
The Changing Face of Feticide in Multiple Pregnancies

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ABSTRACT: The selective termination of one or more fetuses in higher order multiple pregnancies began in the 1980s in response to the increased rate of multiples arising from assisted reproductive technology (ART). Multifetal Pregnancy Reduction (MFPR) was justified by improving outcomes for the remaining offspring and their mother, and while the evidence suggests prematurity and the morbidity associated with it are reduced, there is a cost in increased miscarriage and mortality. As perinatal care has advanced, the margins of improvement have narrowed and hence the cost/benefit ratio. At the same time, MFPR has morphed from a rare procedure undertaken for quadruplets and higher, to one in which triplets and twins are increasingly reduced to a singleton, and more so for social reasons. This review considers the evidence for MFPR's efficacy and risks, along with those changes over time. Notably absent is research on the surviving children or the ongoing physical and mental health of mothers. The ethical reasoning used by practitioners and others is also explored, as is the culture of ART and abortion that drive the practice.

Introduction

Feticide in multiple pregnancies (FIMP) has been happening for nearly 35 years. During that time, it has gone from a rare procedure for the most extreme and difficult cases to a mainstream one for women with triplets and higher order pregnancies and increasingly for those with twins. In practice, it is different to aborting a pregnancy because surgeons aim to eliminate one or more fetuses whilst preserving others, rather than abort a pregnancy altogether. Nevertheless, the ethical similarities are obvious and yet complicated by the fact that some siblings survive, often by arbitrary choice. Justification for the procedure varies depending on the context.

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FIMP has been used to terminate one or more fetuses with an anomaly that may be serious, or at least with a risk of being so. This has variously been called selective reduction, selective termination (ST), selective feticide, selective reduction of pregnancy, or selective abortion. Regardless, the motivation is to prevent the birth of a child with a disability and permit the birth of a healthy child.

FIMP has also been used to eliminate one or more fetuses to reduce the risk of a poor outcome for the remaining fetus(es). This is usually called multifetal pregnancy reduction (MFPR), or embryo or fetal reduction. As a primary or secondary goal, MFPR may be undertaken to reduce the risk of negative outcomes to the mother's health and/or well-being. ST and MFPR have also been combined so that one or more fetuses are eliminated on the grounds of anomaly followed by further feticide to reduce risk for the remaining ones. Such a strategy minimises the risk of eliminating a healthy fetus and retaining a disabled one. MFPR has also been used to reduce the number of offspring for personal reasons.

The term FIMP is preferable as it is more accurate and descriptive for what is actually taking place in either context; however, where necessary and to distinguish between the two main contexts, as well as align with the most commonly used terms in the literature, ST and MFPR will also be used. Additionally, the term 'reduction', whilst accurate in that the number of fetuses is reduced, is a euphemism for feticide; however, it is likewise in common use and will be used at times.

Understandably any form of feticide is controversial, and yet with widespread access to legal abortion worldwide, it is perhaps not surprising that MFPR in particular has grown in incidence at the same time as it has been applied to cases well beyond the initial 'hard' cases.

This article will scrutinize the evidence about ST and MFPR, their efficacy and risks, and the trajectory of change in practice over time. It will also examine the ethical issues. It should be noted that the paucity of research on the longer-term effects of FIMP on mothers, fathers and the surviving children remains a glaring deficiency.

Multiple Pregnancies

Occurrence

The rate at which multiple pregnancies occur is affected by many things, the most relevant being the age of the woman, the use of ovulation inducing drugs, and the number of embryos transferred during *in vitro* fertilisation (IVF) procedures. Less important factors also play a role, include parity, genetics, and nutritional status.

In England and Wales, before the advent of assisted reproductive technology (ART) the rate of multiple pregnancies was in decline, from 13.2 per 1000 pregnancies in 1951 to 9.9 in 1975, most likely due to decreasing parity. Since then, the rate steadily increased to 16.1 in 2011, after which it slowly declined to 15.3 in 2019.¹ For that year,

¹ Birth Characteristics for England and Wales (2019) Office for National Statistics. See <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthcharacteristicsinenglandandwales> Accessed 16 Nov 2020.

the rate translated to 9513 twin pregnancies, 137 triplet pregnancies, and 6 quadruplet or higher order pregnancies (1.5%, 0.02%, 0.0009% of all pregnancies, respectively).

The situation is varied but similar in other countries, some experiencing a peak in the rate followed by a more recent decline, but still elevated compared with the pre-ART rate.² In the US for example, the rate of twinning increased by 79% from 1980 to 2014, then declined by just 4% from 2014 to 2018.³ In other countries, the increase following the advent of ART has been similar, but as in the UK, it has been far more dramatic for triplet and higher order pregnancies than for twins, even though twins make up over 98% of all multiple pregnancies.^{4,5} In the US for example, from 1980 to 1997 the rate of twin births rose by 52% while that for triplets and higher rose by 404%.⁶

In numerous papers on FIMP, the responsibility of the ART industry for the rise in multiple pregnancies has been emphasised. It has been argued that FIMP is an unfortunate but necessary response to a manufactured problem, and proper regulation of the industry with respect to ovulation induction and embryo transfer would make FIMP unnecessary. However, while it is true that ART bears the most responsibility, increasing maternal age is important too, and will not necessarily change even with tighter control over embryo transfer and ovulation induction. Moreover, as MFPR has become increasingly used for the reduction of relatively minor risk with twin pregnancies, increasingly for personal reasons, it will likely remain in use for spontaneous as well as ART multiples. After all, the justifications being promulgated for using FIMP apply as much to spontaneous multiples as they do to ART ones. Even though changing ART practice has led to a very large reduction in triplet and higher order multiples, the change in twinning has been much less so.

What is the relative contribution of maternal age, embryo transfer, and ovulation induction to the increase in multiple pregnancy rate since the early eighties? Bergh *et al.* suggest that about one third of the increase is due to maternal age, one third to ovulation induction, and one third to embryo transfer practices.⁷

One further piece of information is needed to assess the impact of ART and how recent changes in practice have influenced the incidence of multiples. That information is the percentage of multiple births *within* ART alone. In 2007, the UK's Human Fertilisation and Embryology Authority (HFEA) initiated a campaign to address the high

² Pison G *et al.* (2015) Twinning Rates in Developed Countries: Trends and Explanations. *Pop Dev Rev* 41(4):629-649.

³ Martin JA & Osterman MJK (2019) Is Twin Childbearing on the Decline? Twin Births in the United States, 2014-2018. NCHS Data Brief No. 351. See https://www.cdc.gov/nchs/products/databriefs/db351.htm#section_1 Accessed 19 Nov 2020.

⁴ Pison G *et al.* (2015) *Op. Cit.*

⁵ Martin JA & Park MM (1999) Trends in Twin and Triplet Births: 1980-97. *National Vital Statistics Reports* 47(24), Hyattsville, Maryland: National Center for Health Statistics.

⁶ *Ibid.*

⁷ Bergh T *et al.* (1999) Deliveries and children born after in-vitro fertilisation in Sweden 1982-95: a retrospective cohort study. *Lancet* 354:1579-1585.

incidence of multiple births in ART.⁸ In 2008, the percentage of multiple births in ART was 24%, and steadily reduced to 8% in 2018, which remains at least 5 times the spontaneous rate.⁹ Even though the decline in multiples within ART since 2008 has been dramatic, the overall rate of all multiples (within plus outside of ART) has remained virtually unchanged (15.5/1000 maternities in 2008 to 15.3/1000 in 2018). Given that the change in practice within ART has been primarily targeted at reducing the number of embryos transferred during IVF, the relatively steady rate of multiples overall suggests that the other two factors, namely ovulation induction (often unregulated and occurring outside ART) and maternal age, remain as key contributors. In addition, the increasing utilization of ART, even with its reduced but still elevated rate of multiples, may be contributing to maintaining the overall high rate in England and Wales. And with the HFEA having achieved its target of less than 10% of ART pregnancies being multiples, it is not entirely clear what further reduction may be sought or considered achievable.

The change in rate of multiples within ART in the US has also declined. For triplets and higher, the decline has been steady from the 90s at around 6% of all *births* to less than 1% in 2018. For twins the decline began later from around 30% through the 2000s to 13% in 2018.¹⁰ This must be kept in perspective because the overall community rate of twinning has only minimally declined, only since 2014 and by just 4%, as noted above. The rate of multiples within ART is therefore still a problem—in 2016 it was still nearly 10 times the rate in the total birth population.

Risks

It is well known that multiple pregnancies are associated with higher risk of adverse outcomes for the mother and her children; and as the number of fetuses increases, so does the risk. For the child, most of the increased risk arises from increased prematurity and the greater incidence of low birth weight. Mortality and morbidity are higher, and the risk of cerebral palsy is increased. In a recent Dutch study of twins, overall perinatal mortality was 6.6/1000 infants compared with 4.1/1000 for singletons¹¹, but when preterm twins (<37 weeks) were compared with preterm singletons the reverse was true—the preterm twin mortality was 10.4/1000 infants compared with 34.5/1000

⁸ Human Fertilisation and Embryology Authority See <https://www.hfea.gov.uk/about-us/our-campaign-to-reduce-multiple-births/> Accessed 24 Nov 2020.

⁹ Human Fertilisation and Embryology Authority (2020) Fertility Treatment 2018: Trends and Figures. See <https://www.hfea.gov.uk/about-us/publications/research-and-data/fertility-treatment-2018-trends-and-figures/#multiplebirths> Accessed 24 Nov 2020.

¹⁰ Society for Assisted Reproductive Technology. See <https://www.sart.org/patients/history-of-ivf/> Accessed 1 Dec 2020.

¹¹ Perinatal mortality is expressed *per infant*. This is different to the number of *pregnancies* in which there is a loss. While there is a perinatal death in 4.1/1000 singleton pregnancies, for twins there will be a perinatal death in somewhat less than 6.6/1000 *pregnancies*. This will depend on the proportion of twin pregnancies in which both twins die, relative to those in which one twin dies. If all perinatal deaths in twin pregnancies involved the death of both twins, the rate of total pregnancy loss would be 3.3/1000 pregnancies.

for preterm singleton infants.¹² The authors surmised that this was due to closer monitoring of twin pregnancies.

In an Australian study of children born during the 80s, the risk of cerebral palsy (CP) was 4.6 times higher for twins compared with singletons, and 17 times higher for triplets (0.16% of singletons had CP, 0.74% of twins and 2.7% of triplets).¹³ However, when twins and triplets are compared with singletons of the same prematurity, the neurodevelopmental outcomes are the same, confirming that it is prematurity rather than other characteristics of multiples that is associated with risk.¹⁴

For the mother, the risk of gestational diabetes, hemorrhage, pre-eclampsia and other conditions increases with each fetus. The maternal mortality rate for twin pregnancies is approximately 4 times higher than for singleton pregnancies (0.4% compared with 0.1%), but varies by the Human Development Index (HDI) of the country.¹⁵ In many high HDI countries there was no discernable difference in mortality, but higher incidence of complications.

There are also social, economic, and emotional challenges for the parents of multiples, and financial costs to the community in higher healthcare needs in the short and long term. When compared with twins, triplet and higher order pregnancies are associated with higher risk; however, because twins represent about 98% of all multiples, they account for most overall risk and associated costs.

Besides adverse outcomes from multiples alone, the mother's age is also a factor. For example, the twins of older women have more adverse outcomes compared with those of younger women.¹⁶ However, upon closer scrutiny, the difference collapses for women of higher socioeconomic circumstances. That is, for such women, age makes no difference and the risk of adverse perinatal outcomes in a twin pregnancy is the same regardless of age, unlike what occurs for women of lower socioeconomic status.

It has also been suggested that nature 'selects' women to carry multiples and by sidestepping that selection through the use of ART, multiple pregnancies achieved via ART are at higher risk for the mother and her children.¹⁷ Specific risks will be explored further when the outcomes after FIMP are scrutinized.

¹² Vasak B *et al.* (2017) Lower perinatal mortality in preterm born twins than in singletons: a nationwide study from The Netherlands. *Am J Obstet Gynecol* 216:161.e1-9.

¹³ Petterson B *et al.* (1993) Twins, Triplets, and Cerebral Palsy in Births in Western Australia in The 1980s. *BMJ* 307(6914): 1239-1243.

¹⁴ Gnanendran L *et al.* (2015) Neurodevelopmental outcomes of preterm singletons, twins and higher-order gestations: a population-based cohort study. *Arch Dis Child Fetal Neonatal Ed* 100:F106-F114.

¹⁵ Santana DS *et al.* (2016) Twin Pregnancy and Severe Maternal Outcomes. The World Health Organization Multicountry Survey on Maternal and Newborn Health. *Obstet Gynecol* 127(4): 631-641.

¹⁶ Zhang J *et al.* (2002) Multifetal pregnancy in older women and perinatal outcomes. *Fertil Steril* 78(3):562-568.

¹⁷ Blickstein I (2004) How and why are triplets disadvantaged compared to twins? *Best Pract & Res Clin Obstet & Gynaecol* 18(4):631-644.

Incidence of FIMP

The earliest reports of FIMP were cases of ST for anomaly that occurred in the late 70s and early 80s. The number of cases grew steadily, so that by 1999 Evans *et al.* wrote, "Utilization of selective termination has increased – nearly doubling in the last few years."¹⁸ In their report, the authors described 402 cases of ST from 8 centres.

In the mid to late 80s, cases of MFPR also began appearing. In 1990, Evans *et al.* reported 22 cases involving triplets and higher.¹⁹ A review of literature from 1993-1996 reported 1453 cases of MFPR, which was unlikely to have covered all such procedures worldwide.²⁰ This was supplemented in 2001 with 3513 completed cases from 11 centres with "extensive experiences."²¹ In their report of 2002, Stone *et al.* described the outcomes of 1000 consecutive cases from one of the facilities with the most experience of MFPR, the Mt Sinai Medical Center, over 13 years from 1986 to 1999,²² and then again for a second 1000 cases from 1999 to 2006.²³ Such numbers occurring at just one centre give an indication of the increasing prevalence of MFPR. Centres where MFPR has more recently been offered have also seen a steady rise in cases.²⁴

A comparison of the two sets of 1000 consecutive cases from the Mt Sinai Medical Center reveals that the proportion of multiple pregnancies reduced to a singleton has steadily increased over time.²⁵ For example, the percentage of twins reduced to a singleton increased from 4% to 15.6%. Similarly, the proportion of multiple pregnancies, regardless of starting number, that ended with a singleton increased from 11.8% to 31.8%. For the last 200 patients of the second 1000 cases, reduction to a singleton occurred in over 40% of cases. Other trends over time included a dramatic rise in the use of Chorionic Villus Sampling (CVS) to detect chromosomal abnormality before MFPR (almost 40-fold increase), and an increase in the incidence of monochorionicity from 2.1% in the first 1000 cases to 5.7% in the second 1000 cases. Chromosomal abnormality was detected in 3.5% of fetuses. Monochorionicity is associated with a higher risk of complications, including twin-twin transfusion, and is known to increase

¹⁸ Evans MI *et al.* (1999) Selective termination for structural, chromosomal, and mendelian anomalies: International experience. *Am J Obstet Gynecol* 181(4):893-897.

¹⁹ Evans MI *et al.* (1990) Selective termination: Clinical experience and residual risks. *Am J Obstet Gynecol* 162(6):1568-1575.

²⁰ Fasouliotis SJ & Schenker JG (1997) Multifetal pregnancy reduction: A review of the world results for the period 1993–1996. *Eur J Obstet & Gynecology & Reprod Biol* 75:183-190.

²¹ Evans MI *et al.* (2001) Improvement in outcomes of multifetal pregnancy reduction with increased experience. *Am J Obstet Gynecol* 184:97-103.

²² Stone J *et al.* (2002) A single center experience with 1000 consecutive cases of multifetal pregnancy reduction. *Am J Obstet Gynecol* 187:1163-1167.

²³ Stone J *et al.* (2008) Contemporary outcomes with the latest 1000 cases of multifetal pregnancy reduction. (MPR) *Am J Obstet Gynecol* 199:406.e1-406.e4.

²⁴ Mohammed ABF *et al.* (2015) Obstetric and neonatal outcome of multifetal pregnancy reduction. *Middle East Fert Soc J* 20:176-181.

²⁵ Stone J *et al.* (2007) Evolving trends in 2000 cases of multifetal pregnancy reduction: a single-center experience. *Am J Obstet Gynecol* 197:394.e1-394.e4.

in incidence as a result of ART.²⁶ For the second 1000 cases, only 2% of multiples were conceived spontaneously.

In keeping with the trend towards MFPR for reducing twins to a singleton, in their 2014 review, Evans *et al.* revealed that at the time this constituted about 30% of their cases, a proportion they expected to continue increasing. Also changing was a trend toward MFPR for ‘quality of life’ issues.²⁷ Moreover, in their experience, about 85% of couples used chromosomal analysis to screen for abnormality, or increasingly, gender. For gay couples, the use of chromosomal analysis before MFPR (on the surrogate) has involved reduction of triplets to twins so that each man could be the genetic father of just one child. That is, if analysis revealed that one man was the biological father of two of the three, and the other man the biological father of the third, MFPR was used to eliminate one of the fetuses of the first man.²⁸

For England and Wales, official reports group FIMP cases together as STs, even though some will have been MFPR, perhaps the majority. After all, referring to the impact of ART, the reports preface the data with the following statement: “In such cases, the outcome of the pregnancy may be more successful if the number of fetuses is reduced.”²⁹ This implies MFPR for reduction of risk rather than termination of a disabled fetus.

In England and Wales, the numbers throughout the 2000s were in the vicinity of 50-80 per year, increasing steadily to 141 in 2016, before declining to 126 in 2019. Some details were provided for the years 2011 to 2018, but that ceased in the latest report in 2019.³⁰ Between 60% and 76% of terminations were from 2 or 3 fetuses to 1, with a gradual increase in that proportion from 2011 to 2018.³¹

Little is known about these cases, but more than 86% (2019) were done under ground E of the legislation, *viz.*, “there is a substantial risk that, if the child were born, it would suffer from such physical or mental abnormalities as to be seriously handicapped”. However, because there is no legal definition of ‘substantial risk’ or ‘seriously handicapped’, it is unclear whether the increased risk of disability arising from a multiple pregnancy, sometimes by just a few percent for twins, is sufficient to justify MFPR under ground E. Moreover, there is an inconsistency, in that while the official reports state that by far the majority of cases occurred under ground E, the Royal College of Obstetricians and Gynaecologists (RCOG) states that ground C is “usually relied upon

²⁶ Cited by Stone *et al.* (2007) *Op. Cit.*

²⁷ Evans MI *et al.* (2014) Fetal Reduction: 25 Years’ Experience. *Fetal Diagn Ther* 35:69-82.

²⁸ *Ibid.*

²⁹ Department of Health and Social Care (2019) Abortion Statistics England and Wales: 2018: Summary information from the abortion notification forms returned to the Chief Medical Officers of England and Wales. See <https://www.gov.uk/government/statistics/abortion-statistics-for-england-and-wales-2018> Accessed 7 Nov 2020.

³⁰ Department of Health and Social Care (2020) Abortion Statistics England and Wales: 2019: Summary information from the abortion notification forms returned to the Chief Medical Officers of England and Wales. January to December 2019. See <https://www.gov.uk/government/statistics/abortion-statistics-for-england-and-wales-2019> Accessed 7 Nov 2020.

³¹ Department of Health and Social Care (2020) *Op. Cit.*

... by most specialists in this area”.³² Ground C is that category under which the overwhelming majority of abortions occur, viz. that “the pregnancy has not exceeded its 24th week and the continuance of the pregnancy would involve risk, greater than if the pregnancy were terminated, of injury to the physical or mental health of the pregnant woman”. Nearly all ground C abortions are for mental health reasons.

For England and Wales there is therefore no certainty regarding the proportion of cases that were STs because of disability, or MFPR to reduce risk to the mother or surviving children, or for risk to the mother’s mental health, or for unspecified personal reasons. If RCOG is correct, as the reports themselves also seem to imply, most cases were MFPR for maternal reasons, despite being coded under ground E. And the majority of cases involved reduction of twins to a singleton, a particularly controversial example of MFPR amongst practitioners and others.

Finally, what *proportion* of multiple pregnancies undergo FIMP in England and Wales? In 2018,³³ there were 74 twin pregnancies reduced to a singleton and 9873 twin maternities;³⁴ that is, 0.74% of twin pregnancies underwent FIMP. There were 36 triplet pregnancies reduced to 2 or 1, and 128 triplet maternities unreduced; that is, 22% of triplet pregnancies underwent FIMP.³⁵ In the same year there was just one case of a quadruplet pregnancy that underwent FIMP, and 4 quadruplet and higher maternities that did not.

Outcomes

Most studies of FIMP compare a range of outcomes after the procedure to pregnancies in which there has been no FIMP; for example, triplets reduced to twins compared with expectantly managed triplets. Others compare outcomes after the procedure relative to the finishing number of fetuses; for example, triplets reduced to twins compared to unreduced twins. The outcomes of relevance include pregnancy loss (miscarriage of all fetuses before 24 weeks), prematurity, low birth weight, morbidity and mortality. Some studies also look at physical and psychological health of the mother, but such studies are few and far between. There also remains a serious deficiency in the research about the impact of MFPR on the physical and psychological health of surviving children.

³² Royal College of Obstetricians and Gynaecologists (2010) Termination of Pregnancy for Fetal Abnormality in England, Scotland and Wales. See <https://www.rcog.org.uk/globalassets/documents/guidelines/terminationpregnancyreport18may2010.pdf> Accessed 12 Nov 2020.

³³ 2018 is the most recent year for which data is provided that enables the question to be addressed. Detailed data for 2019 were not provided in the report.

³⁴ The UK Office for National Statistics defines a maternity as “a pregnancy resulting in the birth of one or more children including stillbirths”.

³⁵ Office of National Statistics. Birth Characteristics Dataset for 2018. See <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthcharacteristicsinenglandandwales> Accessed 1 Dec 2020.

Pregnancy Loss³⁶

In a recent review, Beriwal *et al.* cited figures from several studies that compared pregnancy loss rates after MFPR with unreduced multiples. For quadruplets, expectant management was associated with a loss rate of 25%, compared with 12.2% after MFPR.³⁷ For triplets, the outcomes depend on the particular type of triplet pregnancy and whether reduction was to twins or a singleton. Reduction to twins resulted in an increase in risk from about 5% to 7% for trichorionic triamniotic (TCTA) triplets, or about 9% to 13% for dichorionic triamniotic (DCTA) triplets. Reduction to a singleton resulted in an increase in risk from 5% to 12% for TCTA triplets, or 9% to 18% for DCTA triplets. For twins (dichorionic diamniotic; DCD³⁸) reduced to a singleton, the risk increased from 0.7% to about 4%.³⁹ Despite these figures, there remains considerable controversy, in part because many studies are cases series with small numbers, but also because there is likely a difference in the technical ability of the clinicians involved and also some variation in gestational age at which the procedure is done, later gestational ages being associated with higher risk of loss.

³⁶ Pregnancy loss is typically defined as the total loss of pregnancy before 24 weeks gestation relative to ultrasound scan data in the lead up to 14 weeks gestation; that is, miscarriage before 24 weeks after confirmation of pregnancy by ultrasound before 14 weeks.

³⁷ Interpreting the significance of risk of pregnancy loss is predicated upon some underlying assumptions. This may perhaps best be explained by reference to a hypothetical 100 women who are pregnant with quadruplets who do not undergo a reduction (expectant management group) versus another 100 women who undergo a reduction to twins (MFPR group). The argument by proponents of MFPR is that the natural pregnancy loss rate of about 25% for the former is worse than the pregnancy loss rate after reduction of about 12.5%, and hence MFPR is an option with a superior outcome, at least on the grounds of pregnancy loss. However, for the 100 women expectantly managed who are carrying 400 unborn children, 100 (25% of pregnancies) will be lost naturally, leaving 300 infants at birth. But for the MFPR group, of the 400 unborn, 200 will be eliminated in the MFPR surgery, followed by 25 subsequently lost by natural means (12.5% of the 100 women carrying 2 unborn children will then lose the whole pregnancy). Therefore, 175 infants will be born, with a total loss of 225 unborn. In terms of the unborn children who get to see the light of day, expectant management is clearly superior. That is, MFPR results in 175 infants born versus 300 for expectant management. However, from the perspective of the woman (and couple) alone, and for the sake of argument ignoring or minimising the individual significance of human life *in utero*, it might be argued that without MFPR, 75 of the 100 women take home at least one child, but after MFPR, about 87 do so. This later calculation seems to be the driving force behind arguments that lower rates of natural pregnancy loss after MFPR are better, and is an argument based upon utility and with assumptions about the value of human life *in utero*.

³⁸ The loss rate for monochorionic (MC) twins is higher than for dichorionic (DC) twins. D'Antonio *et al.* found a miscarriage rate for MC twins of 6% compared with that for DC twins of 0.67% (MC twins represent about 20% of twin pregnancies; D'Antonio F *et al.* (2013). Early fetal loss in monochorionic and dichorionic twin pregnancies: analysis of the Southwest Thames Obstetric Research Collaborative (STORK) multiple pregnancy cohort. *Ultrasound Obstet Gynecol* 41: 632–636). The authors also found that the rate of pregnancy loss had decreased during 2005–2010 compared with 2000–2004 (change for DC twins was not statistically significant), improvements in management of multiple pregnancies being the likely cause.

³⁹ Beriwal S *et al.* (2020) Multifetal pregnancy reduction and selective termination. *The Obstetrician & Gynaecologist* <https://doi.org/10.1111/tog.12690>

In one recent meta-analysis of the data on MFPR for triplets to twins, Zipori *et al.* concluded that pregnancy loss was the same for expectantly managed triplets compared with triplets reduced to twins.⁴⁰ However, the 3 largest studies included in that analysis all found that triplets managed expectantly were better by approximately a factor of 2 compared with triplets reduced to twins,^{41,42,43} although the result was not always statistically significant. In one of those three studies, by Chaveeva *et al.*, reduction of triplets to a singleton always resulted in a higher miscarriage rate compared with reduction to twins.⁴⁴ A separate study included in the meta-analysis had such an unrealistically high loss rate for expectant triplets (25%) that it would likely have muddied the waters.⁴⁵ Zipori *et al.* also undertook a somewhat different meta-analysis that compared triplets reduced to twins with non-reduced twins and found the pregnancy loss rates comparable, a finding they concluded was “probably reassuring” for “clinician and patient decision-making.”⁴⁶ In other words, that the risk of loss after MFPR from triplets to twins was what occurred with twins in any case. However, their conclusion is on shaky ground given the selection of studies and the weighting applied that yielded an unrealistically high rate of loss for expectantly managed twins (4.8%), thus masking the loss rate for the reduced twins.

For triplets reduced to a singleton, in keeping with the conclusions in Beriwal’s review, the data seems clearer that expectantly managed triplets have a lower loss rate by a factor of between 2 and 4.^{47,48}

For twins reduced to a singleton, in keeping with the meta-analysis by Beriwal *et al.* but not included in that analysis, van de Mheen *et al.* found that whereas pregnancy loss was 3.1% for unreduced twins,⁴⁹ reduction to a singleton resulted in a miscarriage

⁴⁰ Zipori Y *et al.* (2017a) Multifetal pregnancy reduction of triplets to twins compared with non-reduced triplets: a meta-analysis. *Reprod Biomed Online* 35:296-304.

⁴¹ Antsaklis A *et al.* (2004) Embryo reduction versus expectant management in triplet pregnancies. *J Maternal-Fetal & Neonatal Med* 16:219-222.

⁴² Chaveeva P *et al.* (2013) Trichorionic and Dichorionic Triplet Pregnancies at 10–14 Weeks: Outcome after Embryo Reduction Compared to Expectant Management. *Fetal Diagn Ther* 34:199–205.

⁴³ Papageorghiou AT *et al.* (2006a) Risks of miscarriage and early preterm birth in trichorionic triplet pregnancies with embryo reduction versus expectant management: new data and systematic review. *Human Reprod* 21(7): 1912–1917.

⁴⁴ Chaveeva P *et al.* (2013) *Op. Cit.*

⁴⁵ Yaron Y *et al.* (1999) Multifetal pregnancy reductions of triplets to twins: Comparison with nonreduced triplets and twins. *Am J Obstet Gynecol* 180:1268-1271.

⁴⁶ Zipori Y *et al.* (2017) Multifetal reduction of triplets to twins compared with non-reduced twins: a meta-analysis. *Reprod Biomed Online* 35:87-93.

⁴⁷ Papageorghiou AT *et al.* (2002) Trichorionic triplet pregnancies at 10–14 weeks: outcome after embryo reduction compared to expectant management. *J Maternal-Fetal & Neonatal Med* 11(5): 307-312.

⁴⁸ Chaveeva P *et al.* (2013) *Op. Cit.*

⁴⁹ This rate for DC twins was much higher than the rate of 0.7% found by D’Antonio *et al.* The reason is not clear, but it may be that whether twins were conceived naturally or via ART could be a factor (see Tummers P *et al.* (2003) Risk of spontaneous abortion in singleton and twin pregnancies after IVF/ICSI.

rate of 11.9%; however, mean gestational age at reduction was high at 16.7 weeks.⁵⁰ Most reductions were STs for abnormalities. Using a different measure of miscarriage, namely loss from 7 weeks to 27 weeks, Luo *et al.* found that for twins reduced to a singleton the rate was 12.7% compared with 6.2% for twins managed expectantly.⁵¹

To summarise, while FIMP leads to a decline in miscarriage rate for quadruplets and higher, the reverse is true for triplets and twins. Furthermore, for triplets, the more fetuses that are terminated, the higher the miscarriage rate.

Mortality

Mortality can be measured in several different ways. The perinatal mortality rate (PMR) is defined as the number of fetal deaths after 24 weeks and up to 7 days post birth per 1000 total births. It is important to note that there have been dramatic improvements in reducing PMR with advances in care; for example, an 82% decline in PMR for triplets and a 66% decline for twins from 1980 to 1998.⁵²

Studies assessing PMR after MFPR yielded mixed results. Some found no difference,^{53,54} while others found a several fold higher PMR after MFPR.⁵⁵

Another measure of mortality is neonatal or infant mortality within 28 days of a live birth. Again, results were mixed; there was either a significant increase in neonatal deaths after MFPR (for quadruplets and higher; 4.3% to 11.7%),⁵⁶ a slight but not statistically significant improvement after MFPR for triplets and higher reduced to twins,⁵⁷ or a much higher rate for expectantly managed triplets compared with MFPR of triplets to twins (21% v. 0%),⁵⁸ although this latter study was a small cases series and 21% is very high and inconsistent with other studies.

Another arguably more meaningful measure, particularly from the perspective of parental consent, is the risk of there being no surviving child after MFPR. For TCTA triplets reduced to twins, risk was found to increase from about 5% to 8-9%, and for

Human Reprod 18(8): 1720-1723. & Wang JX *et al.* (2004) Incidence of spontaneous abortion among pregnancies produced by assisted reproductive technology. *Human Reprod* 19(2):272-277.

⁵⁰ van de Mheen L *et al.* (2015) Pregnancy outcome after fetal reduction in women with a dichorionic twin pregnancy. *Human Reprod* 30(8):1807-1812.

⁵¹ Luo L *et al.* (2019) Is it worth reducing twins to singletons after IVF ET? A retrospective cohort study using propensity score matching. *Acta Obstet Gynecol Scand* 98:1274-1281.

⁵² Blickstein I (2004) *Op. Cit.*

⁵³ Haas J *et al.* (2015) Perinatal outcome after fetal reduction from twin to singleton: to reduce or not to reduce? *Fertil Steril* 103(2):428-432.

⁵⁴ Razaz N *et al.* (2017) Perinatal outcomes in multifetal pregnancy following fetal reduction. *CMAJ* 189:E652-8. doi: 10.1503/cmaj.160722

⁵⁵ Antsaklis A *et al.* (2004) *Op. Cit.*

⁵⁶ Mohammed ABF *et al.* (2015) *Op. Cit.*

⁵⁷ Cheang C-U *et al.* (2007) A comparison of the outcomes between twin and reduced twin pregnancies produced through assisted reproduction. *Fertil Steril* 88:47-52.

⁵⁸ Drugan A *et al.* (2013) Fetal Reduction in Triplet Gestations: Twins Still Fare Better. *IMAJ* 15:745-747.

TCTA triplets reduced to a singleton, from about 5% to 18%.^{59,60} For twins reduced to a singleton, risk increased from 3.4% to 14.4%; although this study involved ST at a relatively late average gestation of 16.7 weeks.⁶¹ For MFPR performed at 7-8 weeks gestation, the risk of no surviving child was 7.2% for expectant twins versus 16.9% for twins reduced to a singleton.⁶² Conversely, a recent study by Kim *et al.* found a *decline* in risk from 3.2% to 1.7% when MFPR was undertaken at 11-17 weeks gestation for triplets and higher reduced to twins compared with unreduced twins; however, the complete reversal was true for MFPR at 6-8 weeks gestation; that is, the risk of a pregnancy with no surviving child increased nearly threefold from 3.2% to 9.2%.⁶³

In summary, while there is lack of clarity about perinatal and neonatal mortality after MFPR, there are sufficient grounds to conclude that the risk for any given woman of failing to take home any baby increases after MFPR. Together with the increased miscarriage rate after MFPR, while the loss for some women might mean taking home fewer babies than hoped, for others MFPR means taking home none at all.

Prematurity

The primary medical justification for MFPR is to reduce prematurity and the risk of low birth weight and morbidity that goes with it. Terminating one or more fetuses is intended to take pressure off the remaining ones to give them a greater chance to develop sufficiently before birth to do well. Most studies measure the preterm birth rate,⁶⁴ fewer measure birth weight, and fewer still assess morbidity, in part because the link between prematurity, low birth weight and morbidity is well-established and therefore prematurity can be taken as a proxy for morbidity.

In Beriwal's recent review, comparing MFPR with expectantly managed multiples always led to a decline in prematurity: from 55.6% to 14.2% for quadruplets to twins; from 35.1% to 13.1% or 8.7% for TCTA triplets to twins or a singleton; from 33.3%-46% to 8% for DCTA triplets to a singleton; and, from 12-14.4% to 5-7.1% for DCD twins to a singleton.

⁵⁹ Chaveeva P *et al.* (2013) *Op. Cit.*

⁶⁰ Papageorghiou AT *et al.* (2002) *Op. Cit.*

⁶¹ van de Mheen L *et al.* (2015) *Op. Cit.*

⁶² Luo L *et al.* (2019) *Op. Cit.*; In this study, the figure for expectantly managed twins appears high because the authors included early miscarriages between 7 and 12 weeks in their calculation of loss.

⁶³ Kim MS *et al.* (2019) Obstetrical outcomes of embryo reduction and fetal reduction compared to non-reduced twin pregnancies *Arch Gynecol & Obstet* 299:953-960.

⁶⁴ The WHO defines prematurity in the following way: extremely preterm <28 weeks; very preterm between 28 and 32 weeks; and, moderate to late preterm between 32 and 37 weeks (see <https://www.who.int/news-room/fact-sheets/detail/preterm-birth> Accessed 15 Feb 2021). However, there is some inconsistency among MFPR studies about how preterm is defined, most using just one measure, and varying from less than 32 weeks to less than 33 weeks, or even 34 weeks.

Other reviews or meta-analyses, as well as various additional studies, have found something similar.^{65,66,67,68,69,70,71,72} A recent study addressing the specific question whether reducing triplets to twins compared with reducing triplets to a singleton resulted in less prematurity, found a large difference (20.2% versus 3.4%).⁷³

However, there have been some exceptions. For example, in a recent review and meta-analysis by Anthoulakis *et al.*, MFPR of DCTA triplets to twins did not result in any change in the rate of preterm births, even though it did for TCTA triplets reduced to twins.⁷⁴ Other studies have found either an *increase* in the rate of preterm births among twins reduced to a singleton versus those expectantly managed,⁷⁵ or no difference,^{76,77,78} although the gestational age at which MFPR was undertaken was relatively high in some of these. A recent study looked more closely at the level of preterm birth, namely comparing preterm deliveries before and after 32 weeks. While the rate of preterm birth after 32 weeks was higher for expectantly managed twins compared with twins reduced to a singleton (42.7% v 5.6%), the reverse was true for preterm before 32 weeks (3.4% v 7.0%).⁷⁹ That is, preterm births associated with the most serious adverse outcomes were more prevalent *after* MFPR, and as the authors note, the outcomes for twins after 32 weeks are in any case 'favourable'.

A different comparison sought to determine whether MFPR to twins produced essentially the same outcome as twins managed expectantly. In other words, did a pregnancy reduced to twins (from whatever starting number) have a preterm rate like a twin pregnancy without reduction? If the starting number was triplets, then Haas *et al.* did find that to be the case,⁸⁰ although their rate for expectant twins was higher (19.2%)

⁶⁵ Drugan A *et al.* (2013) *Op. Cit.*

⁶⁶ Chaveeva P *et al.* (2013) *Op. Cit.*

⁶⁷ Papageorghiou AT *et al.* (2002) *Op. Cit.*

⁶⁸ Papageorghiou AT *et al.* (2006a) *Op. Cit.*

⁶⁹ Antsaklis A *et al.* (2004) *Op. Cit.*

⁷⁰ Haas J *et al.* (2015) *Op. Cit.*

⁷¹ Zipori Y *et al.* (2017a) *Op. Cit.*

⁷² Wimalasundera RC (2010) Selective reduction and termination of multiple pregnancies. *Seminars in Fetal & Neonatal Medicine* 15:327-335.

⁷³ Zemet R *et al.* (2020) Pregnancy outcome after multifetal pregnancy reduction of triplets to twins versus reduction to singletons. *RBMO* 40(3):445-452.

⁷⁴ Anthoulakis C *et al.* (2017) Risks of miscarriage or preterm delivery in trichorionic and dichorionic triplet pregnancies with embryo reduction versus expectant management: a systematic review and meta-analysis. *Human Reprod* 32(6):1351-1359.

⁷⁵ van de Mheen L *et al.* (2015) *Op. Cit.*

⁷⁶ Hasson J *et al.* (2011) Reduction of twin pregnancy to singleton: does it improve pregnancy outcome? *J Maternal-Fetal & Neonatal Med* 24(11):1362-1366.

⁷⁷ Gupta S *et al.* (2015) Outcomes in twin pregnancies reduced to singleton pregnancies compared with ongoing twin pregnancies. *Am J Obstet Gynecol* 213:580.e1-5.

⁷⁸ Kim MS *et al.* (2019) *Op. Cit.*

⁷⁹ Luo L *et al.* (2019) *Op. Cit.*

⁸⁰ Haas J *et al.* (2014) Perinatal outcome of twin pregnancies after early transvaginal multifetal pregnancy reduction. *Fertil Steril* 101:1344-1348.

than in other studies, as well as higher than in a similar study undertaken by Haas *et al.* in the following year (11.7%).⁸¹ A different result might have been obtained had the data been combined. A meta-analysis by Zipori *et al.* found that gestational age at birth was the same,⁸² but it is not clear why the authors did not report the actual rate of preterm birth, as they did in the other meta-analysis they conducted at the same time; and referred to above.

When the starting number of fetuses included triplets and higher reduced to twins compared with expectantly managed twins, the MFPR cases had more preterm births.⁸³ This was corroborated by others who found lower birth weights amongst MFPR cases compared with twins,⁸⁴ as well as an earlier gestational age at delivery.⁸⁵ These observations have led some to suggest that the carriage of higher order multiples 'programmes' the uterus in some way and that MFPR cannot necessarily undo that programming. This idea is supported by the observation that MFPR to a singleton has not produced an outcome that equals that for expectantly managed singletons.

In summary, MFPR reduces the rate of prematurity when compared with expectantly managed multiples. However, despite the findings of some studies, when pregnancies in which the finishing number of fetuses after MFPR are compared with pregnancies with the equivalent unreduced number of fetuses, the rate is not the same, but remains higher. For example, higher order multiples reduced to twins still seem to have greater prematurity than unreduced twins.

Maternal Health

When compared with the impact of FIMP on children, the outcomes for mothers have been the subject of far fewer studies. As noted earlier, multiple pregnancies carry an increased risk of hyperemesis, hypertension, hemorrhage, caesarian section, pre-eclampsia, gestational diabetes, and post-partum depression.⁸⁶ To what extent these are influenced by FIMP is complicated somewhat because these conditions tend also to increase with maternal age, and as MFPR increasingly involves older women, this particular confounder needs to be carefully addressed.

In the 2017 meta-analysis by Zipori *et al.* that compared triplets managed expectantly with triplets reduced to twins, the rate of caesarian section, hypertensive disorders and gestational diabetes were all lower in the MFPR group.⁸⁷ However, as the authors noted, only a few studies could be used and even for those, confounders such as mater-

⁸¹ Haas J *et al.* (2015) *Op. Cit.*

⁸² Zipori Y *et al.* (2017) *Op. Cit.*

⁸³ Cheang C-U *et al.* (2007) *Op. Cit.*

⁸⁴ Groutz A *et al.* (1996) Pregnancy outcome after multifetal pregnancy reduction to twins compared with spontaneously conceived twins. *Human Reprod* 11(6):1334-1336.

⁸⁵ AlShelaly UE *et al.* (2015) Obstetric outcomes in reduced and non-reduced twin pregnancies. A single hospital experience. *Saudi Med J* 36(9):1122-1125.

⁸⁶ American College of Obstetricians and Gynecologists (2016) Multifetal Gestations: Twin, Triplet, and Higher-Order Multifetal Pregnancies. Practice Bulletin No. 169 *Obstet Gynecol* 128:e131-146.

⁸⁷ Zipori Y *et al.* (2017a) *Op. Cit.*

nal age were not properly addressed. There do not seem to be differences between twins managed expectantly compared with twins reduced to a singleton,⁸⁸ except perhaps for reduced pre-eclampsia for the latter.⁸⁹

When obstetric complications in higher order pregnancies were compared with respect to finishing number; that is, triplets and higher reduced to twins versus expectantly managed twins, most studies found either no significant differences⁹⁰ or higher rates of caesarian section⁹¹ or hypertension⁹² with MFPR.

Besides the physical effects of MFPR for the mother, there are psychological effects that can be understood in two related ways—the decision-making experience, and the short- and longer-term effects on mental health, whether that involved a diagnosed mental health condition or not.

The evidence as it exists is clear that the decision making process is traumatic.^{93,94,95} Women who are desperate for a child and accessed ART to become pregnant are shocked at the situation they then face with a multiple pregnancy, that this was a “profound perinatal irony,”⁹⁶ some experiencing an “overwhelming sense that they were so infertile that there was no way that they could have a problem with being hyperfertile”.⁹⁷ Regardless of that irony, the MFPR decision usually occurs within the context of infertility treatment, and is framed by it.

When you are so far along in this process, you are already playing God, you know. So it's almost like we have manipulated this so far, you know, we have the power to manipulate it further.⁹⁸

... we created this child in such an artificial manner - in a test tube, choosing an egg donor, having the embryo placed in me - and somehow, making a decision about how many to carry seemed to be just another choice. The pregnancy was all so consumerish to begin with, and this became yet another thing we could control.⁹⁹

⁸⁸ Haas J *et al.* (2015) *Op. Cit.*

⁸⁹ Hasson J *et al.* (2011) *Op. Cit.*

⁹⁰ Kim MS *et al.* (2019) *Op. Cit.*

⁹¹ Zipori Y *et al.* (2017) *Op. Cit.*

⁹² Haas J *et al.* (2014) *Op. Cit.*

⁹³ McKinney MK *et al.* (1995) The psychological effects of multifetal pregnancy reduction. *Fertil Steril* 64(1):51-61.

⁹⁴ Britt DW *et al.* (2001) Bonding and Coping with Loss: Examining the Construction of an Intervention for Multifetal Pregnancy Reduction Procedures. *Fetal Diagn Ther* 16:158-165.

⁹⁵ Wang H-L & Chao Y-MY (2006) Lived Experiences of Taiwanese Women with Multifetal Pregnancies who Receive Fetal Reduction. *J Nursing Res* 14(2):143-154.

⁹⁶ Schreiner-Engel P *et al.* (1995) First-trimester multifetal pregnancy reduction: Acute and persistent psychologic reactions. *Am J Obstet Gynecol* 172:541-547.

⁹⁷ Callopy KS (2004) “I Couldn’t Think That Far”: Infertile Women’s Decision Making About Multifetal Reduction. *Research in Nursing & Health* 27,75-86.

⁹⁸ *Ibid.*

⁹⁹ Padawer R (2011) The Two-Minus-One Pregnancy. *New York Times Magazine* See <https://www.nytimes.com/2011/08/14/magazine/the-two-minus-one-pregnancy.html> Accessed 12 Dec 2020

In contrast, for some women the fact that MFPR was offered at all was incongruent with having finally overcome infertility. “I’m thinking, ‘We’ve hit the jackpot,’ and then she said, ‘Oh, my God, there are five. This is awful, what we doctors do to you people. This is so terrible. It will be ...’ and she just launches.”¹⁰⁰

Besides the damage to the doctor-patient relationship inherent in this clinician’s response, women can be confronted with a decision that seems completely at odds with the trajectory of their journey to that point. Being asked to consider terminating such desperately wanted children, whose conception was so hard won, could hardly be more incomprehensible.

Whether the decision-making process seemed an extension of infertility treatment or was incongruous with it, many women nevertheless found it ‘agonizing’¹⁰¹ and involving ‘unbearable physical/mental stress’,¹⁰² while for others, the decision was ‘not difficult’.¹⁰³ For those who chose MFPR, the reasons that outweighed other concerns were to avoid risks and to preserve health.¹⁰⁴ And while the research is thin, there is some evidence that the increasing use of MFPR to reduce twins to a singleton is being undertaken for personal reasons such as already having enough children or not wanting the emotional and financial cost of multiples.¹⁰⁵

Psychological reactions after MFPR have been poorly studied, particularly in the longer term, despite many calls for research by authors in the early days of the procedure.^{106,107}

Acute psychological reactions following MFPR involved anxiety, guilt, relief, grief, sadness and depression, and fear of losing the remaining fetus(es).^{108,109,110,111} Never-

¹⁰⁰ Callopy KS (2004) *Op. Cit.*; The doctor’s response is in keeping with FIGO guidelines: “Clinics and clinicians when discussing their results in public must avoid describing multiple pregnancies as a success rather than a complication of treatment. The media should be aware that best professional opinion is to regard multiple pregnancies as a complication.” See FIGO Committee Report (2006) Ethical recommendations on multiple pregnancy and multifetal reduction FIGO Committee for the Ethical Aspects of Human Reproduction and Women’s Health. *Int J Gynecol & Obstet* 92:331-332.

¹⁰¹ Maifeld M *et al.* (2003) Decision Making Regarding Multifetal Reduction. *J Obstet Gynecol & Neonatal Nursing* 32(3):357-369.

¹⁰² Wang H-L & Chao Y-MY (2006) *Op. Cit.*

¹⁰³ McKinney MK *et al.* (1995) *Op. Cit.*

¹⁰⁴ Maifeld M *et al.* (2003) *Op. Cit.*

¹⁰⁵ Evans MI *et al.* (2014) *Op. Cit.*

¹⁰⁶ McKinney MK *et al.* (1996) Multifetal Pregnancy Reduction: Psychodynamic Implications. *Psychiatry* 59(4):393-407.

¹⁰⁷ Ormont MA & Shapiro PA (1996) Multifetal Pregnancy Reduction. A Review of an Evolving Technology and Its Psychosocial Implications. *Psychosomatics* 36:522-530.

¹⁰⁸ McKinney MK *et al.* (1995) *Op. Cit.*

¹⁰⁹ Wang H-L & Chao Y-MY (2006) *Op. Cit.*

¹¹⁰ Schreiner-Engel P *et al.* (1995) *Op. Cit.*

¹¹¹ Garel M *et al.* (1997) Psychological reactions after multifetal pregnancy reduction: a 2-year follow-up study. *Human Reprod* 12(3):617-622.

theless, the majority felt that the right decision had been made.^{112,113,114,115} In a study comparing acute reactions between women who chose reduction versus those who did not, Porreco *et al.* concluded:

Particularly notable was the fact that significantly more women who accepted reduction considered themselves uncomfortable or very uncomfortable with the decision during the course of the pregnancy, whereas no patient who declined reduction had any discomfort with the decision to continue the grand multiple pregnancy.¹¹⁶

Such a stark difference in feelings that may entail elements of regret raise legitimate questions about whether such information should routinely form part of informed consent discussions.

In the longer term, studies have found mixed results, even though there are reasons why adverse mental health outcomes over time might be expected. Given that there is much more research on outcomes after abortion, and it is likewise an experience of fetal loss, it can provide some insight into what may similarly occur after MFPR. While the abortion/mental health field is still riven with disagreement, there is a substantial body of research showing that abortion is associated with, and likely causes mental health problems.¹¹⁷ Moreover, some researchers argue that pregnancy wantedness is a key determinant of adverse mental health outcomes,¹¹⁸ and even though wantedness is an imprecise term, loss of a much-desired child seems to add another layer to the impact of abortion *per se*. The point is, with MFPR both pregnancy wantedness *and* fetal loss occur, making adverse outcomes more likely. Similarly, STs for fetal anomaly or suspected abnormality also involve both wantedness and loss, and while there are no studies on psychological outcomes after STs, there are many for abortions on the grounds of fetal anomaly, and for these the evidence for adverse mental health outcomes is clearer.^{119,120,121} In a 2013 study by Mashriach and colleagues, women who terminated

¹¹² Maifeld M *et al.* (2003) *Op. Cit.*

¹¹³ Garel M *et al.* (1997) *Op. Cit.*

¹¹⁴ Schreiner-Engel P *et al.* (1995) *Op. Cit.*

¹¹⁵ Bergh C *et al.* (1999a) Obstetric outcome and psychological follow-up of pregnancies after embryo reduction. *Human Reprod* 14(8):2170-2175.

¹¹⁶ Porreco RP *et al.* (1995) Parental Choices in Grand Multiple Gestation: Psychological Considerations. *J Maternal-Fetal Med* 4:111-114.

¹¹⁷ Reardon DC (2018) The abortion and mental health controversy: A comprehensive literature review of common ground agreements, disagreements, actionable recommendations, and research opportunities. *Sage Open Med* 6:1-38.

¹¹⁸ Sullins DP (2019) Affective and Substance Abuse Disorders Following Abortion by Pregnancy Intention in the United States: A Longitudinal Cohort Study. *Medicina* 55:741; doi:10.3390/medicina55110741

¹¹⁹ Lafarge C, Mitchell K & Fox P (2013) Women's experiences of coping with pregnancy termination for fetal abnormality. *Qualitative Health Research* 23(7):924-936.

¹²⁰ Coleman PK (2015) Diagnosis of fetal anomaly and the increased maternal psychological toll associated with pregnancy termination. *Issues in Law & Medicine* 10(1):3-23.

¹²¹ Koponen K *et al.* (2013) Parental and professional agency in terminations for fetal anomalies: analysis of Finnish women's accounts. *Scandinavian J Disability Research* 15(1):33-44.

a pregnancy for fetal abnormality and women who underwent MFPR both experienced “a significant degree of grief and anxiety”.¹²² The effect was somewhat higher for the terminations, which might be expected because they occurred later in pregnancy after greater attachment had occurred. Moreover, the psychological tests for the MFPR cohort were conducted at just 10 weeks following the procedure, before the women gave birth and too early to be considered a long-term follow-up.

The likelihood that negative psychological outcomes might develop over considerable time has been identified for abortion,¹²³ and also for MFPR. For the latter, at 6 months postpartum, positive feelings declined as “negative feelings emerged progressively”.¹²⁴ Unfortunately, for longer follow up the data is scarce, and for the studies that do exist, the results are mixed and inadequate. Several authors have concluded that MFPR does not lead to adverse mental health outcomes at between 1 and 5 years,^{125,126,127,128} even though they also report that “moderately severe levels of sadness and guilt continue for many”,¹²⁹ and 20% of women experienced “moderately strong and persistent dysphoric feelings”.¹³⁰ Furthermore, the problem of selection bias that is a persistent weakness with studies following traumatic experiences was exemplified in the report by Garel and co-workers, where nearly 50% of women who initially participated were lost to follow-up, some of them “too upset to talk about what they remembered as a very distressing experience...”.¹³¹ Part of that ongoing distress may relate to the constant reminder of the surviving child:

At the time you make the decision to reduce, parents don't know what the future will hold. Some of the families go on to experience a lot of grief. At every milestone for the child they decided to keep, there is this ghost in the room, this feeling that there should have been two of them.¹³²

It also no doubt crosses parents' minds about whether to tell their surviving children about the MFPR. Unsurprisingly, this difficult question seems to have no easy answer.

¹²² Mashlach R *et al.* 2013 Psychological response to multifetal reduction and pregnancy termination due to fetal abnormality. *J Maternal-Fetal & Neonatal Med* 26(1):32-35.

¹²³ Goodwin P & Ogden J (2007) Women's reflections upon their past abortions: An exploration of how and why emotional reactions change over time. *Psychology & Health* 22(2):231-248.

¹²⁴ Maifeld M *et al.* (2003) *Op. Cit.*

¹²⁵ Garel M *et al.* (1997) *Op. Cit.*

¹²⁶ Schreiner-Engel P *et al.* (1995) *Op. Cit.*

¹²⁷ McKinney MK *et al.* (1995) *Op. Cit.*

¹²⁸ Bergh C *et al.* (1999a) *Op. Cit.*

¹²⁹ Schreiner-Engel P *et al.* (1995) *Op. Cit.*

¹³⁰ *Ibid.*

¹³¹ Garel M *et al.* (1997) *Op. Cit.*

¹³² Statement by Dr Kelly Ross, director of pediatric hospitalist medicine at Missouri Baptist Medical Center. In: Hutchinson C (2011) When Two (or More) Become One: Selective Reduction for Multiple Births. Some couples are opting to reduce multiple births down to one infant. *ABC News* See <https://abcnews.go.com/Health/WomensHealth/reducing-twins-singles-womans-choice/story?id=14311243> Accessed 8 Oct 2020.

As Pector explains: “Although parents wonder, it is still undetermined whether parents should tell remaining children about the MFPR. If told, the living children could conceivably feel they survived arbitrarily at a sibling’s expense or they could view their parents as murderers.”¹³³

Furthermore, the question of simply having a choice to undertake something as morally contentious as MFPR may carry its own risks.

In an environment where you can have so many choices, you own the outcome in a way that you wouldn’t have, had the choices not existed. If reduction didn’t exist, women wouldn’t worry that by not reducing, they’re at fault for making life more difficult for their existing kids. In an odd way, having more choices actually places a much greater burden on women, because we become the creators of our circumstance, whereas, before, we were the recipients of them. I’m not saying we should have less choices; I’m saying choices are not always as liberating and empowering as we hope they will be.¹³⁴

The fact that there has been so little research interest in the long-term mental health consequences of a clinical practice that is known to be psychologically traumatic, and has been increasing in incidence, remains a serious shortcoming that needs attention.

Perhaps of equal or even greater concern is the fact that there has been no research at all on the surviving children of FIMP. This is a problematic area. As noted, parents may be reluctant to tell their children about FIMP, and yet as part of their medical history, children arguably have a right to know. The consequences could be physical as well as psychological.

Discussion

The prevailing culture within which FIMP occurs has two main elements. First, a culture of acceptance of abortion for a wide range of reasons—from protection of a mother’s life, to avoidance of disability, to abortion on demand (increasingly with few limits on gestational age).¹³⁵ That culture has changed substantially over the past 50

¹³³ Pector EA (2005) Ethical Issues of High-order Multiple Births. *Newborn & Infant Nursing Reviews* 5(2):69-76.

¹³⁴ Padawer R (2011) *Op. Cit.*; statement by Josephine Johnston, a bioethicist at the Hastings Center in Garrison, N.Y.

¹³⁵ This perspective needs some qualification. Public opinion about abortion often reveals a more nuanced view than simple acceptance of abortion. In the Queensland debate about the decriminalisation of abortion, a YouGovGalaxy poll (Feb 2018) found 60% opposition to abortion past 13 weeks, 73% opposition past 23 weeks, 85% opposition to sex-selective abortion, and 67% support for parental consent. Moreover, 76% agreed that abortion harms women’s health, 65% supported conscientious objection, and 26% knew someone pressured to have an abortion. (See <http://www.abortionrethink.org/galaxy-poll>; accessed 30 Jan 2019.) In the UK debate on decriminalisation of abortion, referring to responses by women alone, a ComRes poll (May 2017) found that 70% of women wanted the gestational limit of abortion reduced to 20 weeks, only 1% wanted it increased to birth, 91% were in favour of a total ban on sex-selective abortion, 64% wanted parental consent for abortion on girls 15 and under, and 77% want doctors to be required to verify that there was no pressure from a third party to abort. (See <https://www.comresglobal>.)

years and survives primarily because human life *in utero* has been increasingly devalued at the same time as the precedence of autonomy over other ethical values has become further embedded. There are other reasons too, and it is notable that in the eyes of the public, avoidance of disability rates highly as a reason for the legal permission to terminate.¹³⁶ A woman's legal right to abortion has therefore understandably been used to argue that it is inconsistent to withhold equivalent rights to terminate the unborn in the context to FIMP.¹³⁷

Second, and given that MFPR arose in response to the high rate of multiples within ART, the way in which human life is instrumentalised and commodified within that sector may go some way to explaining why MFPR has developed the way it has. What began as a rare procedure for quadruplets and higher has not only grown to become a routinely offered adjunct 'therapy' for ART, or as Evans *et al.* put it, "an integral fail-safe of infertility practice",¹³⁸ but is also now being used to reduce twins to a singleton for socioeconomic and personal reasons. When human life is instrumentalised, utilitarian decisions about maximizing the health of some offspring at the expense of others, or to suit parental lifestyle choices, make more sense. And there always seem to be some practitioners who operate at the fringes of accepted practice, or even see themselves as forging new frontiers in ethically controversial procedures, so restraint on wider application of MFPR seems unlikely. Furthermore, whether the ART industry will achieve any more success in reducing the number of embryos transferred during IVF remains to be seen, even though the HFEA considers single embryo transfer to be best practice.¹³⁹ As noted, the incidence of multiples in ART is still 5 times the spontaneous rate. Despite what the HFEA wants, clinics are competitive commercial enterprises. In the UK in 2007, a leading expert on infertility described IVF clinics as 'greedy and corrupt',¹⁴⁰ and as Ogilvie argues, this contributes to the incidence of multiples: "Competition between private IVF clinics leads to a temptation to maximize pregnancy rates in order to attract more patients, and therefore to transfer multiple embryos, rather than to consider the best interests of patients and their offspring."¹⁴¹

Whether the clinics can shake their competitiveness and drive for financial returns remains to be seen. Even so, embryo transfer rates only contribute to one third of the

com/wp-content/uploads/2017/05/Where-Do-They-Stand-Abortion-Survey-Data-Tables.pdf; Accessed 30 Jan 2019.)

¹³⁶ Sheldon S & Wilkinson S (2001) Termination of Pregnancy for reason of foetal disability: Are there grounds for a special exception in Law? *Medical Law Review* 9(2):85-109.

¹³⁷ Overall C (1990) Selective Termination of Pregnancy and Women's Reproductive Autonomy. *Hastings Center Report* 20(3):6-11.

¹³⁸ Evans MI *et al.* (2014) *Op. Cit.*

¹³⁹ See <https://www.hfea.gov.uk/treatments/explore-all-treatments/decisions-to-make-about-your-embryos/> Accessed 4 May 2021.

¹⁴⁰ Jha A (2007) Winston: IVF clinics greedy and corrupt. *The Guardian*. See <https://www.theguardian.com/science/2007/may/31/medicineandhealth.health> Accessed 24 Mar 2021.

¹⁴¹ Ogilvie CM (2013) Multiple pregnancy, fetal reduction and selective termination. *Reproductive BioMedicine Online* 26:522-524.

incidence of multiples—other factors, such as maternal age and the use of ovulation inducing drugs are mostly beyond the control of the HFEA or the clinics.

Before discussing MFPR in greater detail, a few comments about ST are needed. Even though both ST and MFPR involve direct and intentional feticide, ST is different in some ways to MFPR. By specifically targeting fetal abnormality, it has more in common with elective abortions for fetal anomaly, which constitute some 2-3% of abortions.¹⁴² It is also less likely to occur for ART multiples,¹⁴³ but the degree of disability that is deemed sufficient for termination is open to broad interpretation in ST just as it is in elective abortions. In some respects, abortion on demand makes the degree of disability somewhat moot, even though pro-choice practitioners differ in their beliefs about termination for disability.¹⁴⁴ The other issue in ST that has particular relevance for the couple involved is the risk of terminating the ‘wrong’ fetus.^{145,146} While this is not common (between 1% and 2%¹⁴⁷), one would expect the experience to be highly traumatic. ST can also interface with MFPR as some practitioners combine testing for anomaly routinely before MFPR¹⁴⁸ to avoid the risk of terminating a healthy fetus and leaving a disabled one, whom a couple may then decide to terminate in any case, meaning total loss of the pregnancy.^{149,150} A side-effect of testing prior to MFPR is that the gender of all fetuses may become known, which if disclosed to the couple, could result in selection for termination on the grounds of gender. Gender selection is generally ethically and legally proscribed, so this knowledge is inherently problematic, even though it is known to occur with MFPR.¹⁵¹

When MFPR was first undertaken, the primary justification was to maximize the health of the surviving children. “If one’s definition of success is a healthy mother and healthy family, for both morbidity and mortality, the data show conclusively with multiples, less is always better.”¹⁵²

Whether that statement is true is debatable, but it is nevertheless true that the practice is outcome driven and hence firmly within a consequentialist ethic. “The law

¹⁴² Department of Health and Social Care (2020) *Op. Cit.*

¹⁴³ Legendre C-M *et al.* (2013) Differences between selective termination of pregnancy and fetal reduction in multiple pregnancy: a narrative review. *Reproductive BioMedicine Online* 26:542-554.

¹⁴⁴ Karkowsky CE (2019) I found the outer limits of my pro-choice beliefs. *The Atlantic*, August 7. See <https://www.theatlantic.com/ideas/archive/2019/08/pro-choice-ob-gyn-confronts-limits-her-beliefs/594151/> Accessed 8 Oct 2020.

¹⁴⁵ Evans MI *et al.* (1999) *Op. Cit.*

¹⁴⁶ Evans MI *et al.* (2014) *Op. Cit.*

¹⁴⁷ Brambati B *et al.* (1995) Genetic analysis prior to selective fetal reduction in multiple pregnancy: technical aspects and clinical outcome. *Human Reprod* 10(4):818-825.

¹⁴⁸ Evans MI *et al.* (2014) *Op. Cit.*

¹⁴⁹ Dahl SL *et al.* (2019) Abortion and multifetal pregnancy reduction: An Ethical comparison. *Nordic J Applied Ethics*, 1-23. <https://doi.org/10.5324/eip.v13i1.3002>

¹⁵⁰ Brambati B *et al.* (1995) *Op. Cit.*

¹⁵¹ Evans MI *et al.* (2014) *Op. Cit.*

¹⁵² Evans MI & Britt DW (2010) Multifetal Pregnancy Reduction: Evolution of the Ethical Arguments. *Seminars in Reproductive Medicine* 28(4):295-302.

and ethics of selective reduction of pregnancy [MFPR] have been dominated by a consequentialist perspective.”¹⁵³

The foremost practitioners argue that moral decision-making should be guided by “trying to get the most benefit from the least harm”¹⁵⁴, and that other factors should be set aside. Arguing for MFPR they say: “Most of the literature on medical decision making has emphasized a rational choice model that puts hard data regarding relative risks center stage and treats emotions, feelings, and values as complications that should be considered only as a second stage analysis.”¹⁵⁵

Despite the irony in using a value driven ethic to derive that position, the way such a calculus works must surely be because fetuses are not afforded value and are certainly not seen as persons. Otherwise, MFPR—particularly when the risk of adverse outcomes is relatively low for expectantly managed twins and increasingly so even for triplets with current high quality pediatric care—constitutes sacrificing some humans for a better outcome for others. It is therefore both surprising and yet telling that the ‘lifeboat dilemma’ is often used in reference to MFPR.^{156,157,158} Surprising, because the analogy is typically used for actual persons, and telling because in reality the analogy is weak with MFPR, because fetuses are killed not to *save* the life of the remaining siblings, but to *improve their chances* of optimum health on a broad assessment of risk, which as we have seen is not only debatable but also involves risking the loss of a whole pregnancy. Moreover, the unknown long-term implications for the mental health of siblings who may experience ‘survivor guilt’ were they to find out, could significantly influence determination of what makes for an improved chance of optimum health.

The equivalence between each fetus in the womb, even if the fetus might be viewed not as a person but as a pre-person, might permit the re-emergence of a version of the lifeboat analogy. In that case, arbitrarily terminating a fetus terminates a future person to whom we have obligations. And all such future persons are equal inhabitants of the lifeboat to whom we owe equal obligations, making MFPR morally arbitrary and the decision more like a true moral dilemma.

Some couples who have chosen MFPR certainly see the situation as one of a lifeboat-like decision and use the language of sacrifice seemingly applied to persons:

Dr Woo looked at the physician and said: ‘*One had to be sacrificed, so the others could live ... so the other two could live, right? Right!?*’ [Emphasis ours].¹⁵⁹

¹⁵³ Hall A (1996) Selective reduction of pregnancy: a legal analysis. *J Medical Ethics* 22: 304-308.

¹⁵⁴ Evans MI & Britt DW (2010) *Op. Cit.*

¹⁵⁵ Evans MI & Britt DW (2008) Fetal reduction 2008. *Curr Opin Obstet Gynecol* 20:386-393.

¹⁵⁶ The lifeboat dilemma occurs when a lifeboat is overloaded and the only way to avoid the death of all on board is to throw some people overboard.

¹⁵⁷ Dickens BM & Cook RJ (2008) Multiple pregnancy: Legal and ethical issues. *Int J Gynecol & Obstet* 103:270-274.

¹⁵⁸ Pector EA (2005) *Op. Cit.*

¹⁵⁹ Britt DW *et al.* (2001) *Op. Cit.*

Precious little one, you are sacrificed to save your brothers and sisters. Come back next time and be my child ...¹⁶⁰

If patients perceive that they are in circumstances so dire that the only way for some children to live is for others to be sacrificed, then the way in which they are counseled and presented with information is questionable. Is it possible that at least some of the practitioners involved are so committed to the ideal of healthy outcomes and see multiples as a medical disaster, that they contextualize the situation in a way as to encourage MFPR? Even without being totally aware that they are doing so?

While some patients see MFPR as trading lives, others balance risks around a fuzzier sense of fetal value. Some risks are for negative outcomes, such as the increased risk of miscarriage and of taking home no baby at all, and others are for positive outcomes such as reduced prematurity and risk to maternal health. Others still are more uncertain, such as adverse parental psychological health or imagined futures with multiples. For the increasing incidence of MFPR from twins to a singleton, when the risks and benefits are so finely balanced, as noted by many authors, the justification for the procedure is hard to sustain. In the end, for patients who make the decision to reduce, the reasons will likely come down to imagined futures and whether one or two children are desired. Hence, rather than an option of last resort,¹⁶¹ for some couples MFPR has become an option of equivalent legitimacy to raising twins.

Despite all of the above, the central point remains the value of the life of the unborn child. Some argue for moral compromise in MFPR because of irreconcilable differences about that value.¹⁶² Perhaps it is not surprising that this argument comes from possibly the most liberal of practitioners who accepts and routinely undertakes reductions of twins to a singleton for non-medical reasons. The moral compromise seems to favour one direction. Others suggest that the mother can confer moral status on the fetus she wishes to keep but withhold it from the one to be terminated.^{163,164} Whether supporters justify MFPR by moral compromise, conferred status, or reproductive rights, their arguments are somewhat consistent with those used to support a pro-choice position on abortion, and so MFPR has been argued to be morally equivalent to abortion.¹⁶⁵

But even for those who describe themselves as pro-choice, there seems to be something particularly troubling about MFPR that distinguishes it from abortion. Saletan argues that: "... the main problem with reduction is that it breaches a wall at the center

¹⁶⁰ Wang H-L & Chao Y-MY (2006) *Op. Cit.*

¹⁶¹ Athanasiadis AP *et al.* (2005) Fetal reduction in a nontuplet pregnancy: technical and ethical considerations. *Eur Obstet & Gynecol & Reprod Biol* 120:227-229.

¹⁶² Evans MI & Britt DW (2010) *Op. Cit.*

¹⁶³ Chervenak FA *et al.* (1992) Selective termination to a singleton pregnancy is ethically justified. *Ultrasound Obstet Gynecol* 2:84-87.

¹⁶⁴ Papageorghiou AT (2006) Ethical considerations in embryo-reduction. *Current Obstet & Gynaecol* 16:181-184.

¹⁶⁵ Dahl SL *et al.* (2019) Abortion and multifetal pregnancy reduction: An ethical comparison. *Nordic J Applied Ethics* 1-23. <https://doi.org/10.5324/eip.v13i1.3002>

of pro-choice psychology. It exposes the equality between the offspring we raise and the offspring we abort.”¹⁶⁶

The hint is in the language used to distinguish between a wanted and an unwanted pregnancy. In the former there exists a baby or unborn child, whereas in the latter there is a fetus, or an ‘it’. The point is, as Saletan identifies, MFPR destroys the distinction between wanted and unwanted, for both exist in a single pregnancy. “That’s the anguish of reduction: watching the fetus you spared become what its twin will never be. And knowing that the only difference between them was your will.”¹⁶⁷

Conclusion

Regarding changes over time, there seems to be a parallel of sorts between contraception and abortion on the one hand, and ART and MFPR on the other. In the former, it has been argued that the problem of unwanted pregnancies necessitates abortion, and that the solution is contraception. If only contraception could be made as widely available as possible, there would be few unwanted pregnancies and hence the unpleasant business of abortion would fade away. In the latter, it is argued that the problem of multiple pregnancies (mainly from ART) necessitates MFPR, and that the solution is to properly control the ART industry. If only one embryo was transferred and less ovulation inducing drugs used, MFPR would soon fade away. The problem is, as contraceptive use has increased, abortions have not faded away. Similarly, as fewer embryos have been transferred and awareness raised about controlling ovulation inducing drugs, MFPR has not faded away, but instead continued to grow, both in raw numbers and breadth of circumstances in which it has been applied.

The difficulty seems to be that in both situations, there has been a failure to understand the links between the culture that has developed to underpin both the problem and the proposed solution. Contraception lowers the risk of pregnancy, but also changes behaviour. And the outcomes seem to be more unwanted pregnancies for which abortion is often a backup—or perhaps an integral failsafe for sexual freedom. There has been a culture shift. Fertility treatment, often unregulated, is a competitive industry that commodifies and instrumentalises embryonic human life. In doing so, it also devalues life at early developmental stages. MFPR, as the solution to a particular problem that has arisen because of the culture of that industry, also devalues the lives of those embryos and fetuses. Otherwise, how is it that MFPR has gone from the hard cases to not wanting twins? There has been a cultural shift that at least in part has been stimulated by the ART industry.

Additionally, there is a culture of avoidance of disability that is evident in both abortion and MFPR. Both have been justified on these grounds—as noted, abortion for disability is associated with very high levels of public support, and the very reason

¹⁶⁶ Saletan W (2011) See <https://slate.com/technology/2011/08/twin-reduction-abortions-why-do-they-trouble-pro-choicers.html> Accessed 8 Oct 2020

¹⁶⁷ *Ibid.*

MFPR was first undertaken was to avoid the risk of disability. So much so that the risk of miscarriage and a lower rate of taking home a baby, can be seen as necessary to lower risk by a few percentage points. With time practitioners will likely improve the technology of selective feticide. Similarly, the care of multiple pregnancies will improve and adverse outcomes decline. Which way will the balance shift, and will it even matter?

Perceptions about multiple pregnancies have changed. Once seen as something unique and special, indicative of high fertility and drawing forth all the obstetrical skill that could be mustered to protect the mother and her children, they are now increasingly understood as a problem to which MFPR is a solution. It will likely remain a solution as long as the ethos of ART remains as it is, disability is overly feared, and fetal life continues to be devalued.

