

Delay in the Procreation Age and Infertility. Turning to Assisted Reproduction and Embryo Selection. The Intergenerational Issue.

1. The delay in the age to conceive influences in fertility

Society has experienced great changes in the roles traditionally given to men and women. The incorporation of women in the working environment has entailed that the formation of the nuclear family is postponed until the wished upon career advancement has been reached. This has generated a postponing each time greater in the childbearing age. But the biological clock continues its rhythm and a woman's reproductive ability is not the same at age 25 as it is at age 35.

Meanwhile the rate of sterility, the incapacity to conceive without resorting to artificial fertility techniques, maintains itself at approximately 1% and does not depend on the age, fertility has decreased dramatically in the last few years, affecting 15% of couples. This decrease in fertility is attributable in the first place to the ageing of the gametes (eggs and spermatozooids) over time.

In women, the ripening of ova is carried out strictly following the biological rhythm. The origin of the ova begins in the embryonic development with the proliferation of parents' primary cells. With sexual maturity, and by the action of the follicle-stimulating hormone (FSH), that gradually transforms the primordial follicle, the ripening of the ovum is produced periodically. Fecundity is cyclical and its threshold is menopause in females, contrary to the lineal fecundity in males.

Although up to the moment a standardized procedure does not exist to assess the correct functioning of the ova, it has been proved that the amount of ovarian follicles, the ovarian reserve and the quality of the oocytes diminishes with age. The ripening of an oocyte is the result of a long and regulated process, especially consistent in gene expression regulation. And the pattern of gene expression changes during ripening. Numerous groups of genes express themselves in a different way in women younger than 35 years of age and in women between 37 and 39 years old. These genes play an important role in the regulation of the cell cycle and oxidative stress.

Another main cause of the loss of the reproductive capacity in women is the damage of the fallopian tubes, which can lead to pelvic inflammatory disease (PID). It evolves in many cases as a result of sexually transmitted diseases such as gonorrhoea or Chlamydia infection. Although not all cases lead to reproductive maladjustments, it is widely understood that 22.5% of women who had been diagnosed at one time with this type of alteration developed sterility.

Approximately 25-30% of cases of a couple's infertility is due to male factors. Age also affects male fertility. The most common causes of masculine infertility is related with sperm quality. Several studies maintain that throughout the years semen volume and the mobility of the spermatozooids progressively decline. The loss of mobility can be due to some extent to changes in the epididymis function or of the accessory sex glands and these alterations are usually accompanied by abnormalities in gamete morphology and an increase of the deterioration of his DNA.

Other factors exist that can affect the quality of the masculine sperm. Increasingly, data backing the fact that environmental pollution by nitrogen oxides, carbon monoxide, lead and other heavy metals or the consumption of contaminated foods with using the same methods, seriously affects the capabilities of the masculine sperm taking into account the classical seminal parameters as well as the damage of the gametes at a genomic level. Since more than a decade ago, it is known that pesticides and the “environmental endocrine disruptors” are causes of infertility and sterility in males.

Apart from age fertility is also altered by smoking, overweight and physical inactivity, anorexia and diabetes, and stressful life situations.

Genetic alterations, so much so in ova as in spermatozoids, can happen with more probability as time passes and can be the underlying causes of fertility loss.

In short, infertility analysis-measures such as the number of cycles required to conceive, with unprotected sexual relations physically or pharmacologically-according to age show that there is a notable tendency to a decrease in fertility in women from 35 years and onward. In addition to the advanced female age add the male’s age although their loss of fertility happens moderately and at very advanced ages.

On the other hand, the confidence that assisted reproduction techniques solves possible problems leads to the outcome that couples increasingly delay the conception age to after thirty for their first child. Some women even have their oocytes frozen before age thirty to later on resort to IVF techniques for the first child.

Several studies emphasize that this fact implies a continuous descent of fertility and a gradual increase of complications during the pregnancy and of alterations in the child’s development, and her future fertility, if the aged ova are fertilized.

Some of the gamete alterations of the parents have influence during the embryonic development of the children, in such a way that it entails health risks and that can be passed on to the following generations since these induced alterations during the early development can be permanent, in contrast to the changes that occur during adulthood.

Thus it is an intergenerational problem that requires careful attention and reliable information that allows for possible consideration.

2. Reproductive Age and the western demographic winter

It is a fact that fertility has decreased. To reach the natality balance that guarantees the generational turnover means that 2.1 children are to be borne from each female in each country. And the majority of nations are very underneath that birth rate.

Theoretical models maintain that all nations go through three phases of demographic change, going from declining birth rates-the current situation in the majority of developed nations- to rates below the level of replacement that all developed countries except the United States of America are experiencing-, and finally to the recovery with rate close to the turnover, by a few Northern Europe nations, due to immigration. For those who adhere to the hypothesis of generational recovery say that the fall of European rates of fertility can be because women postpone maternity. According to

theoretical models, the result of the delay to conceive can be permanent for the population as a whole, even if it was not so for a woman.

The UN has reversed a decade of speculations on the western demographic winter, to now pose the old estimate as lacking in rigour that assures that each nation will reach the level of natality required for the generational turnover by 2100, and then-threatening once again- there will not be enough reserves and resources.

However, the real data of fertility differ. Recent reports of the European Commission and the Japanese government, for example, assume that fertility will remain close to the actual levels, that are around 1,3 in Japan and 1,46 in Germany.

It is very significant that the German Minister for Family, Kristina Schröder, announced that Germany would begin to pay families to use IVF technologies to achieve births, in women who are at the age limit of their biological clock.

3. False assumptions on birth control methods on ageing

Another factor related to infertility-age-ageing of the gametes has been the perception without any scientific basis, to the advantages of hormonal contraceptives and disadvantages of the natural systems.

In the first case it is assumed that hormones delay the ageing of the oocytes, by preventing the ovulation, but there is no data to conclude this consequence.

Secondly, it was claimed that the fertilizations that are produced in the days further away from the prolific period would entail, because of the ageing of the gametes, serious defects for the children, apart from causing numerous embryonic deaths.

The article written by Gonzalo Herran published in issue 75 of *Cuadernos de Bioética* “Retractación de artículos en bioética: propuesta de un caso paradigmático” (“Retraction of bioethical articles: a proposal of a paradigmatic case”), analyzes, rigorously, the influential article published in 1976 by Bernard Häring⁹ who harshly criticised the natural method of birth control based on periodic abstinence. According to his assertions, his criticisms were not based on theological-moral arguments, but on “overwhelming” evidence provided by biomedical research.

His premises were that there was an undisputable relationship between the frequency of a spontaneous abortion and the over-maturity of the spermatozoids and, especially, of the oocytes. Thus the rhythm method, in the way that it had been used until then, caused a considerable loss of zygotes and there existed a relatively high frequency of chromosomal abnormality in foetus after the fertilisation of aged gametes.

The apparent early abortive character attributed by Häring to the rhythm method was regarded by bioethicists as precipitated conclusions and that went beyond the scientific conclusions of the authors that they are based: the data lacked selection bias and were misinterpreted. They are manipulated in order to change mere hypothesis and suggestions into factual, solid and overwhelmingly facts.

⁹ Häring B. “New Dimensions of Responsible Parenthood”. *Theological Studies* 37, (1976), 120-132.

There is no data that supports that retarded fertilisation regarding the moment of ovulation can act as a cause for spontaneous abortions and malformations. Studies with animals, with the toad *Xenopus*, show the relationship of abnormalities with the hyper-maturity of the oocytes inside the follicle, which has nothing to do with periodic abstinence: there is no deferred ovulation.

This fallacy has not been retracted. And the social impact that it caused continued fostering the discredit and distrust towards the natural system. Only in the voice “Contraception” of the Lexicon of Bioethics, signed by this author, and published a year after his death, does not refer to the aged gametes or to the damage tied to the realisation of natural methods. Even in the article accompanying “Contraception” the authors asserted: All the methods of natural family planning have the advantage of being absolutely harmless. It does not imply any hazards, it has shown that here is no risk of aged gametes.”

This is very clear: nature is in charge of selecting the gametes for a fertilisation when this is not forced upon artificially.

The natural reality is how it is and not how the ideologies of any sign want it to be to set some theoretical limits. The solution always comes from looking at reality without any bias seeking the certainties that we can reach with the full rigor that the scientific method requires.

4. Resorting to Assisted Reproduction Techniques

The childlessness levels have grown reaching 15% of couples. More and more In Vitro Fertilisation (IVF) Techniques are resorted in order to achieve a pregnancy. Through these techniques oocytes and spermatozoids outside the feminine reproductive tract are brought into contact, in a culture media that facilitates fertilisation.

One form of IVF is ICSI (intracytoplasmic sperm injection) where the injection of only one spermatozoids inside the egg. It is offered to couples with severe factors of masculine infertility, whose probabilities of procreation by means of *in vitro* fertilisation are limited.

In both methods of IVF ovarian stimulation is needed to obtain more than one or two eggs, which mature naturally because of the menstrual cycle. Ovarian stimulation is also required for the insemination and in some fertility treatments.

To induce fertilisation clomiphene citrate, human chorionic gonadotrophin, or the recombinant follicle-stimulating hormone is used. Some women-without it being predictable-produce an excessive ovarian response to exogenous hormones and suffer the so-called ovarian hyperstimulation syndrome that causes the women considerable damage. Also, although there is not enough conclusive data, it should be reported that in some studies it has been observed that to women who were administered drugs for ovarian induction during more than twelve months, had two times more risk of developing cancer than those that finished the treatment in less than a year. For

example, tumors such as uterine, ovarian, breast, malignant melanoma and Non-Hodgkin's Lymphoma cancers.

These techniques lead to two serious deficiencies with respect to natural begetting. In the first place, the gametes are not detected in their state of adequate maturity and in the natural state of fertilisation but that this strengthens and realises itself lacking the fertilisation potential one or two gametes. In the second place, just as much the embryo in its original stage of development as the maternal uterus they are deprived from the maternal-filial communication that is what permits and facilitates the nesting.

There also exists an increasing alarm among neonatologists and pediatricians in the face of the higher risk of suffering illnesses and malformations in children originated by *in vitro* with regard to those begetted naturally.

5. What happens with women at an advanced age that resort to in vitro fertilisation techniques?

As is analyzed in the article "Retraso de la edad de la procreación, incremento de la fertilidad y aumento del recurso a la reproducción asistida" ("Postponement in the procreation age, increase in the fertility and increase in the turning to assisted reproduction. Consequences on the child's health"), published in issue 75 of Cuadernos de Bioética, it is known that the effectiveness rate lowers with a woman's age drastically after age 35, being practically nil at forty. In such a way that from 35-37 it is advised to use the eggs of a young donor and, it will be dealt with later, subject the embryos to a prior diagnosis to the implantation because of the frequency of chromosomal abnormalities that appear with age.

The European Society of Human Reproduction and Embryology (ESHRE) turns out every year a publication of the results obtained in European centres. According to the last report published in 2010 the global rates of efficiency are estimated at almost 30% of pregnancies produced by ovarian stimulation cycle. In the previous report the pregnant efficiency index by groups was separated according to women's age group. The given facts were confirmed in this manner. The results with the two techniques-IVF and ISCI-show a loss of the effectiveness around 33% in age groups between 33 and 39, 13% at 40 to 44, and 1% from age 45 on.

Artificial insemination, which consists in depositing a great amount of spermatozoids at the moment of ovulation in the feminine reproductive tract, either in the cervical canal or inside the uterus has a lesser effectiveness rate than the IVF: 14% for each ovarian stimulation cycle. When 12 cycles are accumulated a pregnancy is achieved 77% at age 30-34 and decreases to 52% for those in the 40-45 age group.

It is a moral duty to inform, without evading uncomfortable facts for Assisted Human Reproduction Centres, which are resorted upon every time more for egg and sperm donors. Among other consequences weakens or breaks the close human parentage bond and the couple's stability.

6. Indications for the Prior Genetic Diagnosis (PGD) and the Prior Genetic Screening (PGS) to implantation

The article “Selección de embriones humanos. Diagnóstico Genético Preimplantación, (“Selection of Human Embryos. Pre-implantation Genetic Diagnosis”), published in the same issue number 75 of Cuadernos de Bioética, analyzes the 10 years of history of diagnosable techniques for the selection of *in vitro* embryos, showing the enormous deficiencies and errors that still have not been rectified.

The Preimplantation genetic Diagnosis (PGD) consists in selecting embryos originated by *in vitro* that have certain genetic characteristics, and in rejecting those that could inherit a genetic defect, a genetic predisposition or a sex not desired for before transferring them to the uterus to proceed with their embryonic development. To do so, a biopsy of the embryo is required: one or two cells are extracted, usually on the third day of life when it reaches the stage of eight cells.

The genetic analysis is well carried out to detect chromosomal abnormalities and sex-linked illnesses-Fragile X syndrome, Duchenne muscular dystrophy and haemophilia- to detect alterations in genes that cause monogenic sicknesses such as cystic fibrosis, beta-thalassemia, myotonic dystrophy or Huntington disease. Since its start in 1990, the PGD puts forward itself as an option to invasive prenatal diagnosis prior to childbirth of a eugenic abortion.

On the other hand there is the Preimplantation Genetic Screening (PGS) with which the embryos are analyzed to discard those that carry aneuploids-changes in the number of chromosomes-. It is indicated to improve the implantation rates in women of an advanced age, failures in prior IVF attempts, women that are subject to repetitive miscarriages or in the cases where there is a severe masculine factor. For the analysis at least one embryonic cell is required.

These technologies have been set down in IVF centres all over the world and the Screening is recommended to all women of an advanced age to procreate, to try to avoid pregnancies of embryos with chromosome defects. But it turns out that up to the date the studies which have concentrated on this topic have not shown that this is so.

In fact, the European Society of Human Reproduction and Embryology (ESHRE) has recently published an article where it states that “there is no evidence that the routine realization of these technique causes benefits in women with an advanced maternal age and that there also is not enough sufficient data to recommend it in cases of repetitive miscarriages, implantation failure or severe masculine factor.

However both eugenic practices, that imply the selection of embryos seems to have turned into a routine process in IVF clinics. The Consortium of laboratories of analysis linked to IVF centres, (the ESHRE PGD) has completed ten annual Reports on IVF cycles that include the DGP and the PGS in different European countries.

The increase in the number of cycles that include the diagnosis (PGD and PGS) has grown from Report I to X of 116 to nearly 4000 in the intervening years. The majority of the cycles with Screening (PGS) correspond to women of an advanced age for procreation.

Several aspects require the unavoidable ethical duty to inform on this form of eugenics that, apart from being so and directly and intentionally destroying the lives of human beings in their first stage, does not meet the essential minimum requirements in a scientific or biotechnological investigation.

- a) The prior tests in animals to validate the techniques by which serious errors exist in the diagnosis of false positives and false negatives. The analysis system has resulted incapable of detecting the alterations that are being searched for; in part because the biopsy has been taken on day three when the situation of the chromosomes of one cell is not representative of the embryo's cells. And there are also errors of diagnosis because the technique can not examine all the chromosomes.

166 non-transferable embryos have been analysed again after the Screening carried out by indication of a mother of advanced age and it has been demonstrated that 4% were false positives and just as much were false negatives. Thus, the screening detects chromosomal anomalies in the cells but does not determine the exact chromosomal constitution of the embryo. It is not valid.

- b) Recently it has been discovered that some discarded embryos can eliminate their defects by development two days after the biopsy. The event that occurred in July 2011 is very significant. In the *meeting of the European Society of Human Reproduction and Embryology held in Stockholm, a study by the team of Kearns was made public that showed that embryos with defective cells at day three of life, for having more chromosomes or less, can really correct their genetic errors two days later.*

Certainly, few are the discarded embryos that are donated for investigation which survive, but the majority of those that do so are normal. This possible recovery of damaged cells at the beginning of their development was dealt with in the nineties but it was refused to be taken into consideration. Now it is difficult to ignore and should suppose a drastic change in the prior diagnosis to implantation. Everyone agrees that this question should be investigated to such an extent that the obligation of freezing abnormal embryos is approached that they stay in a viable state until it is known with certainty what such a recovery means.

- c) It is not known with certainty the effects that a biopsy per se has in the embryos that have been diagnosed, selected as healthy and transferred to the mother. Prospective work that comparatively analyze the health of children born after the biopsy with others born by IVF and ICSI but without it, in the same centre and in similar years, alert on the increment of perinatal death, low weight and prematurity as a consequence of the biopsy. Other studies showed this tendency and a high rate of malformations is mentioned.

This data does not permit at this moment a rigorous conclusion but it can not be ignored, all the more so when studies performed on animals show a negative effect of the biopsy in the embryo, foetus, new-born and adult.

Although everyone admits that it is very questionable an analysis based on a one-cell study, and the shadow of a negative effect of the biopsy on the normal foetal

development, there is an effort to find a way out on applying these techniques. A balance is tried to be found between the autonomy of the parents- that presuppose the right to a child and that it be healthy- and the obligation of the clinicians to take into account the health of the children that are born as a result of these technologies.

However, interest focuses on supervision on behalf of the consortium of diverse laboratories to help ensure the correct use of the materials commercialised for the techniques and that the system is not discredited that entails high economic gains for firms and centres. And however, the serious problem of lesions and provoked deaths is not taken into account as is the use of live human embryos to validate some techniques, etc. The panel for the accreditation of the laboratories has conducted two meetings with the sponsorship of the company EuroGentest that commercialises the materials for the diagnosis.

These techniques are not only a eugenic practice *but have serious objections of science. The probability of success in a pregnancy does not increase by the use of genetic diagnosis prior to implantation, three days after fertilisation and then to count the chromosomes. It is a message that society should know about.*

7. The cryo-conservation of ovum and spermatozooids

In the case that the woman suffered a cancer, whose treatment entailed risk of infertility, there have been attempts to save the ovum by cryo-conservation although without knowing with certainty if good results would be achieved due to the fragility of these cells. A procedure of cryo-conservation of ovary biopsies has also been begun but is still in its experimental stage

In the case of males the number of affected has increased in the last twenty years in the reproductive years especially with leukaemia, Hodgkin's lymphoma and tumours of the germinal cells of the testes. The loss of fertility has been tried to be fought with the cryo-conservation of semen before beginning treatment. But in the case of a tumour in the germinal cells, from where spermatozooids develop, they are already affected at the moment of diagnosis, so this plan of action is of no use.

The idea of freezing the ovum, which was originally applied to alleviate the drop in fertility of cancer patients, was later posed as a way of maintaining the ovum fresh for later use. However the technique has not given positive results.

8. Risks for the descendants in relation with the procreating age

Ovarian stimulation, accompanied or not by one of the assisted reproduction techniques, is not in fact a solution to the difficulty of procreating at a later age.

Also there exists an increasing alarm among neonatologists and pediatricians before the greater risk to suffer illnesses and malformations of the children generated in vitro in regards to those begotten naturally which entails the obligation of a rigorous exam of the consequences of the application of this technology, which more often is turned to by women due to age.

Other harms for the offspring are directly relevant to the parent's age of the parents. Among them is the higher risk of delayed intrauterine growth that is defined as the pathological reproduction of the rhythm in foetal growth, when the mother is younger than 20 or older than 35. It results in a foetus that does not reach its growth potential and is in danger of suffering perinatal complications and death with a higher frequency than normal foetus.

Advanced maternal age is associated with having a higher risk of presenting chromosomal abnormalities, such as Down syndrome and mental retardation. On the other hand, paternal age has been linked with malformations and diverse congenital disorders.

An important study, published recently¹⁰ states that the offspring of parents of advanced age have an increased risk of illnesses, especially cancer-the daughters of older mothers have more of a risk of breast cancer and the sons of older fathers of prostate cancer-, diabetes disorders of neural development; specifically autism, obsessive compulsive disorder, schizophrenia, bipolar disorder and stuttering. And it shows that the cause is not only attributable to the lack of disjunction or chromosomal realignments but to the natural aging of the gametes over time.

9. What does the biological clock of the transmission of life mean?

Throughout millions of years, evolution has adjusted the best of possible processes to transmit life. Without them mammal species would not have endured and we would not be here. In the centre of life is the transmission of the genetic information of the parents to the offspring.

With fertilization, natural or *in vitro*, the passing of an ovum, reached by a sperm, a zygote, the single totipotent reality capable to prompt the development of an individual. This transition from ova to zygote is one of the most complex and controlled transitions of biology. And we can add more challenges. Indeed, only one ova and spermatozoid, in the exact moment of maturity-and with it the genetic background in the state required by the biological clock of that person-can mutually fertilize and generate a zygote that "premieres" its program of development and life. Only then the zygote has zero age in its clock and begins to live without aging that do not correspond to its age. Its genetic pattern is renovated.

The organism depends on several clocks that indicate the times of the different body processes. We are going to refer to the one that keeps track of life and allows that individuals of all types have the maximum amount of years of life. It is a sand clock which turned upside down when it is engendered, at the end of fertilization, and that inexorably at 110 years in our case all the sand will have fallen to the container on the bottom, if before because of sickness, scarce health means, or accident has not taken the lives. A clock that does not have to be manually wound up.

Each organ, tissue or system of the organism grows, matures, and ages at a different rate but it does so in the same organism that, in turn, has in each stage and throughout its life

¹⁰ Adkins, RM, Thomas, F, Tylavsky, FA, Krushkal, J "Parental ages and levels of DNA methylation in the newborn are correlated" *BMC Medical Genetics*, 12 (2011), 471.

an exact age. The brain does not age at the same rate as the gametes or the ova as the spermatozooids.

How does the organism keep track of an individual's age? Systematically each time a cell divides in two, in its genome a mark in certain zones is made or a mark is eliminated from others. These marks are chemical-an introduction or elimination of a methyl group-in one of the four bases that are the ashlar stones in the long DNA chain-specifically the so-called cytokine-. Thus this means that throughout time, the chromosomes of diverse cells of the organism presents a pattern, exact and specifically of age and sex, of methylation of cytokines.

And what happens with that changing pattern of chemical marks in the genome? Something so important that it is how some genes that change into proteins and others are not are regulated in each moment and in each body part. This is how the kidneys or the eyes begin to be formed, grow, mature, stop growing, age at certain fixed moments and in the place that corresponds to them at waist level or in the head below the forehead level. An alteration of these marks involves developmental abnormalities, diseases linked to that process, or a predisposition to having them.

The reason is very simple: each gene has in front of them a region, called promoter, which has to receive a signal that indicates that the gene has to change into a protein. If a cytokine of the promoting region is covered with a methyl the signal does not reach. That is to say then that the change of methylation pattern implies regulating gene expression.

During the process of formation and maturity of the ova and spermatozooids the genome goes on developing their own and specific pattern, which if fertilised transmits the genetic inheritance with the father's and mother's mark. And the most important thing that happens in fertilisation is that this paternal mark, which permits them to be gametes, changes drastically in those hours: the genome provided so much so by the egg as by the sperm take away markings from some zones and puts markings in others, in a very precise way, resulting in the genetic heritage of a child with their own markings from the moment life begins.

If they exist, in one or another gamete the markings that do not correspond to a mature gamete of an organism at reproductive age, they do not change in the fertilisation process and, therefore, the child can receive in some moment of its development a mistaken signal.

It is understood in this manner that some neurological disorders will present themselves more frequently in children with older parents. We will focus on Autism.

10. Autism

Autism is a chronic disorder that appears before age three, and that brings about serious developmental and behavioural deficiencies that impede social relationships, language and communication, and that cause stereotype and repetitive patterns of behaviour.

Its prevalence has increased in the last few years, from 5 to 50 cases for every 10000 children born, that in some way can be explained as the result of improvement in

diagnosis. However, several studies link the advanced age of the parents with the risk of their children developing autism.

An array of genes whose alteration has to do with these disorders is known; the alteration can be because of an inherited mutation of a gene-more frequent as the age is higher- or by a change in its regulatory system to change into a protein. These genes are responsible for the transmission of signals in the brain, which explains why it constitutes a congenital disorder of the cerebral function of development.

Although a variety of altered genes is observed in autism, all of them are involved in the communication between nerve cells¹¹. The proteins that codify are in charge of anchoring well the receptors of the membranes of the two neurons that interact among themselves-synapses- permitting the transmission of signals between them. Others, like *reelin*, are proteins that allow the neurons to reach its exact location and it spreads out correct connections with other neurons. This deficiency in the cerebral structure affects the connections between the different regions of the brain. Among others, the hippocampus that collaborates in the segregation of the memory, especially the emotional memory, the cerebellum that directs involuntary movements and the muscular tone and the very important connections of the amygdaline complex with the frontal lobe that integrates the cognitive with the emotional, permits the acknowledgment of the emotions of others by their facial expressions, etc.

11. Finding solutions to an intergenerational dimensional problem

The data provided shows that the undesirable complications of delaying the procreating age of the first child not only has satisfactory solutions not been found but that it does not appear that it is appropriate to manipulate the biological clock of feminine fertility.

It is obvious that to change the biological clock without negative consequences for the children, and for the mother, is not possible. Neither IVF nor the freezing of “young” oocytes, resolve the infertility that is naturally provoked by age. The delay of conception poses, in fact, a problem for the procreating dimension, of a great human depth. And also a serious debt in altering the genetic heritage transmitted to the following generations, in spite of the tries of eugenics prior to implantation.

It is deduced then the necessity for an ample social debate that reflects on this question and broaches possible measures just as much labour as health care to modify the lifestyles that this problem generates.

As is logical we are not dealing with going backwards in the process of incorporating women into public and working life. Fortunately there is no turning back and it is each woman, each family that has to decide how to carry out the conciliation between working life/family life.. It is each family that has to be able to decide when to bring their first child into the world.

A point of view of great interest for reflection and social debate and that can propitiate others in favour of the procreating age should not be imposed by external factors, is the one provided by the professor of “Managing People in Organizations” Nuria

¹¹ Brose, N “Autismo” *Mente y cerebro* 38 (2009) 36-41.

Chinchilla that we then sustain: the added value to the company of paternity and maternity.

12. Maternity and paternity add value to the company.

Finding sustainable happiness implies recognizing that there are important realities in life that are above one's own business and profession. One of these realities is the family trajectory, specifically the roles of mother and father.

Nowadays, fathers want to equally share with the mothers the obligations of raising their children, however, the majority admits that they are far away from obtaining it as a survey of almost 1000 parents carried out by the Centre of Work and Family of Boston College.

In Spain the tendency is similar to the United States. There is a cultural change in the father's role (more willingness to compromise, to interact and to participate) although a radical change of behaviour still does not exist. La Rossa (1988) affirms that in the history of paternity *the culture of the fathers has evolved quicker than its conduct*. According to HETUS¹² Spanish fathers with children less than 10 years old, dedicate an hour and 31 minutes to their children on average while mothers dedicate more than twice that. Three hours and seven minutes. Even though, analyzing only the quality time, that is to say, the time that the parents dedicate to their children playing, reading and doing homework, is exactly the same in both cases: 23 minutes.

On the other hand, an extensive part of academic literature on work and family conciliation has based itself solely on the conflict, that is to say, in how the work and home responsibilities have negatively affected the lives of people. Nonetheless, in the last decade a new tendency has emerged that analyzes the benefits of participating in different areas (family-work-community), and have different roles. A long road still has to be trudged on, but the first studies show that the parents who actively participate in the care of their children and in the household tasks develop qualities (empathy, leadership,...) and skills (time management, teamwork, ...) and values (patience, initiative,...) that are key aspects for businesses in the 21st century.

During decades the world revolved around a mistaken paradigm: the idea that one's personal life, including family, was a type of impermeable bubble and that what happened inside it was not determining for the environment. Today we know that the family has a pivotal role, because inside it human capital is formed, people, and the social capital, the capacity to commit oneself and to generate stable ties¹³.

One way of seeing the social and business benefits of such conciliation is the analysis of family-work enrichment, that is to say the extent in which the experiences obtained in a role better the quality of life in the other role¹⁴. In the Centro Internacional Trabajo-Familia of the IESE Business School, we have measured the perception of family-work enrichment as part of the "IESE Family-Responsible Employer Index", (IFREI by its English initials). The measure, in April 2011, was carried out among 4,359 employees

¹² Harmonized European Times Uses Survey, HETUS, 2007.

¹³ Chinchilla, N. y Moragas, M. (2009), *Dueños de nuestro destino*, Barcelona: Ariel.

¹⁴ Greenhaus, J.H. Y Powell, G.N. (2006), "When work and Familias are Allies: a Theory of Work-Family Enrichment", *Academy of Management Review*, Vol. 31, No. 1, pp. 72-92.

scattered in 22 countries around the world, in which 60% are males and 40% are females. To the question, “The fulfilment of my family responsibilities has enriched the interpersonal abilities to have success at work”, the participants responded with an average of 5,65 in the Lickert scale from 1 to 7, where 7 means “Completely in favour.”, the mode being 7. To the question “Overcoming home obstacles has given me confidence in carrying out my abilities at work.” the answer was 5,64. To the question, “Managing multiple tasks in the household has improved my ability to carry out multiple tasks at work” the answer was 5,22. And to the question “Being involved at home has permitted me to better understand my co-workers” the response was 5,43.

McNall, L.A.¹⁵ did a meta-analysis of 25 studies on the effects of work-family enrichment and finds a significant correlation of living paternity and maternity with being satisfied at work, commitment, the minor intention of leaving the company and better mental and physical health of the employee.

Many employers complain about the imbalance of the curricula: technical perfection of the candidates but with human profiles that are often less than satisfactory. The truth is that the managerial skills most valued coincide in a great measure with those that are acquired in the family. The famous orientation to the client arises from the habit of thinking and acting in accordance to the needs of family members. Integrity emerges from the effort to earn the spouse’s and the children’s trust, by being coherent in what one thinks, says and does, etc.¹⁶

Another way of seeing the importance for the company is to understand what talent means for the firm and the difficulty of retaining the best in whatever stage of the economic cycle. Talent is the result of aptitude by attitude, or said in another way, the skills of the employee because of his commitment with the firm to put it to work in it. Being that it is a multiplication, if the commitment of one with the firm is of 0, even though his knowledge and skills are brilliant, his talent will be equal to 0.

Companies have, then an imperative challenge: to develop policies and an organizational culture that favours the balance between work and maternity/paternity of their colleagues, in order to be able to conceive and raise children. This is a necessary investment for the corporate and social sustainability that is part of their obligations as an institution with a great Social Responsibility, since it is what impacts the most in the daily lives of the people. Hereupon, the real fertility rate is of 1,4 children per woman in the reproductive years (Eurostat, 2008), before the 2,1 children necessary to reach the replacement rate and the 2,4 of the fertility rate desired by the Spaniards (CIS, 2008).

Maternity and paternity apart from being an enormous contribution to leave the demographic winter that we find ourselves in and makes feasible the pensions system, helps those that exercise it grow and adds value to the venture. According to Alfonso Aguiló, “taking care of children is a great source of humanity” and according to Katherin Ellison “the altruism that maternity arouses and develops is one of the most powerful driving forces that moves forward our society each day”.

¹⁵ McNall, L.A., Nicklin, J.M.M and Masuda, A. (2010) “A Meta-Analytic Review of the Consequences Associated with Work-Family Enrichment”, *Journal of Business Psychology*, 25, pp. 381-396.

¹⁶ Chinchilla, N. y Moragas, M. (2009), *Dueños de nuestro destino*, Barcelona: Ariel

Also, IFREI 2011 confirms the very significant correlation between the flexible business environment and family responsible and the intention of leaving the company. This drop of 5,74 to 2,23 in the Likert scale 1-7 when you go from one company without policies or culture that facilitates the balance between a flexible corporation and family responsible.

And in the last Edenred study (September 1, 2011) to users of nursery school collects these relevant data: 63% of those surveyed stated they did not have enough time to be with their children; and 55% of workers would stop working to take care of their children-

In summary, maternity and paternity add three types of value to the company: economic value (minor intention of leaving the company, greater performance and execution, to go from single-tasking to multitasking, better interpersonal relationships, leadership and teamwork,...) psychosocial value (job satisfaction, greater compromise,...) and moral courage (positive learning and parent-employee virtues: better understanding of others, improve self-confidence, altruism,...)

Available articles in line with the scientific bibliography of the issues dealt with:

López Moratalla, N., Palacios Ortega, S. “Retraso de la edad de la procreación, incremento de la infertilidad y aumento del recurso a la reproducción asistida. Consecuencias en la salud de los hijos.” *Cuadernos de Bioética*, 75. (2011) (www.aebioetica.org)

Herranz, G. “Retractación de artículos en bioética: propuesta de un caso paradigmático” *Cuadernos de Bioética*, 75 (2011) (www.aebioetica.org)

López Moratalla, N. Lago Fernández Purón, M., Santiago, E. “Selección de embriones humanos. Diagnóstico Genético Preimplantación” *Cuadernos de Bioética*, 75 (2011) (www.aebioetica.org)

López Moratalla, N. “Objeción de conciencia a Técnicas de Reproducción Asistida” 2010 (www.arvo.net)

Sánchez Abad, PJ, López-Moratalla, N. “Carencias de la comunicación biológica en las Técnicas de reproducción asistida” *Cuadernos de Bioética*, 70, (2009), 339-355.