwave radiation has now become the leading cause of miscarriages: in 47.7% of cases of exposure to this radiation, cases of miscarriage occur within the seventh week of pregnancy. Electromagnetic pollution is still strongly underestimated. Pregnant women should avoid exposure to these sources as much as possible, including smartphones.

In the case of mobile phones, simple precautions should be taken to limit the risks:

- 1) Do not let children use mobile phones except in an emergency.
- 2) Always use corded headsets (not wireless headsets). The use of the speakerphone is also recommended;
- 3) In case of low network or lack of range, do not make calls.
- 4) Use your mobile phone as little as possible on the move, such as in a train or car.
- 5) Do not hold your mobile phone near your ear or near your head when making a call, when the radiation is stronger.
- 6) Do not keep your mobile phone in your trouser pocket, shirt pocket or jacket;
- 7) Change your ear often during the conversation and, above all, reduce the duration of calls;
- 8) Never fall asleep with your mobile phone near your head;
- 9) Always choose models with a low SAR (specific radiation absorption rate).

If we think that every year in Italy alone more than 150,000 thousand tons of pesticides are distributed on agricultural land, we can understand how much even a suburban territory can be polluted. The use of pesticides has a double repercussion, since not only do they pollute the environment in which they are distributed, but they are also found in the food we consume. There are many agricultural methods, from organic to biodynamic, which do not use synthetic chemical products. The worldwide conversion to these methods of agriculture is more essential than ever to be able to live in a healthy environment and to be able to feed on uncontaminated food.

Protecting from lead exposure

Exposure to lead, with the risk of intoxication, was much more frequent in the past, when leaded paints were used and lead was also present in petrol for cars. Today the risk is certainly reduced, but it is certainly necessary to be very careful to avoid any form of intoxication from this heavy metal. The main hobby activities that are a source of possible exposure to lead are: Hunting or fishing with lead; Restructuring; Target shooting in a shooting range; Car repair work; Stained glass processing; Ceramic processing; Painting with artistic colours; Distillation of liquor in leaded containers. Lead can also be assimilated through contaminated water and food and tobacco smoke.



Informing women of childbearing age about levels of methyl mercury in fish

The presence of mercury in big fish is a known risk. The problems arise mainly from methylmercury, the most common form of mercury in the food chain and also the most toxic. In contrast to inorganic mercury, methylmercury is also able to cross the placenta, the brain and cerebrospinal barrier, thus reaching the brain and central nervous system. Recent studies have confirmed the link between fetal exposure to methylmercury and the reduced neurological development of the child. Recent indications from the scientific community are quite clear: pregnant women and children, to be safe, should not eat sharks (blue shark, blue shark, porbeagle), swordfish and large tuna such as red shark.

Promoting use of improved stoves and cleaner liquid/gaseous fuels

Three billion people in developing countries around the world rely on biomass, in the form of wood, coal, manure and crop residues. Because much of the cooking of food is done indoors, where proper ventilation is lacking, millions of people, especially poor women and children, face serious health risks. High efficiency stoves significantly reduce these risks. Other more sustainable options include liquid fuels and gases that are burned in high-performance ovens.

4. How behavior can change- the role of professionals

Behavioural change interventions, including interactive and multifaceted education, training with audits and feedback, habilitation through advanced information technology-based systems and collaborative team-based interventions, can effectively change acquired habits and behaviours.

It is essential to train professionals who work in the health field, teaching them how to provide valuable interventions to be passed on to future parents in order to change their habits. It is essential to teach communication skills, to facilitate the contribution of family and friends for support.

There are 3 main approaches:

- **the behavioural change approach** that seeks to change people's cognitive processes and beliefs;
- **the self-empowerment approach** that changes happen if people feel they have control over their social and inner environment: the more this control is perceived, the greater the incentive for action;
- **the community development approach** that emphasizes the relationship, the health status of the individual and the social context of the environment in which they live; hence the importance of moving collectively as a community to change the physical and social environment.

In short, it is important to help people to increase the control of their well-being and improve it by bringing them closer to an optimal state of health - understood as a dynamic balance between physical, intellectual, emotional, social spiritual - by increasing awareness, increasing motivation and training specific skills to make them more and more effective in identifying and realizing aspirations and passion, satisfying needs, changing the surrounding environment, wrong habits, social conditioning. (O'Donnel 2009)



Perception of risk

An important element to take into account is the perception of risk, which has been explored in terms of unrealistic optimism and through self-assertive theory: a person who smokes and has always seen his or her grandmother smoke until the age of 90 is led to think he or she is not at risk of lung cancer.

Persevering in unhealthy behaviour is due to INAPPROPRIATE PERCEPTIONS OF RISK, and the belief that risk can be compensated by other virtuous attitudes in such cases:

”I can smoke because then I will do physical activity during the weekend”;

”I do not have protected sex but in return I do not use drugs,” etc.. Weinstein (1983) argues that people focus selectively on one behavior rather than another, and tend to think that healthy behavior compensates for unhealthy behavior.

According to the self-affirming theory, people are motivated to protect their physical integrity and their sense of being morally compliant, so much so that in everyday life, if information such as "smoking kills" is presented to them, they behave defensively or with disinterest or rejection (Steele, 1988).

The role of professionals in this sense is fundamental in changing the perception of risk in a proactive and concrete way..Edoardo Giusti, Andrea Pagani Il Counseling psicologico Sovera Edizioni, 16 feb 2016 Specifically, the figure best suited to the purpose seems to identify with ostretica= midwife. The effectiveness of different models of care for pregnant women has been explored in a systematic review (11 randomised controlled trials, n=12,276). The primary objective of the review was the comparison - in terms of morbidity, mortality and psycho-social outcomes - between the care offered by midwives (midwifery-led model), the care offered by doctors of different specialties (medical-led model) and the care shared by several professional figures (shared-led model). The model based on the midwife's assistance assessed in the systematic review consists in ensuring continuity of care for the woman, i.e. assistance guaranteed throughout the birth path by a single midwife (caseload midwifery) or by a team of midwives who share the case (team midwifery). In both schemes the care is complemented by a multidisciplinary network of experts to be consulted when appropriate. In the review, this model is associated with **several benefits for the mother and child:**

- reduced incidence of prenatal hospitalizations
- reduce incidence of fetal/neonatal losses before 24 weeks,
- reduced frequency of use of local anesthesia/analgesia,
- reduced rates of forceps use and suction cups
- reduced rates of episiotomy.
- increased perception of control during labour
- increased rate of initiation of breastfeeding.
- Among the psycho-social outcomes, the available evidence suggests that women are more satisfied with the care received by midwives.Hatem M, Sandall J et al. Midwife-led versus other models of care for childbearing women. Cochrane Database Syst Rev 2008;(4):CD004667. Hatem M, Sandall J et al. Midwife-led versus other models of care for childbearing women. Cochrane Database Syst Rev 2008;(4):CD004667.Villar J,



Khan-Neelofur D. Patterns of routine antenatal care for low-risk pregnancy. Cochrane Database Syst Rev 2003;(1):CD000934

The available evidence supports a care model based on the midwife or team of midwives taking charge of the pregnant woman, complemented by a multidisciplinary network of professionals to be consulted when appropriate, as it is associated with benefits relating to outcomes relevant to maternal and neonatal health, including increased satisfaction of the woman with the care received.

Prenatal education can be fulfilled very early in life. UNESCO *United Nations Educational, Scientific and Cultural Organization* considered, several decades ago, that during school education children should be trained for different aspects of family life and child bearing, including:

- Mental health programs and emotional balance for children
- Hygiene and health promotion
- Sexual education
- Life Adjustment and Family life preparation for acquiring parenting skills
- Vocational and professional guidance
- Administrative and economical domestic skills as a component of family skills
- Marriage and relationships
- Human and children rights
- Political, civic, religious and philosophical education

Let's hope that schools will resume such initiatives with programs adapted to the today's young people needs, in order to form both skills and attitudes for life!

5. Education for future parents/population for a healthy life style concerning the General description of ENVIRONMENTAL FACTORS and GENETIC PREDISPOSITION and in general – the role of educational programs, the role of community, schools. How information can be spread

Science has now confirmed that the prenatal period is of fundamental importance for the psycho-physical well-being of every future human being, and recent scientific research has highlighted how much the environment can positively or negatively affect pregnancy. Scientific studies have shown in particular how various types of pollution*

(-atmospheric,
-environmental,
-food and
-electromagnetic)

can affect the correct development of the foetus in the prenatal period with huge human, social and health costs. The new emerging theories on how our genome relates to the environment are also making us understand how the relationship between man and the environment is of fundamental importance for a healthy lifestyle. If, as epigenetics teaches us, the environment, in



the broadest sense of the word, can influence our genome, then it is clear that the quality and healthiness of the environment in which we live is a factor of extreme importance. Therefore, the ability to evaluate the healthiness of an environment, determines the possibility of adopting a healthy and correct lifestyle for future parents.

The quality of the place of the house

A lifestyle adapted to the needs and requirements of a pregnant woman involves first of all an awareness of the quality of the place where one lives (the house) and the context in which one lives (the context in which the house is located).

For a lifestyle that can be defined as healthy and to promote a proper pregnancy, future parents should ensure that the place where they live is free of

- air pollution,
 - environmental pollution
 - electromagnetic pollution.
1. The most suitable context is therefore far from urban centres or industrial areas, where smog is often above tolerance limits; quiet places in contact with nature or urban greenery.
 2. If the place is located in the countryside, places where intensive forms of agriculture with the use of synthetic chemicals should also be avoided.
 3. The quality of the air, water and also the presence of possible sources of electromagnetic pollution, such as antennas or repeaters, should therefore be checked. It is certainly difficult to find places where there is no source of pollution, but for a correct lifestyle, depending on a future pregnancy, it is good to try to consider all these aspects before conception in order to possibly change everything that could be harmful.

For example, if a couple who wish to have a child lives near a heavy industry, a steel mill, or something similar, or near fields cultivated with intensive farming methods, using chemical pesticides, or in a heavily polluted city, etc., in all these cases they should seriously consider the possibility of seeking a healthier environment for the well-being of their unborn child. Epigenetics today tells us that similar decisions can be of vital importance for the psycho-physical health of the child.

Healthy home environment

A healthy lifestyle also means a healthy and healthy "home" environment.

1. The home where a pregnant woman lives should be bright, quiet and peaceful.
2. The woman should feel perfectly at ease, in tune with her partner who should take care to create a warm and welcoming environment around her.
3. The house should then be in a quiet social and environmental context, where there are no difficulties with neighbours or people living in that context, where there are no disturbances of any kind, such as noise.

Healthy workplace

The workplace, as far as possible, should also have the same characteristics,

1. The pregnant woman, as long as she does not go on maternity leave, should feel welcomed and appreciated,



2. the environment around her should be calm and welcoming and
3. she should be relieved of all those tasks that may be physically or psychologically harmful to her health. There are laws in every state to protect pregnant workers.
4. Women should be informed of their rights and how to exercise them.

Social context

Finally, for a healthy lifestyle in relation to the environment, pregnant women should also develop a balanced relationship with the social context in which they live.

The social context has two aspects:

- the "real society" the people and the community in which she lives
 - the "virtual society", composed in particular of social networks and media. This last aspect of the environment that we can define as "virtual" is becoming more and more important as we are more and more solicited by information, contacts, relationships, messages of various kinds, which stimulate contrasting emotions, but often activate anxiety, concern, anger, which, according to many researchers, are detrimental to the well-being of the future child.
1. The social context, the real one, as well as the virtual one, are of extreme importance for the pregnant woman, since society should have the task of supporting and supporting the future parents.
 2. The pregnant woman should feel supported by the state and should be able to take advantage of all the facilities that allow her to live the nine months of pregnancy in the best possible way.
 3. All this information should be passed on to future parents so that they are aware of the importance of living in a healthy and healthy environment. As far as possible these aspects should be explained well before conception, as it is often impossible to change the context in which one lives during the nine months of pregnancy.
 4. Awareness of how harmful air, environmental and electromagnetic pollution can be should enable future parents to correctly assess whether the place where they live is suitable for the well-being of the pregnant woman.

Of course, the problem of the environment is complex, as the couple who decide to have a child can only partially affect the environment in which they live. Deciding to change home and the place of residence is often complex because of all the factors connected with it, such as the place of work, the presence of other relatives who can help, the emotional bond with a certain place, etc.

When we talk about the environment, we cannot forget the climate change currently underway and the economic model adopted by states, which aims primarily at development and growth, to the detriment of Nature (environment) and the healthiness of the environment. In order to finally live in a context in which all places on the planet can be considered suitable for a healthy lifestyle, we need to change development models and current economic systems.

“Human use, population, and technology have reached that certain stage where mother Earth no longer accepts our presence with silence.”

— **The Dalai Lama**



The quality of life of a nation or a society should be measured according to the level of well-being of its citizens, but not only material well-being, but also psychological and emotional well-being. A model of development that puts the wellbeing of man and the environment back at the centre, and no longer profit. With such a model all the environments in which man lives would return to being healthy, harmonious, vital, favouring a deep psychophysical well-being for future generations. If we think of the environment from a global point of view, with reference to ecology, all educational programs should always deal with the environment, because a healthy and healthy environment promotes the health and vitality of those who live in it.

Communities and schools should plan meetings and debates on the environment and the importance of living in a healthy and pollution-free environment. In relation to this issue, new discoveries concerning the principles set out in epigenetics should also be taught and disseminated on a large scale, as they sanction the effect that the environmental context has, not only on our health, but even on our genome.

This information should therefore be shared first of all in school contexts, with ad hoc lessons, meetings and discussions, in particular with regard to the environment, pollution and what can be a lifestyle suitable for creating a harmonious relationship between man and the environment in which he lives.

For example, choosing to eat organic products to encourage producers to pay more attention to this aspect, or trying not to use polluting products, or goods and services of companies that produce toxic products, etc.. The issues concerning the effect of the environment on lifestyle should be dealt with not only in schools, but also in other social contexts, through meetings and debates, publications, leaflets, but also in institutional contexts so that each municipality, region or state decides to restore all contaminated places by limiting as much as possible the sources of pollution, such as electromagnetic pollution, whose consequences on the health of people, animals and plants (as in the case of experiments with 5G) are not yet known in depth.

Also with reference to the "home" and "work" environment, this information should be disseminated widely, not only in schools but also in all other social contexts. As these two environments are fundamental for the psychophysical well-being of a pregnant woman. It is true that in this case the quality of the environment is determined above all by the type of relationships that are established with the partner or with the employer and colleagues, but the structure itself, i.e. the physical place, "home" and workplace also play a decisive role. Parents-to-be should be able to organise their home in such a way that it becomes cosy, joyful, i.e. that it has a positive effect on the mood of those who live in it. The way it is furnished and maintained is therefore important; a dirty, sad, neglected house will not foster positive psychic states in women. Attention to these details is important, as we have seen how much the environment affects the proper development of the fetus in the prenatal period.

Finally, also with regard to the relationship with the environment, which we can define as social, it is fundamental to already provide adolescents with correct information. We are in the era of communication, media and social networks, which together constitute what we can define as the virtual environment of our existence. The interaction with this virtual environment, as far as the relational level is concerned, can also be seen as a part of the environmental context we are analyzing. Not only because the excessive use of modern mobile phones subjects people to



continuous radiation, and therefore to an excess of electromagnetic pollution, but also because this interaction affects the way of thinking, perceiving and living reality. Virtual reality often becomes more "important" than the reality around us. Young people, already in schools, should be instructed to develop a correct relationship with modern means of communication. Of course, these communication tools also bring great benefits, but you need to know how to use them intelligently, for example, avoiding creating dependencies with social networks, as they affect the mood of those who use them, and as we have seen, this can be detrimental to the pregnant woman.

Here are some proposals for a wide dissemination of this information:

1. **Information and advice desks dedicated to the relationship between pregnancy and the environment:** Citizens can request information and / or advice at these counters. You can organise temporary or permanent desks according to the need for information to be communicated and can be located at the Town Hall, decentralized in different areas of the city or itinerant. It is essential that the operators have an excellent training, concerning the very topics on which they are called to disseminate information.
2. **Events or moments of direct meeting with citizens:** Organization of seminars, round tables, events, municipal assemblies open to the public, lectures, classes, etc.
3. **Information and communication campaigns:** The purpose of the communication or information campaign is to promote a particular service or product. A communication campaign may also aim to raise awareness: in this sense it seeks to promote a certain behaviour or attitude.
4. **Brochures:** The booklet is used to communicate in a simple and clear way with users, with the following objectives: to make available a sort of simple mini-guide on the subject.
5. **Telematic tools:** Thanks to the help of new technologies it is possible to inform and communicate with citizens, adopting a multi-channel logic (websites, facebook, instagram, youtube, etc.). Multichannel allows to use different communication channels to inform citizens and in particular future parents about the relationship between the environment and pregnancy. In addition, with the contribution of the Internet you can create virtual communities capable of spreading quickly, with the use of modest resources, ideas, information and trends.

The core information future parents should get is that every day they can take simple small steps to accomplish their mission experiencing emotional harmony, balanced relationships, ecological choices for eating, breathing, exercising, practicing self awareness and personal development. A true prenatal education will turn becoming ecological. A broader perspective of parental responsibility includes not only the care for the health and fulfilment of the next generations but also the attentive care to maintain the health of the environment in which we all live.



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