Insurance coverage and in vitro fertilization outcomes: a U.S. perspective

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Objective: To compare the impact of mandated IVF insurance coverage on ET practices and resulting multiple pregnancy rates.
Design: Retrospective analysis of all fresh, nondonor IVF cycles performed in the United States in 2006.
Setting: United States.
Patient(s): A total of 91,753 fresh, nondonor IVF cycles in the United States.
Intervention(s): None.
Main Outcome Measure(s): Pregnancy rate, live-birth rate, embryos transferred, multiple pregnancy rate.
Result(s): Overall, nonmandated states had a significantly higher pregnancy rate (38.8% vs. 35%) and live-birth rate (32.2% vs. 29.1%) than mandated states. Nonmandated states also had a significantly higher twin rate (28.1% vs. 26%) and triplet rate (3.9% vs. 3.4%). The average number of embryos transferred was also significantly higher in nonmandated states (2.6 vs. 2.2). These findings were more pronounced in the <35 and 35–37 age groups.
Conclusion(s): In the last 8 years, despite a reduction in the average number of embryos transferred and multiple pregnancy rates, there is a continued association between mandated IVF coverage, the transfer of fewer embryos, and lower rates of multiple pregnancies and births, particularly in the younger age groups. (Fertil Steril® 2011;95: 964–9. ©2011 by American Society for Reproductive Medicine.)

Key Words: Insurance, mandate, IVF, outcomes, embryos transferred, multiple pregnancies

Recent epidemiologic data estimate that more than 7 million U.S. women, or 12% of the reproductive population, are infertile (1), and many require IVF to conceive. However, IVF remains an expensive and unaffordable self-funded treatment option for many infertile couples in the United States. The average cost of an IVF cycle in the United States is $12,400, and it can get up to $85,000 when including the cumulative cost of failed cycles and medications (2–4). This costly treatment is occasionally covered by insurance but is primarily self-pay (5).

Recently, several states have passed legislation requiring insurance companies to provide varying degrees of coverage for infertility treatment, and a few have specifically mandated coverage for IVF. This coverage, however, is restrictive in some states and not always available to the entire population (see Table 1). Infertility insurance mandates are intended to increase access to treatments that are financially prohibitive for most couples. In 2008, the World Health Organization joined the American Society for Reproductive Medicine (ASRM) in classifying infertility as a disease (6). This definition may make it more difficult for insurance companies to deny coverage for infertility in the future and should support the inclusion of infertility treatment in insurance plans.

IVF has become increasingly successful over the years, resulting in high pregnancy rates with a lower number of embryos transferred; despite this, in 2006, the percentage of multiple live births was still elevated at 34.3% (7). The frequency of multiple pregnancies in the United States has increased dramatically since the advent of assisted reproductive technology (ART). In 2006, 32% of all live births resulting from ART were multiples, compared with 3% in the general U.S. population not using fertility treatment (7). This represents an improvement from 1998 when the percentage of IVF pregnancies that resulted in multiples was 38.2% (7). Unfortunately, this rate is still alarmingly high. Multiple-pregnancy births are associated with greater medical problems for both mother and infant, including preterm delivery complications, cesarean section rates, prematurity, disabilities, and death (8–11). These conditions not only affect the families involved but also place financial stress on the health care system that must provide coverage for extensive lifelong medical bills.

Earlier literature published on the relationship between state infertility insurance mandates and practice patterns has indicated that mandates increase the use rate for ART services (12). More importantly, several studies have also shown that physicians practicing in states with insurance mandates transferred fewer embryos per cycle and had less multiple pregnancies compared with states without IVF insurance (12, 13). This association has also been seen in countries where national IVF coverage is mandatory and single ET has become the standard of care to reduce multiple pregnancies and their associated costs (14–19). The association between mandated states and lower multiple rates is an important finding as this can have significant impact on maternal/fetal health and economic impact on the health care system (20).

Previous studies evaluating insurance mandates and IVF outcomes in the United States made their conclusions based on data from 1998, when only three states had passed legislation to require comprehensive insurance for IVF (Illinois, Massachusetts, and Rhode Island) (12). At that time, other states such as Arkansas,

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TABLE 1

States with insurance mandates that cover at least one IVF cycle and states with insurance mandates that exclude IVF.

State	Year	Clinics	Infertility coverage
Insurance mandates that cover IVF			
Arkansas	1987	1	All group insurers that provide maternity benefits must cover IVF. Lifetime maximum $15,000. Two-year history of infertility or specific infertility diagnosis. Health maintenance organizations (HMOs) exempt from the law.
Connecticut	2005	8	Individual and group insurers must cover up to two IVF cycles for those <40 years old. Infertility defined as inability to conceive after 1 year.
Hawaii	1987	3	Individual and group insurers are required to cover one cycle of IVF if patient has a 5-year history of infertility or a specific infertility diagnosis.
Illinois	1991	27	Group and HMOs that provide pregnancy-related coverage must cover infertility treatment, including IVF, for up to four cycles. Two additional cycles covered for subsequent pregnancy. Lifetime six cycles covered.
Maryland	1985	7	Individual and group insurers that provide pregnancy-related benefits must cover up to three cycles per live birth. Up to $100,000 lifetime maximum. Employers with less than 50 employees exempt. Patient must have a 2-year history of infertility or specific infertility diagnosis.
Massachusetts	1987	6	All insurers providing pregnancy-related benefits must cover infertility treatment, including IVF. Coverage limited to six cycles of IVF.
New Jersey	2001	21	All insurance policies that cover more than 50 people and that cover pregnancy-related benefits must cover up to four cycles of IVF for those <45 years old. Infertility defined as the inability to achieve pregnancy after 2 years. Coverage does not apply to those who were voluntarily sterilized.
Rhode Island	1989	1	All insurers who cover pregnancy-related benefits must cover infertility treatment, including IVF. Only women 25–40 covered, and there is $100,000 lifetime maximum. Insurers may impose a 20% copay. Infertility defined as inability to achieve pregnancy after 2 years.
Insurance mandate that excludes IVF coverage			
California	62	1989	Certain insurers must offer coverage for infertility diagnosis and treatment. Law exempts insurers from offering IVF. Infertility defines as inability to achieve pregnancy after 1 year.
Louisiana	5	2001	Prohibits the exclusion of coverage for the diagnosis and treatment of a correctable medical condition solely because it results in infertility. The law does not require coverage for IVF or fertility medications.
Montana	0	1987	Requires HMOs to cover infertility services as part of basic health care services. Infertility is not defined by the law. There were no facilities in the state performing IVF in 2006.
New York	33	2002	Prohibits the exclusion of coverage for the diagnosis and treatment of a correctable medical condition solely because it results in infertility. Mandate covers infertility diagnosis and treatment except IVF.
Ohio	11	1991	Requires HMOs to cover "basic health care services" including fertility services. IVF may be covered but is not mandated.

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TABLE 1

Continued.

State	Year	Clinics	Infertility coverage
Texas	29	1987	Group insurers are not required to cover IVF. Insurers are only required to offer IVF. Employers may choose whether or not to include infertility coverage.
West Virginia	2	1995	HMOs to cover infertility services under "basic health care services." Infertility is not defined by the law. IVF is not covered.

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Hawaii, Maryland, Ohio, and West Virginia had statutes that required partial IVF coverage (Table 1). Between 1998 and 2006, the number of mandated states has increased and standards of practice regarding IVF have changed significantly. Our study defines mandated states as those with legislation that covers at least one cycle of IVF, which includes eight states (Arkansas, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, New Jersey, and Rhode Island). Concurrently, IVF success and transfer practices have also significantly improved since 1998, highlighted by an increase in the live-birth rate of 6.8% (from 32.0% to 38.8%) in patients under the age of 35. This has also been achieved with an average of one fewer embryos transferred (7).

In this modern era of reduced numbers of embryos transferred, improved pregnancy rates, and more widespread insurance coverage for IVF, we have compared the impact of mandated IVF insurance coverage on ET practices and the resulting multiple pregnancy rates. These data are increasingly valuable as the feasibility of nationalized health care is debated.

MATERIALS AND METHODS

We conducted a retrospective analysis of Society for Assisted Reproduction (SART) and Centers for Disease Control (CDC) data on all fresh, nondonor IVF cycles in 2006 performed in the United States. Individual clinic data were obtained from the publicly available SART data published by the CDC. No patient data were obtained. Outcomes were pooled from all U.S. clinics, and outcomes from each clinic were weighted according to the number of cycles performed. Cycle results were categorized by age group and into states that mandate coverage for IVF and those that do not. Pertinent data extracted from the CDC were number of cycles, pregnancy rate, live-birth rate, live birth per transfer, cancellation rate, number or embryos transferred, twin pregnancy rate, triplet pregnancy rate, and multiple rate.

Verification of state coverage mandates was confirmed by ASRM and Resolve, a consumer organization, for those with infertility (21, 22). The mandates were then confirmed by examining each state mandate (Table 1). There are many differences between states on the definition of infertility, what insurance plans are under each mandate, and what they are required to cover. To evaluate how IVF coverage (not infertility coverage) affects IVF outcomes, we referred to states with an insurance mandate that covers at least one cycle of IVF as a "mandated" state. Those that did not mandate coverage for at least one IVF cycle were considered nonmandated states. Mann-Whitney *U*-test was used for continuous variables, and χ^2-tests were used for statistical analysis of categorical variables.

RESULTS

In 2006, 426 infertility clinics in the United States performed fresh, nondonor IVF cycles that were reported to the CDC. Seventy-four (17%) clinics were in states that mandate IVF coverage, and 352 (83%) were in states that do not mandate IVF coverage. A total of 91,753 fresh, nondonor IVF cycles were performed in U.S. clinics, 64,188 (70%) in nonmandated states and 27,565 (30%) in mandated states. The CDC data define "twins" as the percentage of pregnancies with twins and "triplets" as the number of pregnancies with triplets or more. The CDC definition of "multiples" is the percentage of live births having multiple infants.

In the under 35 age group, there were 41,369 cycles, 11,700 in mandated states and 29,669 in nonmandated states (Table 2). Nonmandated states had a significantly higher pregnancy rate (47.3% vs. 43%, $P<.001$), live-birth rate (41.6% vs. 37.6%, $P<.001$), and live birth per transfer (47.8% vs. 43.7%, $P<.001$) than mandated states. In addition, nonmandated states also had a significantly higher twin pregnancy rate (34.2% vs. 31.8%, $P<.001$), triplet

TABLE 2

All 2006 IVF cycles reported to the CDC for those under 35 years old and 35–37 comparing IVF mandated and nonmandated states.

Age group	IVF mandated	Nonmandated	*P* value
<35 y			
Cycles	11,700	29,669	
Pregnancy rate (%)	43	47.3*	<.001
Live-birth rate (%)	37.6	41.6*	<.001
Live-birth transfer (%)	43.7	47.8*	<.001
Cancellation rate (%)	7.1	8.2*	<.001
Embryos transferred	2.2	2.6*	<.001
Twin rate (%)	31.8	34.2*	<.001
Triplet rate (%)	3.5	4.1*	.005
Multiple births (%)	33.6	36.3*	<.001
35–37 y			
Cycles	7,277	16,334	
Pregnancy rate (%)	36.2	37.3	.11
Live-birth rate (%)	29.7	30.6	.169
Live-birth transfer (%)	36.8	36.3	.471
Cancellation rate (%)	11.6	11.3	.187
Embryos transferred	2.3	2.6*	<.001
Twin rate (%)	25.8	26.3	.427
Triplet rate (%)	3.4	4.6*	<.001
Multiple births (%)	27.2	29.6*	.008

Note: "Twins" are defined as the percentage of pregnancies with twins and "triplets" as the number of pregnancies with triplets or more. The CDC definition of "multiples births" is the percentage of live births having multiple infants.

* $P<.05$.

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pregnancy rate (4.1% vs. 3.5%, $P=-.005$), and multiple live birth rate (36.3% vs. 33.6%, $P<.001$). More importantly, the average number of embryos transferred was also significantly higher in nonmandated states (2.6 vs. 2.2, $P<.001$), as was the cancellation rate (8.2% vs. 7.1%, $P<.001$).

In the 35- to 37-year-old age group, there were a total of 23,611 IVF cycles reported to the CDC, 16,334 in the nonmandated and 7,277 in the mandated states (Table 2). The pregnancy rate, live-birth rate, live birth per transfer, and cancellation rate were all similar. However, in nonmandated states, the triplet pregnancy rate (4.6% vs. 3.4%, $P<.001$) and the multiple live-birth rates (29.6% vs. 27.2, $P=.008$) were significantly higher than in the mandated states. Similar to transfer practices in the younger patient group, the average number of embryos transferred was significantly higher in the nonmandated states (2.6 vs. 2.3, $P<.001$). The results for the 38–40 and 41–42 age groups are seen in Table 3 and show nonsignificant trends of higher pregnancy rates, multiple birth rates, and more embryos transferred in the nonmandated compared with in the IVF mandated states.

Overall, in all IVF cycles performed in 2006, the nonmandated states yielded a higher pregnancy rate and live-birth rate compared with states with mandated IVF coverage (Table 4). However, the percentage of pregnancies with twins (28.1% vs. 26.0%, $P<.001$) and triplets (3.9% vs. 3.4%, $P<.001$) and multiple live-birth rates (29.8% vs. 27.3%, $P<.001$) was significantly higher in nonmandated states as compared with in mandated states. However, nonmandated states transferred significantly more embryos than mandated states (2.7 vs. 2.4, $P<.001$). The 38–40 and 41–42 year old age groups were also analyzed, and no significant differences were found. The differences between insured and noninsured states were more pronounced in the age groups that are more likely to have multiple pregnancies (<35 and 35–37).

TABLE 3

All 2006 IVF cycles reported to the CDC for those 38–40 and 41–42 years old comparing IVF mandated and nonmandated states.

Age group	IVF mandated	Nonmandated	*P* value
38–40 y			
Cycles	6,148	13,615	
Pregnancy rate (%)	25.9	28.9*	<.001
Live-birth rate (%)	19.5	20.7	.052
Live-birth transfer (%)	25.9	26.2	.661
Cancellation rate (%)	15.2	13.9*	.011
Embryos transferred	2.6	2.8	.060
Twin rate (%)	19.7	20.1	.502
Triplet rate (%)	3.7	3.6	.771
Multiple births (%)	21.1	21.7	.352
41–42 y			
Cycles	2,440	4,570	
Pregnancy rate (%)	16.3	18.2*	<.001
Live-birth rate (%)	10.2	10.6	.617
Live-birth transfer (%)	14.8	14.1	.441
Cancellation rate (%)	17.5	17.4	.922
Embryos transferred	3.0	2.9	.061
Twin rate (%)	14.2	19.6*	<.001
Triplet rate (%)	2.1	1.9	.612
Multiple births (%)	12.1	12.6	.577

Note: "Twins" are defined as the percentage of pregnancies with twins and "triplets" as the number of pregnancies with triplets or more. The CDC definition of "multiples births" is the percentage of live births having multiple infants.

* $P<.05$.

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DISCUSSION

In this study we found that clinics in states without IVF insurance mandates have higher pregnancy and live-birth rates and higher multiple pregnancy rates (both twins and triplets) because they transfer significantly more embryos than states with coverage for IVF. Our results clearly demonstrate that mandated IVF insurance remains associated with lower multiple rates. When comparing the current study to previous studies (12, 13), the association between insurance coverage and IVF outcomes is maintained, despite an increase in the number of mandated states and improvements in national ET practices and pregnancy rates.

One factor that impacts the higher rates of multiples in mandated states can be attributed to an increased financial incentive for self-pay patients to maximize per-cycle success rates by requesting the transfer of more embryos. Conversely, it is our hypothesis that patients in insured states may be willing to transfer fewer embryos with the knowledge that a subsequent IVF cycle would be covered should the first one fail. It is unclear how many patients per state are self-pay, which may confound the interpretation of the data. However, physicians continue to face dual pressure to transfer more embryos: first to maintain competitive publicly reported pregnancy rates and second because self-pay patients desire to maximize their per-cycle success rates.

Some investigators have argued that competition among IVF clinics has also contributed to the significant rise in multiple birth rates over the last 20 years (23, 24). Patients often use pregnancy rates published in the SART/CDC database to choose where to seek treatment, often without examining ET practices (i.e., number of embryos transferred) and multiple rates. Published pregnancy rates further exacerbate the already competitive specialty. This highlights the importance of educating the public about using implantation rate and low multiple rates as parameters to assess the success of a practice. The implantation rate is typically defined as the percentage of embryos transferred that

TABLE 4

All 2006 IVF cycles reported to the CDC comparing IVF mandated and nonmandated states.

Overall	IVF mandated	Nonmandated	*P* value
Cycles	27,565	64,188	
Pregnancy rate (%)	35.0	38.8	<.001
Live-birth rate (%)	29.1	32.2	<.001
Live-birth transfer (%)	35.4	37.9	<.001
Cancellation rate (%)	11.0	10.9	.66
Embryos transferred	2.4	2.7	<.001
Twin rate (%)	26.0	28.1	<.001
Triplet rate (%)	3.4	3.9	<.001
Multiple births (%)	27.3	29.8	<.001

Note: "Twins" are defined as the percentage of pregnancies with twins and "triplets" as the number of pregnancies with triplets or more. The CDC definition of "multiples births" is the percentage of live births having multiple infants.

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implant and develop to the stage of ultrasound-documented fetal heartbeat. In 2006, ASRM attempted to regulate ET practices to reduce the incidence of multiples by encouraging single ET for those with a favorable prognosis and no more than two embryos to be transferred in patients <35 and by recommending two embryos but no more than three in those 35–37 years old (25). Our data indicate that mandated states are more likely to abide by these guidelines as the number of embryos transferred is closer to two when compared with the nonmandated states.

There has been debate in the literature about the effectiveness of insurance in reducing the incidence of multiple pregnancies (3, 13, 26–28). Henne et al. suggested that the association is not necessarily due to insurance mandates but is due to a change in patient characteristics that pursue IVF when coverage is available (3). The presence of a state insurance mandate could potentially encourage patients with a poorer reproductive prognosis (such as diminished ovarian reserve) to seek treatment, thus lowering pregnancy and multiple birth rates while increasing the number of embryos transferred. Although we cannot prove a definitive causality between the number of embryos transferred and multiple pregnancies with respect to insurance coverage alone, the presence of a significant association is noted, especially in younger age groups.

There is widespread legal, ethical, and medical debate about mandating coverage for infertility services and how mandates may affect IVF outcomes and the population that seeks treatment. Physicians are concerned that national insurance mandates would lower reimbursement for IVF. It is also recognized that insurance coverage would provide access to infertility treatment for those who previously could not afford it. Studies have shown that state-mandated IVF insurance is clearly associated with the increased use of these services (3, 12). This, in turn, would increase the number of IVF cycles performed, which may increase the absolute number of multiple births. However, this hypothetical risk can be controlled more effectively than it can be in patients without IVF coverage who are treated with controlled ovarian stimulation and insemination. Furthermore, physicians can be provided with incentives by insurance companies regarding ET practices, which may also control multiple births from IVF. From a moral standpoint, it is socially just and desirable for people to be able to seek and obtain medical treatment for a condition that is now widely considered a disease. Nationalized coverage would allow insurance companies to provide incentives for physicians to lower the multiple-pregnancy rates by transferring fewer embryos in accordance with ASRM guidelines. This would diminish the large fiscal strain that multiple pregnancies resulting from IVF have placed on an already stressed health care system.

Reducing multiple gestations is a worthwhile goal, as their incidence has risen significantly, from both controlled ovarian stimulation and IVF (29, 30). Multiple pregnancies are at risk for maternal and fetal complications compared with singletons (31–33). Complications associated with multiple pregnancies have led many countries to limit the number of embryos transferred (34). They can also give financial incentives to physicians who perform single ETs while maintaining competitive success rates. The only strategy to reduce the frequency of multiple pregnancies is to transfer fewer embryos. Single ET protocols are now performed throughout the world with increasing success and drastically diminished multiple rates (35–37). In the future, proteomics and metabolomics will be additional ways that physicians can identify biologically competent embryos to reduce the number of transferred embryos. The decrease in multiple pregnancies and its consequences can have significant impact on maternal/fetal health and financial burden on the insurance system.

Insurance companies incur tremendous costs for maternal/fetal complications as a result of multiple pregnancies from IVF. In 2005, it was estimated that the economic impact associated with preterm birth was $26.2 billion (8). Companies could benefit financially by covering IVF and encouraging and incentivizing single ET, despite potentially increasing the number of cycles required to become pregnant. Previous studies have shown that since the publication of ET guidelines by ASRM there have been consistent decreases in the number of embryos transferred and percentage of pregnancies with triplets while a competitive pregnancy rate has been maintained (38, 39). This fiscal strategy could prevent multiple pregnancies that are avoidable by adhering to responsible transfer practices that have already been successful. Recognizing the societal benefit of lowering multiple-pregnancy rates, Belgium offers complete IVF coverage and is a leader in single ET. Belgium covers up to six IVF cycles and restricts the number of embryos allowed for transfer. This, in turn, has drastically reduced the number of multiples and increased use and is an example of how self-regulation can have a positive impact on a health care system (40, 41).

Despite a dramatic reduction in the average number of embryos transferred and multiple pregnancy rates, the introduction of national guidelines, and a rise in the number of states that mandate coverage for IVF over the last 8 years, our data suggest there is a continued association between mandated IVF coverage and a lower rate of multiple pregnancies. The simplest way to reduce the incidence of multiple pregnancies in IVF is to transfer fewer embryos. Financial coverage for IVF is strongly and consistently associated with responsible ET practices both in the United States and internationally. This study and past comparisons of IVF practices in mandated and nonmandated U.S. states cement the argument that an effective way to significantly reduce the practice of transferring many embryos and the subsequent complication of multiple pregnancies is through IVF state insurance mandates.

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