Genetics and Human Affairs dealing with Infertility and Super ovulation
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April Nicole Newkirk
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“I have neither given nor received unauthorized aid on this assignment”
Part A: Genetic information

Super ovulation and infertility are major concerns of the millions of couples trying to conceive today. Throughout this part of the paper I will discuss the genetics behind these two phenomenons. Although it is hard to prove, that old saying, “Twins run in families” has some truth to it. However the genetics related to infertility is more of a touchy subject and therefore not talked about as openly. Before we get into the genetics behind these concerns let us first explain the basics.

Beginning with super ovulation, this is the process in which multiple eggs are released during ovulation. This could be due to the female’s natural over production of eggs, or it could be a result of infertility drugs that increase egg production. Whichever the case, super ovulation often results in twin or higher numbered multiples. However, natural super ovulation results in twins and rarely triples; it is not likely to be higher number multiple. There are two categories of twins: Monozygotic (MZ) which refers to identical twins and Dizygotic (DZ) which refers to fraternal twins. The difference between identical and fraternal twins is in the egg(s). To be MZ twins, there is one egg and one sperm, once fertilized the egg splits and produces two eggs with the same DNA. Identical twinning is not inherited. Therefore MZ is not genetically influenced by family history which is coincidental that MZ twins are genetically identical, with little variations.

DZ twinning involves two eggs present during ovulation and two sperm. Once fertilized the two fetuses grow and develop on their own, no more alike than normal brothers or sisters. There is good evidence that DZ twinning is inherited. The old wives tale that the DZ twinning “skips a generation” is referring to father’s receiving the “twin
genes” and he does not have twins himself, for the fact that he does not influence egg production but he could pass the genes to his children and then shows up as a result of his daughters having twins. DZ twinning is also influenced by race; in the case of Caucasians, DZ twins are twice more likely than MZ twins and in some African races there is a 11-12 times increase to be DZ twins. The gene that causes DZ twins is likely to be many genes, not just a specific one, as well as many environmental influences that increase the likelihood of having twins. A possible genetic affect of increased twinning in families is due to the hormone FSH or follicle-stimulating hormone, as it is often higher in mothers that have DZ twins. However the “twin genes” are still unknown. Some environmental influences include: the female’s age or the number of births she has had, meaning those who are pregnant with their second or third child are more likely to have multiples than if it was their first child.

On the other end of the spectrum of super ovulation is infertility; however the outcome of the two often overlaps as I will discuss later. This is also genetically and environmentally influenced, however it is not as sexist as the genetics in DZ twinning in the fact that infertility can be present and expressed in either the male or the female. After all it takes two to tango. Infertility is a worldwide concern and it affects 20% of all couples attempting to get pregnant. Infertility has been defined as “1 to 2 years of unprotected coitus without conception” Such reasons for infertility in females are often found in the cervix, fallopian tubes, or the uterus. Other issues could be found in the

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hormones or insufficiency within the reproduction organs and or related organs such as a
dysfunctional thyroid gland or production in the ovaries. There are equal chances
among males and females as to the cause of infertility. The most common cause for
infertility among males is a spermatogenic defect, as well as other genetic factors such as
cytogenetic abnormalities and microdeletions of Y chromosome. Due to infertility’s wide
range of affected people, many studies are conducted to reveal any new causes, and
possible treatments of infertility. A recent study revealed a 5 fold increase chance of
infertility among females that have a mother or sister that has endometriosis. There are
an increase number of studies each year being done to unlock the secrets of reproduction.

One such breakthrough in reproduction and infertility is In vitro fertilization
(IVF). IVF is when eggs and sperm are collected; the sperm is injected into the egg, thus
fertilizing it, and then is transferred back into the female. Unfortunately, there is only
about a 30% success rate as of 2004 however this percentage is thought to have increased
since then. Increasing this percentage even more is an ongoing issue for genetic
engineers. Concerns with this procedure include, its cost which is very expensive
ranging from 10,000 to $15,000 as well as the uncertainty that the procedure will be
successful meaning resulting in a live birth. One reference revealed what has happened
since IVF was introduced: IVF is shown to be a safe and natural conception; the major
remaining problem is multiple births however IVF is becoming more and more popular

5 Hildt, Elisabeth, and Dietmar Mieth. In Vitro Fertilization in the 1990s. 1st. Great Britain: Ipswich Book
6 Daya, Salim, Roger Pierson, and Joanne Gunby. Research Papers in Fertility. 1st. San Diego, CA:
8 Daya, Salim, Roger Pierson, and Joanne Gunby. Research Papers in Fertility. 1st. San Diego, CA:
9 Perloe, Mark. "Duration, Cost of IVF Treatment." iVillage Total Health 09 Nov. 2007
among couple who are unable to conceive otherwise.\textsuperscript{10} The success of IVF includes many factors such as: a woman’s age, her reproductive history, obesity, as well as the duration of the infertility.\textsuperscript{11} Infertility is closely linked to a woman’s age as it is illustrated in the table below (as of 1996):

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Live birth rate/cycle (percentage)</th>
</tr>
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<tbody>
<tr>
<td>25</td>
<td>19.9%</td>
</tr>
<tr>
<td>30</td>
<td>16.9%</td>
</tr>
<tr>
<td>35</td>
<td>13.9%</td>
</tr>
<tr>
<td>40</td>
<td>8.2%</td>
</tr>
<tr>
<td>45</td>
<td>2.5%</td>
</tr>
</tbody>
</table>


Therefore, many geneticists as well as Obstetrician/Gynecologist recommend woman to reproduce or at least start trying before age 35. Other genetic influences on fertility have been linked to polycystic ovary syndrome (PCOS) which occurs in 5-10% of infertile females. The inheritance of this gene is unknown but evidence suggests that is in an autosomal dominant gene. This gene also is linked to obesity. Out of the women that are diagnosed with PCOS 48% of them are obese and as I stated earlier that also has an influence of infertility.\textsuperscript{13}

\textsuperscript{12} Hildt, Elisabeth, and Dietmar Mieth. \textit{In Vitro Fertilization in the 1990s}. 1st. Great Britain: Ipswich Book Company, 1998. Table 1:160
Coincidentally, both of the issues stated, super ovulation and infertility often overlap as a result of multiple births. The multiple births that result in fertility treatment are almost always DZ twins (or higher numbered multiples) due the reasons that fertility treatments either increase egg production or transfer more than one fertilized egg back into the female. As we can see in the charts below, there is a dramatic increase in multiple births from 1990 to 2004. This is mostly contributed to the increase in the use of fertility drugs.

![Number of Multiples in 1990](image1)

![Number of Multiples in 2004](image2)


However interesting natural super ovulation running in families is to geneticists, it does not cause a great deal of concern as the interest in infertility does. Reproduction is our purpose on earth and when couples are faced with being unable to fulfill this purpose many issues arise. Infertility is a major issue and genetic engineers are researching how to make the present treatments more effective. After a general understanding of the genetics involved in super ovulation and infertility, I will now go into the second part of this paper discussing the human affair related to the two.

Part B: Human affairs

After having a better understanding on the genetics behind super ovulation and infertility let us discuss and explore the human affairs issues as well as the ethical issues behind these two topics. Both issues have different human affairs however, as stated earlier, the two topics overlap meaning once the infertile couple overcome not being able to get pregnant they are often blessed by multiples and there lies the similarities in the human affairs and ethical issues between super ovulation and infertility.

Super ovulation’s human affairs are mostly dealing with feeding and providing for more than one child. It also has a lot to do with time management. New parents of singletons often struggle in these areas, just image taking those difficulties and multiplying by two. Another issue during a multiple pregnancy is the limited space in the mother’s tummy therefore the twins have restricted space to grow resulting low birth weights. Also related to the limited space in mom’s tummy can result in premature labor and dealing with two preemies only adds to the difficulties. The latest rage among mothers is breastfeeding. As you can image this too is an issue of a mother of multiples. These women consult a lactation specialist to learn different techniques to overcome this obstacle.\textsuperscript{15} Caring for multiples is a difficult task; it does not just deal with making sure you have two of everything. There are many things to take in mind. Linda Leonard and Jane Denton said it best in the article \textit{Preparation for parenting multiple birth children} “Multiple births are associated with substantial medical, health care, socio-emotional, developmental, educational and economic consequences for both families and society.”\textsuperscript{16}

The parents of multiples need to be aware of all of the components and how they differ from singleton babies. Most multiples developed in the normal range however there are some common issues that do arise. Multiples have a higher risk of developing cerebral palsy as well as learning and language difficulties. Twins are at higher risk for having attention deficit hyperactivity disorder and competition issues between the twins (especially for the attention of the parents).\(^\text{17}\) Other concerns with having multiples are finding a good balance of nurturing the twins into individual people without completely isolating them from each other. This often occurs when parents decide if they will dress their twins alike and whether to put their twins in the same classroom once they start school. Lastly a major obstacle with having multiples is finance.\(^\text{18}\) Children as a whole are very expensive; when you have multiples it is almost unbearable. The twins often grow out of their clothing at the same time, participate in different activities that require supplies or uniforms, they turn 16 at the same time and need a car, and go to college at the same time. Therefore it is very important for expecting parents of multiples to take in all these concerns and issues and develop a game plan that eliminates as much stress and complexity as possible. There are also a number of support groups to help with such needs such as: National Organization Of Mothers Of Twins Clubs, Multiple Angels Network, Sidelines National Support Network, Complicated Multiple Pregnancy Treatment & Support, Twin Hope, Inc. and many more.\(^\text{19}\)


When it comes to the issues related to infertility the discussion become a little more heated. Anytime science is used to solve issues in nature there are many views and ethical issues involved and overcoming infertility by use of fertility treatments or IVF is no different. IVF or the use of genetic engineering is often referred to as “playing God”. At the President’s Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, General Secretaries state “Those who would play God will be tempted as never before.” However when they called on three religious leaders their interpretation of the biblical text related to this issue was quite surprising. They felt there was a great deal of respect and encouragement in the growing development of knowledge about nature. Therefore, these three religious leaders endorse genetic engineers however not without a warning “misuse of human freedom [in reference to improving human estate] creates evil and human knowledge and power can result in harm.” However there are some scientists that disagree with “tampering with evolution”. Both Erwin Chargaff and Robert Sinsheimer are concerned about this issue. Chargaff states “the future will curse us”. Evolution has been happening long before we were here on this earth, and meddling with it could cause some irreversible damage. One Author sums this issue up “Humans can be wise of foolish: evolution can be neither.” Many individuals are concerned for this in reference to IVF.

Other concerns of IVF are the likely outcome of multiple births. This is much different than super ovulation because super ovulation normally only result in twins or triplets whereas IVF and fertility treatments can result in as many as six fetuses. Not

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only is fertility treatments and IVF very expensive, they bring multiples into the world making it even more financial difficult for the parents. My second concern referring to multiples due to IVF is for the safety of the fetuses and the mother. Parents expecting high numbers of births often reduce the number of fetuses in utero. Since this is looked upon as a form of abortion there are many critics. Since 25% of IVF result in multi-fetal pregnancies this is a reoccurring issue. Such health concerns are miscarriage of some or all of the fetuses, toxemia, high blood pressure, kidney trouble, complications in delivery, premature birth, low birth weight and post-birth hemorrhaging.24 Due to the controversial nature of multi-fetal pregnancy reduction (MFPR) there will always be opposing views and until abortion issues are resolved this will continue to be an issue. Scientist recognize the correlation of increased multiple births and IVF and some are conduction research to eliminate this problem. It seems like an obvious solution, decrease the number of eggs transferred into the mother or create fertility drugs that are more effective without increasing egg production to an unmanageable number. Such a project is the Belgian project. In Belgium they have decreased the number of embryos transferred into mothers since 1997, therefore resulting in a 24% decrease of multiple births in 2000.25 Since then, single embryo transfer (SET) has become increasingly popular and surprisingly reducing the number of embryos implanted has not affected the overall national results.

Lastly, once and IVF is successful and the parents are satisfied with the size of their family all the eggs and embryos are left in storage. It is estimated that as many as

400,000 embryos are stored in the US alone.\textsuperscript{26} Suggestions as to how to dispose or use these embryos result in more controversial discussions. Some are kept in storage for the possibility of future attempts of a pregnancy, some can be donated to others who are unable to conceive with their own eggs or sperm, and perhaps the most controversial solutions of them all are that the embryos can be used for research purposes or allowing the embryos to thaw and then be discarded.\textsuperscript{27} The issue comes down to whether people feel that these embryos are human or not. By disposing of the thawed embryos as if they are garbage creates waves among pro-life advocates. The use of scientific research of embryos is often linked to stem cell research which is also a significant debate among society and scientists. As you can see, tampering with nature causes multiple views and opinions as to the ethics behind such acts. Unfortunately, there does not seem to be a solution to these problems in the near future.

The reason I choose super ovulation and infertility is because they seem to go hand in hand but more specifically, super ovulation was my major interest. As they say “twins run in my family” and I was curious of the likelihood of myself having twins. My paternal grandmother was a fraternal triplet and there are a number of other fraternal twins on my father’s side. My grandmother had four children, two boys and two girls however none of them are a result of a multiple birth. As we stated earlier, the “twin genes” can be present in either sex but only expressed in females. Only one of my grandmother’s daughters reproduced and resulted in a single male. I am the only granddaughter on my father’s side, although I know that has no impact on my chances of

possible expressing the “twin genes” I was interested as to what to expect and my increased risk of have multiples. If I have multiples, I will take into consideration all that I have learned in reference to the developmental and financial issues related to raising multiples. My personal view as to the MFPR, meaning to reduce the number of fetuses is not a question for me. One reason is because it is not likely that I would have more than triplets which should not result in drastic reducing means and also because of my belief that each fetus is human and they all get a chance at life.