Introduction

When the doctor congratulated Wen-Min on having successfully conceived after a nine-year quest to do so, her first reaction was a pang of disappointment because the blood test indicated she was pregnant with *only* a singleton.[1] "I had made tremendous efforts for so long … I responded to the doctor that I deserved to have twins," she told me in a café in Kaohsiung, Taiwan. Wen-Min regarded having twins as the ideal reward for her hard work. The list of her efforts to achieve pregnancy was indeed long: following traditional Chinese medicine, taking fertility drugs, trying nutrition supplements, exercising regularly, and even considering divorce so that her husband could have biological offspring with someone who did not have fertility problems. She remembered how tears had silently flowed down her cheeks during one painful procedure in the operation room, and how she had sworn that this would be her last attempt. And then she finally became pregnant.

With her seven-year-old triplets playing next to us, Wen-Min, a cheerful elementary school teaching assistant, resumed sharing the story of her reproductive journey with me. Yes, triplets! Neither a singleton nor twins. Although the blood test had shown a singleton pregnancy, at Wen-Min's next maternal checkup two fetal heartbeats had been detected, and when she was three months pregnant, the ultrasound images revealed three fetuses moving around. "I was shocked and speechless. The doctor did mention that taking fertility drugs for the insemination might increase the chance of twins, but I did not expect triplets." Wen-Min's emotional roller coaster continued. She was advised to undergo fetal reduction—the surgery to reduce one or two fetuses during pregnancy—but she decided not to do it after navigating through the complicated information and undergoing difficult moral struggle. Carrying triplets, she could hardly walk in the late stage of pregnancy and had to take sick leave from work to rest at home. The strategies to prevent preterm birth

were not effective, so the triplets were born prematurely, staying in incubators for between twenty and forty days before going home. When I interviewed Wen-Min, her three boys were fooling around happily in the café, occasionally interrupting us to ask questions like, "What is fetal reduction?"

I first met Wen-Min at the annual gathering of triplet families in Tainan, Taiwan. These triplets were conceived in different ways—naturally, with the help of fertility drugs, or through multiple embryo transfer (MET) during in vitro fertilization (IVF). Their parents organized an annual get-together on the third Sunday in March, which they named the Day of Triplets. I served as a volunteer there several times, helping the parents arrange the outdoor picnic and games and activities for the kids. Being with so many lovely toddlers and children simply brightened me up. Wen-Min's three chubby little boys were so much fun to play with that I could not take my eyes off them. The annual group photo, full of smiles, was often published by the media the next day. Yet amid the joyful and noisy laughter, it was hard to ignore the fact that one or two kids were sitting in wheelchairs, and some were wearing glasses on their tiny faces. The gathering was also meant to support those families whose triplets had health problems, especially those meeting the most difficult health challenges. Wen-Min remembered helping to transport one child in a wheelchair up the stairs to another triplet event. The elevator did not work, so the mother carried the seriously disabled child while Wen-Min carried the wheelchair. "I was in tears; the mom had gone through so much hardship. She must have been burnt out." The child in the wheelchair had cerebral palsy (CP), the most serious mobility disease among newborns.

To my surprise, CP stood out as a key topic at the annual meeting of the Taiwanese Society for Reproductive Medicine (TSRM) in November 2021. "We have probably *created* several hundred CP families," Dr. Kuo-Kuang Lee said in his keynote speech at Taiwan's largest gathering of fertility experts and professionals. Attending TSRM meetings regularly, where participants present and discuss the most advanced research and technical breakthroughs, I seldom heard doctors self-position themselves as being the cause of any inadvertent harm. I could feel the uncomfortable silence of the audience. Dr. Lee asked the TSRM members to imagine the miserable life of a family caring for a child with serious CP for forty years. He stressed that it is the procedure of multiple embryo transfer during IVF, widely practiced in Taiwan to increase the success rate of pregnancy, that increases the prevalence of multiple pregnancy.

And when the number of fetuses doubles or triples, so do the risks to maternal and fetal health. Babies being born too early is the leading complication of multiple pregnancy. Some premature babies may die, some survive well, and some survive but with CP. The CP rate for singletons is roughly 0.2 percent, which rises to 1–2 percent for twins and 4–5 percent for triplets.[2] Based on the incidence rate, Dr. Lee estimated the extent to which Taiwan's IVF cycles have created CP kids. He warned that "there is no reason to increase the chances of CP for the sake of doing infertility treatment." With worrisome data and gloomy scenes of families coping with CP, Dr. Lee asked fertility experts to make a change.

The solution is single embryo transfer (SET). After presenting the international guidelines of countries such as Japan and the US, which recommend SET, Dr. Lee shared his own practice of SET and its clinical outcomes to reassure his listeners that SET can both maintain Taiwan's current pregnancy success rate and prevent the incidence of multiple pregnancy. The skills needed lie in both patient/client selection and embryo selection. Dr. Lee, a former TSRM president, empathized with how doctors may initially feel intimidated about practicing SET rather than MET, so, in order to encourage his fellow members, he revealed his own trajectory from doubting SET to routinely practicing it. His last slide was an image of the phrase "Just Do It," the famous motto of the Nike sports brand. I was laughing with all the others at this funny ending, even though deciding the number of embryos to transfer is certainly not a laughing matter. Does "Just Do It" effectively invite individual doctors to follow in Dr. Lee's footsteps? If not, is the TSRM going to issue a new guideline of SET for its members?

For both Wen-Min and Dr. Lee, making multiple babies is a journey of expecting new life and struggling with life-threatening danger. Having twins or triplets exemplifies the best reward for some and the worst nightmare for others. Assisted reproductive technologies (ARTs) bring hope for those who desire to become parents, yet it is exactly the use of medical intervention to maximize success that magnifies the risk of serious illness and even death. How have people handled the tension between the two? Through what mechanisms do they achieve the best possible future, and whose future is it? In this book I analyze the debates, struggles, and governance over the emergence since the 1980s of increasing numbers of multiple pregnancies/births created through ARTs, both in Taiwan and globally. For several decades this dilemma has haunted parents like Wen-Min, doctors like Dr. Lee, and scientists,

activists, and policymakers around the world. It remains an urgent issue because making multiple babies has never been so prevalent in human history as it is today.

The World's Highest Twin Rate

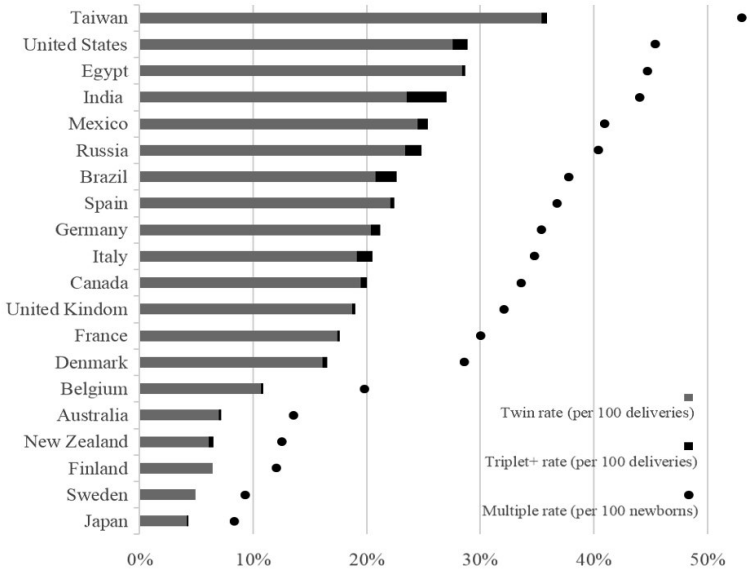
Human beings are producing more twins, triplets, and quadruplets than ever before. Since the 1980s, the global twinning rate has increased by one-third (Monden, Pison, and Smits 2021). Triplets occur in natural conception around once in every ten thousand deliveries, yet by the late 1990s, due to ARTs, this rate had grown fourfold in countries such as England, Australia, and Singapore (Macfarlane and Blondel 2005; Umstad and Lancaster 2005; Imaizumi 2005). Such unprecedented growth in carrying and giving birth to more than one baby at one time is the result of the expansion of medically assisted conception. Some spectacular higher-order multiple births, defined as bearing three or more babies at once, remind us of the extremes that ARTs can create. The best-known case in recent years may be that of the so-called octomom Nadya Suleman of California, who gave birth to octuplets (eight children) conceived by implanting twelve embryos by IVF. Such unusual cases in the history of human reproduction have gradually become a staple on our living-room TV screens. *OutDaughtered*, the reality series on the TLC channel featuring an American family with quintuplet girls conceived due to the use of egg stimulation drugs as an infertility treatment, debuted in 2016. In 2021 I watched its new episode on a "Quints in Quarantine" broadcast in Taiwan. While it was quite amusing to see how the parents managed to homeschool the five sisters during the pandemic, I wondered whether making multiple babies has become normalized and even entertaining. Hopefully not.

Unlike the octuplets and quintuplets who are often reported as a special or even sensational occurrence, twins are common and have become the important target of monitoring. The International Committee for Monitoring Assisted Reproductive Technologies (ICMART)—the leading organization to collect and report worldwide ART data since the late 1990s to better understand the safety of ARTs—regarded the twin rate as one of the key indicators. Multiple pregnancy, including twin pregnancy, has been repeatedly presented as the leading complication of ARTs in medical literature. This may not be evident when we hear that the California octuplets happily celebrated their tenth birthday, or see the quintuplet

girls complaining on TV about the boys in their kindergarten class. However, as I have just shown, parents and health professionals who have witnessed the care burden of CP kids may feel alert to the health statistics, which are very telling. It has long been recorded that multiple pregnancy brings serious high risk to both mothers and babies. Women face various complications in carrying multiples, and maternal mortality is higher for them than for expectant mothers who carry a singleton. Babies from multiple pregnancy tend to suffer from premature birth and low birthweight. The chances of having a serious disability such as CP, and of neonatal death, are almost ten times higher than for singletons.

The prevalence of ART-made twins and triplets is uneven around the world. According to the 2011 international data collected by the ICMART, "the highest twin rate from fresh nondonor IVF and ICSI [intracytoplasmic sperm injection] with at least 100 embryo transfers (in a country) was Taiwan at 35.4 percent and the lowest was Japan at 4.2 percent" (Adamson and Norman 2020: 681). In other words, more than one-third of women who became pregnant with "test-tube babies" with their own fresh eggs were bearing twins in Taiwan. If we count by number of babies rather than by number of mothers' deliveries, then twins make up more than half of the tens of thousands of test-tube babies born in Taiwan each year. Out of the sixty-five countries the ICMART surveyed, I selected twenty to demonstrate the variation (see graph 0.1). I present both the twin and the triplet rate per one hundred deliveries (as mothers' statistics), and the multiples rate per one hundred newborns (as babies' statistics). Taiwan stands at the top and Japan at the bottom. Why is the multiple birth rate more than 35 percent in Taiwan and near 30 percent in the US, but less than 5 percent in Japan and Sweden? How do we explain the differences? What has been the trajectory of confronting multiple birth in the world of assisted reproductive medicine?

ARTs such as IVF are not only the way to deal with infertility but also the main mechanism that creates twins, triplets, and those even greater multiple gestations that human beings would never experience without medical intervention. Since the birth of the first test-tube baby, Louise Brown, in 1978, an estimated eight million babies have been born through IVF to date (De Geyter 2018). At least two to three million of that global total are twins, and in some countries, like Taiwan, more than half are twins. This estimate does not include the results of the older ARTs, such as taking egg stimulation drugs with or without intrauterine insemination (IUI), which



GRAPH 0.1. Twin Rate, Triplet + Rate, and Multiple Rate of Fresh Nondonor IVF and ICSI Transferred Cycles in 2011, in Selected Countries. Source: Adamson et al. 2018. © Chia-Ling Wu

Wen-Min went through. Because most of the national data reporting systems focus only on IVF, the multiple birth rate for other ARTs is less often recorded (e.g., Bardis, Maruthini, and Balen 2005). Still, whether old or new, ARTs are now almost the primary channel for making twins.

Viewing multiple pregnancy and birth as the leading complication of ARTs, the international medical world has heatedly debated this issue. Since the 1980s, leading medical journals on ARTs, such as *Human Reproduction* and *Fertility and Sterility*, have published numerous forums and research papers addressing this leading complication. National and international organizations of reproductive medicine have formed think tanks, offered advice, and built guidelines to deal with this compelling issue. The most salient effort to reduce the incidence of multiple pregnancy is to impose regulations on the number of embryos transferred (NET). In 1990, the UK and Germany passed laws to limit NET during IVF. In 1996, Japan became the first country in East Asia to issue a guideline on NET, through its medical society. In 2003, Belgium implemented a

subsidy program requiring single embryo transfer (SET) for those wished to receive financial support for infertility treatment from the state. In 2004, Italy attempted to limit the number of embryos by referendum. Still, some efforts work, and others prove to be in vain. When the president of the ICMART, David Adamson, gave an online talk to the TSRM members in 2021, he pointed out this pressing agenda that the world, certainly including Taiwan, needs to take seriously: "Why do higher multiple rates occur with ART? Why is there so much variation globally? What can we do about it?"

Surprisingly, however, compared with the enthusiasm for reducing multiple rates caused by ARTs in the field of reproductive medicine, there are few social studies of ARTs—primarily from the fields of medical sociology/anthropology, gender studies, and science, technology, and society (STS)—and existing studies do not often focus on the health risks of multiple pregnancy and birth. Marcia Inhorn and Daphna Birenbaum-Carmeli (2008) noticed that little research had been done on higher-order ART-assisted pregnancy and proposed it as one of the issues in need of more scrutiny from social studies of ARTs; this book intends to fill the gap. To date, most research has used multiple pregnancy and birth as an example to illustrate the risks that ARTs entail (e.g., Ferber, Marks, and Mackie 2020: 131–34; Franklin 1997: 110; Wu 2012), or as something of less concern than "mundane, day-to-day, adverse reaction" during the treatment of infertile women in Egypt (Inhorn 2003: 190). Risk is crucial, but making multiple babies encompasses more than that. For example, Charis Thompson (2005: 260–62) illustrates how implanting multiple embryos to increase success rates is one of the features of the health economy. Andrea Whittaker (2015: 30–31) shows how multiple birth is viewed positively in Thailand and is associated with how IVF has been viewed as a nationalist pride.

Following Marcia Inhorn's (2020) approach to "think with" the ARTs, I present how making multiple babies provides a powerful lens for examining how a society struggles with unruly technology. These struggles embrace the various domains of social life, including science and innovation, professional work and reflexivity, medical markets and regulation, family making and reproductive labor, and morality and responsibility. I also present in this book how these aspects are gendered. Even though social studies of ARTs to date have seldom engaged with multiple birth as their primary subject, their abundant literature has enriched our understanding of how ARTs and society have shaped each other and has created new theoretical and methodological tools. This has paved the way for

this book to examine the clinical procedures of ARTs, the management of increasing multiple births, and women's lived experiences of conceiving and carrying multiples. In doing so, I use "anticipatory regimes" as the overarching framework for analyzing the world of making multiple babies.

Anticipatory Regimes: Hope Technology or Risky Medicine?

Recent STS literature has been engaged with the conceptualization of anticipatory regimes—the apparatus of power regarding "thinking and living toward the future" (Adams, Murphy, and Clarke 2009: 246)—to capture how we live today. Three major components characterize anticipatory regimes: new knowledge making, being in time, and affective mobilization. The classic example might be climate change. Our increasingly sophisticated modeling foresees the disastrous outcomes, facilitating the urgency of intervention, as a title such as *Fight Global Warming Now* shows (McKibben 2007). Another important area of STS literature researches emerging knowledge-based technology. STS scholars examine how to evaluate and engage with new technoscience, showcasing nanotechnology (see the review of Guston 2014). Research on biomedicalization provides ample insights. Treatment of illness and disease has shifted toward the treatment of risk, being called *Risky Medicine* by Robert Aronowitz (2015). The quest to reduce fear and uncertainty has intensified, due both to our increased capacity to calculate probability and to the impetus of health enterprises to "riskize" the normal so as to create more "patients" (Clarke et al. 2010; Aronowitz 2015; F.-T. Tseng 2017). Anticipatory medicalization burgeons—to "medicalize a condition before a problem or condition has manifested" (Conrad and Waggoner 2017: 95). Even without showing any symptoms, people may feel at risk, gain the identity of being a patient, and begin an invasive treatment, such as the increasing use of mastectomy to reduce the risk of breast cancer (Basu et al. 2021). The sense of urgency to do something for a better future leads to the present action. Due to hope for the desired future or fear of the foreseeable crisis, the affective dimension is mobilized to shape a palpable sense that doing something now for the future is the crucial task.

Making Multiple Babies focuses on "anticipation" as the common thread running through the multifaceted levels of the assisted conception politics and controversy, from clinical innovation and regu-

lation making to the lived experiences of women carrying multiples. Even though the social studies of assisted reproduction seldom adopt "anticipation" as their major concept, much literature has discussed it in different terms. Pioneering scientists *envision* medical breakthroughs such as IVF and its ethical concerns (Johnson 2019). The IVF market seizes upon such "promissory capital" to reassure aspiring parents that the new medical intervention will succeed in bringing them new family members (Thompson 2005). Policymakers and activists *estimate* the benefit and cost of ARTs for regulatory reform (Wagner and Stephenson 1993). Infertile couples who regard the latest ARTs as "hope technology"—the answer to their quest to conceive a child—often meet uncertainty and difficulty during the procedure, and many attempts end in failure (Franklin 1997). Social egg freezing as women act upon "anticipating infertility" may best illustrate how their reproductive future is handled in advance (Martin 2010; Brown and Patrick 2018). These important arguments closely link with the literature of anticipation.

I argue that making multiple babies serves as an exemplary site of anticipatory practices. Multiple pregnancy caused by ARTs involves both sides of anticipation—success and failure, hope and risk. Some procedures of ARTs are intended not only to treat the infertility but also to create/increase the success rate. Multiple embryo transfer is the leading example. In the early 1980s, fertility experts found that the more embryos were transferred, the higher the success rate. The result is what Sarah Franklin (1997: 110) calls "too successful," namely, having twins and triplets that these women could not imagine conceiving at the outset. The action to increase the success rate also leads to increasing risk. How to work with this dilemma has been one of the toughest tasks in the world of assisted reproduction. The medical intervention that brings about the most desired outcome may cause the most horrible nightmare, and what do people do with that?

To analyze the anticipatory regimes of assisted reproduction, I highlight two dimensions: "anticipatory governance" and "anticipatory labor."

Anticipatory Governance

I define "anticipatory governance" as the totality of actors, rules, processes, and mechanisms concerned with what to think and how to act now for the future. Diverse stakeholders, evolving technoscience, and enrolling deep emotion are the most salient aspects of anticipatory governance. The conceptualization I build

here was inspired by the literature on technoscientific and reproductive governance from an STS perspective (see the reviews of Fisher, Mahajan, and Mitcham 2006; Irvin 2008; Jasanoff 2005; Morgan 2012; and Stilgoe, Owen, and Macnaghten 2013), including works that directly use the same term "anticipatory governance" (e.g., Barben et al. 2008; Guston 2014). David H. Guston (2014: 218) defines "anticipatory governance" as "a broad-based capacity extended through society that can act on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible." His ideal type is the deliberate democracy involving public participation in the development of nanotechnology, which has prompted both hope and concerns, much as ARTs have. Echoing other participatory democracy governance in new technology development, this approach focuses on the involvement of the lay public in the stage of innovation. I would like to broaden the concept to non-emerging technology, since after the "yes or no" question about investment in promising new technology (to do IVF or not), the "how" question (such as which embryos and how many embryos) can still attract contention and engagement from policymakers, scientists and practitioners, and the lay public.[3] Compared with traditional policy studies, "anticipatory governance" involves more stakeholders to understand how technoscience is ruled. In addition to formal policymakers such as the state, congress, experts, and organized civic groups in the formal policy forum, it investigates how practitioners, markets, activists, and laypeople shape the moral landscape involving what to do with technoscience. Therefore, the governing activities need to incorporate not only formal actions like congressional debates, public hearings, and administrative negotiations but also informal ethical contentions in clinics and living rooms. As I show in chapters 1–4, leading scientists, IVF experts, medical societies, public health officials, pediatricians, feminists, aspiring parents, civic groups, and media have all become involved in discussing what to do about the increasing multiples created by ARTs.

To capture the contention among stakeholders, "framing" becomes a useful starting point for examining how different actors select a particular aspect of anticipation—fulfillment of reproductive rights or disruption of social order, enhancement of clinical success or entailment of health risk—to demand certain deeds. Professional conflicts arise among IVF experts who target the clinical procedures, pediatricians who handle the dying premature babies resulting from multiple pregnancy, and public health officials who rely on the

benefit and risk models to evaluate the clinical procedures. Even among IVF experts, there has been much contention; some demand strict regulation by imposing guidelines, whereas others may challenge standardization that harms their professional autonomy. The particular dimension(s) of women, as the essential participants in ARTs, that can be selected for anticipatory attention reveal the spectrum of possible framings. Dimensions selected for highlighting in or erasure from the public forum range from women's strong desire for biological motherhood and the prevalence of complications during twin pregnancy, as well as women's ambivalence about fetal reduction, to the maternal death rate of carrying multiples. The power dynamics among the actors—medical professional dominance, statist intervention, and vibrant activism, including how strongly to put women's welfare in the center, for example—explains why certain framings prevail and others are ignored.

The global diversity of governing multiple pregnancy has been a puzzle, and may push us to generate some explanatory model. While evidence-based medicine and some international organizations such as the ICMART have promoted single embryo transfer (SET) as the most effective method to reduce multiple pregnancy caused by IVF, SET has not been adopted in all countries. The Nordic countries have taken the lead, the US has stayed behind, and Taiwan's law has permitted the transfer of as many as four embryos. This global variation has long been noted in social studies of ARTs. Earlier literature has shown that ART regulations are enormously diverse, comprising a sort of "legal mosaicism" (Pennings 2009), because they are formed in specific cultural, social, and political contexts. For example, scholars have examined how pronatalism in Israel (Kahn 2000; Birenbaum-Carmeli 2004), religion in the Muslim world (Inhorn 2006), political culture in Britain, Germany, and the US (Jasanoff 2005), and stories of ART use told in Demark and Sweden (Adrian 2010) have shaped ART governance. Therefore, both the contextual factors and stakeholder dynamics need to be brought in to explain the global variation.

In addition, I would like to highlight the importance of "national sociotechnical imaginaries," which Jasanoff and Kim (2009: 120) define as "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects." Counting the world's first and/or a nation's first test-tube baby or other ART-related technical breakthrough has been a trademark way for countries to vie with one another in the arena of global competition (Ferber, Marks, and

Mackie 2020). At the same time, the condemnation of such technologies as causing social chaos never slackens. Therefore, whether IVF is framed as a nationalist glory to achieve a medical breakthrough or as a procedure full of worries for unpredictable outcomes, it turns stakeholders' attention toward looking into the future.

Within the framings that prevail, much anticipatory work evolves. Adele Clarke (2016) convincingly asks us to look into the ample layers of "anticipatory work": hope work, abduction, and simplification. This offers useful guidance for investigating anticipatory governance with the details of the affective dimension (hope work), the back and forth of technoscience making and testing (abduction), and the implementation of effective strategy (simplification). Clarke's anticipatory work echoes the governance approach of regarding technoscience not only as a fixed object that needs to be governed but also as a development that is evolving along with the governance, such as generating new knowledge in order to meet the new requirements of regulation. In the world of assisted reproduction, faced with the increases in multiple pregnancy after IVF, medical societies and the state keep changing NET guidelines along with the innovation of skills, such as growing the embryo to the fifth day in the lab and doing genetic testing for the embryo quality. Fields such as epidemiology and health economics invent new indicators and estimates for the most cost-effective models. International and national professional societies such as the ICMART and the TSRM operate "midstream modulation of technology" to govern from within these professional communities (Fisher, Mahajan, and Mitcham 2006). Engagement of "responsible innovation"—"taking care of the future through collective stewardship of science and innovation in the present" (Stilgoe, Owen, and Macnaghten 2013: 1570)—is salient in the world of reproductive medicine, as seen in the efforts made by Dr. Lee, and also needs critical examination.

Anticipatory governance engages affection. What I would like to adjust in Clarke's hope work here is to incorporate fear work, or the work of revealing the false hope. In literature on new technologies, anticipation is often presented as an either/or situation—namely, either anticipating the good or anticipating the bad. Anticipating the terrible outcomes of climate change, genetic-related cancer, and Covid-19, we act at present to prevent the harmful consequences. Anticipating the good lives promised by vaccines, time machines, and nanotechnology, we invest and we hope, even knowing that counterarguments are certain to arise. Medically assisted reproduction stands out as a case of anticipating both the good and the

bad. It is a brave new world in which scientists experiment with human biology, and it is a hopeful technology for people longing to conceive biologically related offspring. At the same time, "[these] treatments for infertility not only have the potential to alleviate infertility but also entail the risk of inducing multiple gestation pregnancies" (Callahan et al. 1994: 244). Expectant parents may regard multiple pregnancy as the best reward—or as shocking news. Practitioners may paper the walls of their offices with all the lovely photos of twins to be proud of, or they may confess—along with Dr. Peter Braude (2006: 3), who led a task force to tackle the problem of multiple birth in the UK—that "it saddens and frustrates me to see [that] so many children born after fertility treatments are denied the best start to life." How such sadness and frustration is an affective force to initiate new action is part of the investigation in researching anticipatory governance. Anticipatory governance is composed of the strong emotions tangled with the data, the formal and informal deliberations of stakeholders, and the devices to make changes for a better future.

Anticipatory Labor

I spotlight women's anticipatory labor as another important dimension of the anticipatory regimes of assisted reproduction. I define "anticipatory labor" in this context as women's thinking and doing, during conception, pregnancy, and childbirth, to achieve the better futures they perceive for their offspring. Again, making multiple babies is an illuminating site of anticipatory labor. First of all, making multiple babies epitomizes the maternal-fetal conflict during decision-making and care management. Achieving pregnancy through ARTs relies on many medical intrusions upon women's bodies. Women must face procedures such as multiple embryo transfer, which may increase the chances of success, but these also raise the question of the extent of health complications of carrying multiples. Some measures to save the mother or the babies from being exposed to risk often entail uneasy anxiety. Fetal reduction may best dramatize this tension. Although doctors advised Wen-Min to reduce one of the three fetuses so that she would carry twins rather than triplets—for better health outcomes for the mother and the remaining fetuses—she worried that the procedure might induce miscarriage, and also felt moral guilt toward the unborn child. Such conflict is best discussed in earlier literature on abortion and fetal surgery (e.g., Casper 1998; Hardacre 1997). I bring in the case of making multiple babies to join the work of these feminist scholars so

as to highlight women's struggles between prioritizing their dearly desired children and their own welfare and to problematize how anticipatory regimes put women in such a situation.

Second, making multiple babies reveals the challenging hurdles at every stage of reproduction, from conception and pregnancy to the decision about fetal reduction, the possibility of miscarriage, and (highly likely premature) birth. For each stage, much feminist scholarship has made important arguments. For example, Sarah Franklin (1997) stresses the "reproductive labor" that women go through during the quest for conception to counter the spotlight that IVF experts receive (see also the discussion of embodiment in Inhorn 2003 and of alienation in Thompson 2005). Feminists' studies on pregnancy also emphasize the need to recognize the months of gestation women undergo, involving physical, emotional, and social relationship with the fetus(es) (Rothman 1989; Ivry 2009; Neiterman and Fox 2017; L.-W. Shih 2018). As Rothman (1989: 90) points out, "The pregnancy is thought of as a time of "expecting" for the mother—its future the only thing that counts, its present having meaning only for its future." To underscore the present, Caroline Gatrell (2011, 2013) has coined the term "maternal body work" to highlight the body work that employed pregnant women do in the workplace. I extend this maternal body work from the office to the household and also to medical clinics. As Almeling (2015) argues, the scholarship on reproduction tends to focus on a specific reproductive event (abortion, prenatal testing, or childbirth) rather than exploring reproduction as continuous processes instead (see also Ginsburg and Rapp 1995). Making multiple babies has the great potential to regard all the events involved (the quest for conception, the decision on fetal reduction, the security of a stable pregnancy) as a connected whole. Transferring a high number of embryos at the early stage so as to increase the success rate of clinical pregnancy may lead to hardships to prevent miscarriage at later stages. Making multiple babies thus helps reveal the different and related natures of anticipatory labor during assisted conception, fetal reduction, and pregnancy management.

Anticipatory labor uncovers what the major statistics of making multiple babies fail to present. Biomedical research tends to calculate multiple pregnancy success and risk in terms of live birth rate, or morbidity and mortality; to frame it within a risk/benefit model; and to apply quantitative methods for assessment. By presenting women's anticipatory labor behind and beyond the health statistics, *Making Multiple Babies* shows how laypeople interpret and act in light

of success and failure, and therefore participate in the anticipatory regime of ARTs. Women and their families must face a continuum of desired outcomes and uncertain risks: physical, emotional, and social. I locate their navigation and negotiations within their specific sociocultural contexts, including their economic resources, social welfare, religious beliefs, and gender norms. In the context of Taiwan, the lack of public financing for most ARTs, combined with delayed parenthood due to late marriage and the gender division of childcare, may all contribute to women's framing of having multiples. Why Wen-Min decided to stop intrusive procedures at some point, preferred a twin pregnancy, and worried about carrying triplets needs to be considered within the broader social milieu of how reproduction, gender, and care are organized in Taiwan. Anticipatory labor highlights how women, under such constraints and with such opportunities, coordinate heterogeneous technical, legal, financial, emotional, ethical, political, and gender elements around hope and fear, life and death.

Global Comparison and the Case of Taiwan

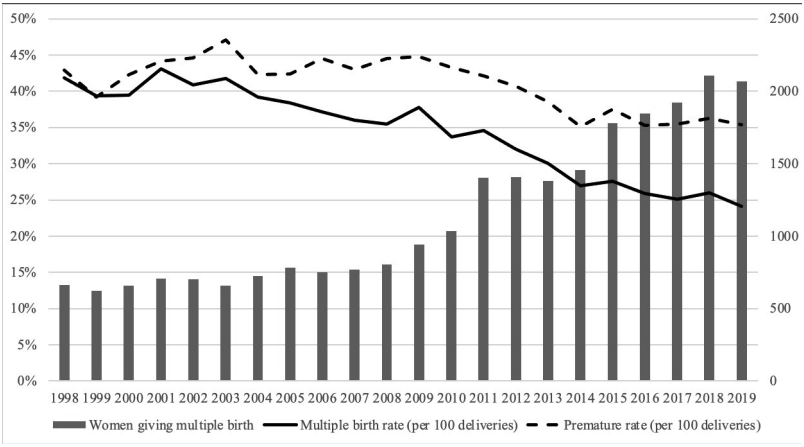
Making Multiple Babies traces international regulatory debates, explores East Asian ART politics, and uses Taiwan as an extreme case in elaborating anticipatory ART regimes. Although most IVF ethnography and histories are nation based, there have been important efforts to compile global IVF history (e.g., Ferber, Marks, and Mackie 2020) and to advocate for a globally comparative approach (see the review and advocacy of Franklin and Inhorn 2016). With respect to making multiple babies, globally collective efforts to tackle the issue are evident, from the international surveys of IVF practices by the International Federation of Fertility Societies (IFFS) and the global data collection and reporting by the ICMART, already mentioned, to evidence-based medicine to find the causes and solutions to multiple pregnancy caused by IVF. Still, great global variety exists precisely because local complexity exists. Therefore, to fully understand how the world is facing the challenge of making multiple babies, I incorporate different levels of investigation—those of global governance, national comparison, and one exemplary case.

For anticipatory governance, I focus on the characteristic procedure involved: the number of embryos transferred (NET) during IVF. Although the use of fertility drugs also causes multiple pregnancy, the most visible exertion in anticipatory governance is how

to handle NET. After the birth of the first test-tube baby in 1978, the world awaited the second, the third, and more, only to discover that it was not that easy. And when efficacy consisted not simply of one successful event but of an acceptable successful rate, IVF experts needed to find a new recipe for success. Multiple embryo transfer became the key to boosting success rates to meet the expectations of aspiring parents and the competitive IVF industry. When increasing multiple pregnancy came up, some tragic events and alarming statistics in Europe, Australia, and the US attracted risk framing from the state, reflexive expertise, international regulatory agency, and feminist activism. Number governance—imposing three, two, or just one embryo to transfer by law or by voluntary guideline—is never an easy battle. Data, new techniques, moral responsibility, money, and the joy and the tears of sorrow of the families involved all became entangled in considering the action of simplification (reducing to one embryo or two, or doing nothing). The global variation, as I discuss in chapters 1–2, including the diverse contrasts among East Asian countries, illustrates how local reproductive politics interact with global evidence-based medicine and policymaking.

Taiwan's rich and specific features contribute to this field both empirically and theoretically. The international statistics on ARTs, which first became available in 1998, reveal that Taiwan has the world's highest number of multiple embryos transferred during IVF, followed by the US and South Korea (IWGRAR 2002). In 2007, Taiwan enacted the Assisted Reproduction Act, limiting the number of embryos transferred to fewer than five—the most lenient globally. As an extreme case, Taiwan thus provides abundant data on the regulatory debates. As a latecomer to number governance, why did Taiwan generate such a permissive regulation, which has inevitably led to the highest multiple birth rate, as shown in graph 0.1? Taiwan's extreme case needs to be understood within the global context. In chapters 3–4, I propose three interrelated aspects that reveal the "global in the local" analytical framework based on the case of Taiwan: (1) the power relationships among stakeholders, (2) the selected global form that involved actors drew upon, and (3) the recontextualized assemblage made of local networks.

To illustrate the anticipatory labor involved, Taiwanese women's experiences provide rich data, somewhat sadly. The first test-tube baby was born in Taiwan in April 1985. IVF was widely welcomed as a medical breakthrough to treat infertility, limited to married couples through various stages of regulation. Before that, women in Taiwan already experienced higher chances of bearing mul-



GRAPH 0.2. Number of Women Giving Multiple Birth, the Multiple Birth Rate, and the Premature Birth Rate after IVF in Taiwan. Sources: ROC Ministry of Health and Welfare 2021a, 2021b. © Chia-Ling Wu

tiples due to the use of egg stimulation drugs. After IVF became a medical option for conceiving children, it was largely privatized until very recently, so people needed to pay for IVF out of pocket. Still, the treatment cycles in Taiwan increased from seven thousand cycles in 1998 to forty-four thousand cycles in 2019, largely due to the increasing delayed parenthood (ROC Ministry of Health and Welfare 2021a). Since the 2000s, Taiwan has had one of the lowest fertility rates in the world and one of the highest average maternal age when first giving birth. Late parenthood drastically enhances the use of ARTs. After IVF became an option, the number of women experiencing multiple pregnancy due to IVF increased as well. Graph 0.2 shows that more and more women who used IVF gave birth to twins, triplets, and quadruplets. In 1998, the year that registry data first became available, it reveals that more than 40 percent of such women were pregnant with twins or more. The rate would have been higher if some of them had not used fetal reduction to reduce a higher-order multiple pregnancy. Although the multiple birth rate in Taiwan subsequently declined, the most recent data show that roughly one-fourth of women in Taiwan who undergo IVF still give birth to twins. This is far above some policy goals, such as less than 10 percent in the UK, or the 3 percent that Taiwan's neighbor Japan is proud of. Another warning sign is that around 40 percent of Taiwanese women pregnant through IVF

give birth before the thirty-seventh week, most of them because of carrying multiples. Women face challenges hurdle by hurdle, from the great hope promised by ARTs to failure of embryo implantation, possible miscarriage induced by fetal reduction, and preterm birth due to multiple pregnancy. Taiwan has become a fruitful site for probing the strenuous anticipatory labor women must do at different reproductive stages.

Data and Methods

The research design of *Making Multiple Babies* was born of a broad project on IVF. I conducted four waves of research on IVF development in Taiwan and East Asian countries: in 1999–2001, 2006–8, 2010–12, and 2015–21. In 1999–2001 and 2006–8, I investigated the gender politics of ARTs in Taiwan, focusing on how the sociotechnical network of infertility treatment and sperm banking shaped the gender order there. In 2010–12 and 2015–21, I focused on the controversy of making multiple babies through ARTs and compared the governance among East Asian countries. The data I use most in this book come from those collected since 2010. However, the earlier research projects helped me build a long-term understanding of how stakeholders work and transform, as well as how the diverse users of ART include married heterosexual couples, single women, and lesbians and gays.

The data for this book include archival documents, participant observations, in-depth interviews, and registry statistics. Combing both archival data and fieldwork, I pursued a multisited ethnography to trace various stakeholders' governing and laboring activities. Data on the anticipatory governance to standardize and regulate embryo transfer include actors' testimony at public hearings, discussions during regulatory meetings, negotiating processes with other actors, opinions on media stories on the subject, related public education, and proposed solutions. Since regulating activities occur at different sites, I followed these activities through different methods. Archival data used to follow these activities include newsletters and reports of related organizations, conferences, academic research, and governmental documents and newspapers, globally and particularly in East Asian regions. Interviews and fieldwork were conducted in Taiwan, and a few in Japan and South Korea, including more than a hundred interviews with and observations of relevant actors, such as government officials, IVF specialists and technicians, NGO activists, legislators, journalists, and scholars of bioethics, about their prac-

tices of multiple embryo transfer and participation in policymaking. I attended the annual meetings and continuing education sessions of several medical societies in Taiwan over the past fifteen years and gave about twenty talks to practitioners in different institutions to exchange ideas. Cross-national comparison helps to identify how anticipatory governance differs. In this book, while the analysis of global governance is mainly based on archival data, I conducted interviews and fieldwork in Japan between 2015 and 2019, which became the second richest data source I have for analyzing anticipatory governance.

The data on anticipatory labor were mainly interviews with more than a hundred Taiwanese women (and a few men) who had experiences of assisted conception, fetal reduction, and/or multiple-fetus pregnancy from 1999 to 2021. I used a snowballing technique to find interviewees, and some came from support groups for parents of twins and triplets, or for lesbians, gays, and single women who often need to go abroad to use ARTs. I had two overlapping groups of interviewees. The first sample consists of women (and their families) using ARTs to achieve pregnancy, ranging from women such as Wen-Min, who turned out to have triplets through IUI, to others who withdrew after several attempts. This group's reproductive trajectories reveal their diverse anticipation trajectories toward becoming parents. I analyzed how the social, cultural, financial, and legal situations in Taiwan shaped their framing of ARTs and of making multiple babies. The second sample includes women carrying multiples, whether spontaneously or through ARTs. No matter whether women conceive multiple fetuses "naturally" or by IUI and IVF, they are categorized as a high-risk group, in contrast to those pregnant with a singleton. These women faced the decision of whether or not to undergo fetal reduction during their second or third month of pregnancy, and often made efforts to prevent premature birth in the second and third trimesters. Combining experiences from the two samples shows the different layers of anticipatory labor women undertake, from before conception through to the end of their nine-month pregnancy (or less, in many preterm cases).

Overview of the Book

The first part of *Making Multiple Babies* traces the global anticipatory governance of ARTs. Chapter 1 delineates the anticipatory practices of IVF since the 1970s, centering on the clinical procedure of multiple embryo transfer. I examine historically how different framing

actors selected specific dimensions of anticipation and developed their anticipatory tools. In the early years of IVF development, a singular successful event—such as the birth of Louise Brown in the UK, or the birth any other nation's first test-tube baby—could meet the expectations of a medical breakthrough. A pioneering British team used women's "natural cycle" to take one egg during the menstrual cycle, develop one embryo in the lab, and achieve a successful pregnancy. Soon after such widely publicized events, leading IVF teams faced the new anticipation that they would be able create acceptable success rates for IVF clients, which led to multiple embryo transfer (MET) standing out as the solution. This solution led to a sharply increasing incidence of multiple pregnancies, bringing new health risks to both mothers and infants, criticized by feminists, public health experts, pediatricians, and some reflexive IVF doctors. Since the late 1980s, fetal reduction has been a new solution to manage the crisis, even though it has generated new physical, psychological, and moral troubles. The global IVF community therefore began to impose new guidelines to limit the number of embryos transferred, but there was no standardization: in 1998, for example, while the UK recommended that only two embryos be transferred, the US allowed as many as five.

Number governance arrived at the proposal of elective single-embryo transfer (eSET). Chapter 2 describes the anticipatory practices of eSET, proposed by some as the only effective solution to dealing with the skyrocketing incidence of multiple births after IVF. Some reflexive medical communities identified the misleadingly high clinical success rate of MET as creating "false hope," asserting instead that the "real hope" that expectant parents needed and deserved lay in the "take a healthy baby home" rate. I compare and contrast the ways Belgium and Japan have successfully built an eSET network by integrating the resources from the state, the medical societies, the international community, and civil society. The global anticipatory governance of IVF involves both international collective efforts and highly diverse national practices.

Chapter 3 discusses the anticipatory governance in Taiwan. Taiwan's first birth of a test-tube baby was widely perceived as a nationalist glory and hence restrained the state from rigorously supervising the medical community. I illustrate how the contrasting national sociotechnical imaginaries of emerging IVF between Taiwan (glory) and Japan (controversy) influenced the dominant dimension of anticipation in each of the two countries—namely, achieving success in Taiwan and preventing risk in Japan. In

Taiwan, it has been the protests from NGOs concerning the increasing numbers of premature babies caused by ARTs and the feminist health movement concerning maternal health that have framed multiple pregnancy as a public problem. Still, these critical framings of health risks have not led to an effective solution.

Chapter 4 analyzes the making of the world's most lenient guideline on number of embryos transferred (NET): Taiwan's "fewer than five" was stipulated in its Assisted Reproduction Act in 2007. Although some reflexive medical doctors, engaged governmental officials, and concerned activists have endeavored to restrict the clinical procedure of IVF in order to handle the health problems caused by making multiple babies, the disconnected patchwork of these efforts has led to an ineffective legal restriction to prevent the health risk that had been well discussed in the international community of reproductive medicine by the year 2000. This chapter shows that Taiwan, as a latecomer in regulating IVF, selected a certain global form to meet the local anticipation. Although some actors may select the governing practices in the UK, Japan, and the Nordic countries to model, it is the US that has become the crucial reference point for local Taiwanese medical societies to follow.

Making Multiple Babies then turns to exploring Taiwanese women's anticipatory labor—their various making and doing during conception and pregnancy to achieve their reproductive goals. I focus on how women pregnant with twins, triplets, or quadruplets calculate, act, and "live in preparation" (Clarke 2016: 90). Chapter 5 presents women's (and a few men's) optimization of ARTs for their reproductive ideals. Advanced medically assisted conception serves as the tool to reach one's best possible future, but people anticipate their futures differently. I sketch four trajectories of anticipation to demonstrate why people may perceive reaching multiple pregnancy as "winning the lottery," as efficient family building, as a worrisome outcome, or as fulfilling reproductive justice. The sociodemographic trend of late marriage, the gender order, and the social organization of reproductive care in Taiwan are the major contextual dimensions for understanding women's optimization within their disrupted reproduction.

Fetal reduction in the first trimester and bed rest after the second trimester are the two most challenging tasks when women carry multiples. Based on women's experiences in deciding to undergo fetal reduction and on pregnancy management to prevent premature birth, chapters 6 and 7 present women's anticipatory labor during pregnancy: navigating information, maternal body work,

and negotiation between production and reproduction. Comparing different tasks and hurdles women meet at different reproductive stages, I elaborate upon how the responsibility to reach their reproductive goals gradually narrows down to women alone.

Making multiple babies is a crucial arena in which IVF experts, policymakers, activists, and aspiring parents advocate for their ideal futures and battle for various intervention options. In the conclusion, I return to the theoretical themes of anticipatory regimes and argue for the importance of thinking with anticipation. Based on the research findings, I offer some policy recommendations, especially for Taiwan, the country with the world's highest twin rate caused by ARTs.

Notes

1. All names are pseudonyms except those of public persons.
2. The prevalence of CP that Dr. Lee used was not based on the data in Taiwan but on textbook data based on studies in the UK and Australia in the 1980s and 1990s (see Pharoah 2005).
3. For example, the UK built one of the most complete regulations on IVF, viewing itself as the creator of the world's first test-tube baby (Jasanoff 2005). But the governance continues. To handle the high multiple birth rate after IVF treatment, an expert group composed of scientists, practitioners, and lay civic groups produced a report titled *One Child at a Time* (Braude 2006). The new guideline to promote elective single-embryo transfer (eSET) has become the important anticipatory governance since then.