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Assisted reproductive technology use, embryo transfer practices, and birth outcomes after infertility insurance mandates: New Jersey and Connecticut

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Abstract

Objective—To explore whether recently enacted infertility mandates including coverage for assisted reproductive technology (ART) treatment in New Jersey (2001) and Connecticut (2005) increased ART use, improved embryo transfer practices, and decreased multiple birth rates.

Design—Retrospective cohort study using data from the National ART Surveillance System. We explored trends in ART use, embryo transfer practices and birth outcomes, and compared changes in practices and outcomes during a 2-year period before and after passing the mandate between mandate and non-mandate states.

Setting—Not applicable.

Patient(s)—Cycles of ART performed in the United States between 1996 and 2013.

Intervention(s)—Infertility insurance mandates including coverage for ART treatment passed in New Jersey (2001) and Connecticut (2005).

Main Outcome Measures(s)—Number of ART cycles performed, number of embryos transferred, multiple live birth rates.

Result(s)—Both New Jersey and Connecticut experienced an increase in ART use greater than the non-mandate states. The mean number of embryos transferred decreased significantly in New Jersey and Connecticut; however, the magnitudes were not significantly different from non-mandate states. There was no significant change in ART birth outcomes in either mandate state except for an increase in live births in Connecticut; the magnitude was not different from non-mandate states.

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Conclusion(s)—The infertility insurance mandates passed in New Jersey and Connecticut were associated with increased ART treatment use but not a decrease in the number of embryos transferred or the rate of multiples; however, applicability of the mandates was limited.

Keywords

Infertility insurance mandate; embryo transfer; multiple births; assisted reproductive technology (ART); in vitro fertilization (IVF)

The increased use of assisted reproductive technology (ART) and non-ART fertility treatments over time has led to an increase in the multiple birth rate (1). Assisted reproductive technology cycles average $12,400 for fresh, autologous cycles in the United States (2). Because the majority of patients in the United States pay for ART directly out of pocket, financial pressure can lead patients to transfer more than one embryo to maximize their chance for success, thus increasing multiple births. However, multiple births are associated with increased health risks to mother and infants (3, 4).

Infertility insurance mandates require that private insurers cover some costs associated with infertility diagnosis and treatment. Infertility mandates that include coverage for ART can reduce pressure to transfer multiple embryos during an ART cycle. Currently 15 states have infertility-related insurance mandates; only 8 require coverage for ART, among which there are various treatment restrictions, and patient and employer exemptions (5–9). Previous studies of infertility-related insurance mandates compared embryo transfer (ET) practices and ART treatment outcomes in mandate states with those in non-mandate states; however, observed effects could reflect differences in patient populations rather than insurance mandates (6–8,10–13).

The Centers for Disease Control and Prevention collects data on all United States ART cycles and outcomes per the Fertility Clinic Success Rate and Certification Act of 1992 (14). Because data collection began in 1995, only Connecticut and New Jersey have implemented infertility insurance mandates that include ART coverage. The objectives of this study were to explore changes in ART use, ART practice, and ART birth outcomes after the implementation of these infertility mandates in Connecticut and New Jersey, compared with non-mandate states.

MATERIALS AND METHODS

Data Source

We analyzed data from the Centers for Disease Control and Prevention's National ART Surveillance System and annual, state-specific population data prepared by the Census Bureau in collaboration with the National Center for Health Statistics, namely 1996–1999 bridged-race intercensal, 2000–2009 revised bridged-race intercensal, and 2010–2013 bridged-race vintage 2013 postcensal July 1 estimates (15, 16).

Insurance Mandates

Infertility insurance mandates including coverage for ART were enacted in New Jersey on August 31, 2001 and in Connecticut on October 1, 2005 (17, 18). The New Jersey mandate applies to patients younger than 46 years and includes women younger than 35 years who are unable to conceive over a 2-year period, women aged 35 years and older who are unable to conceive over a 1-year period, men unable to impregnate a woman, women unable to carry a pregnancy to live birth, and anyone with medical sterility. The Connecticut mandate applies to patients younger than 40 years who are unable to conceive or sustain a successful pregnancy within a 1-year period and who have been covered by a policy for at least 12 months. The New Jersey mandate covers a total of four egg retrievals along with all associated ART, fresh and frozen embryo transfers, assisted hatching, intracytoplasmic sperm injection (ICSI), and medications, whereas the Connecticut mandate covers at most two cycles of ART, with each fertilization or transfer counting as one cycle. Connecticut also limits each cycle to “not more than 2 embryo implantations per cycle” (18), whereas New Jersey has no such limitations. In addition to ART coverage, the New Jersey mandate covers artificial insemination, ovulation induction, and surgery, whereas the Connecticut mandate covers four cycles of ovulation induction and three cycles of IUI. Both states require patients to use less-costly procedures first. Both states allow exclusions for religious employers and employers who self-insure, and New Jersey also exempts employers with fewer than 50 employees (5).

Statistical Methods

We explored trends in ART use, ART practice, and ART birth outcomes among all ART cycles for New Jersey, Connecticut, and all four states in the Northeast census region that do not have any infertility insurance mandate (the non-mandate states: Maine, New Hampshire, Pennsylvania, and Vermont) from 1996 through 2013. These four states were chosen for their close geographic proximity to New Jersey and Connecticut, resulting in more similarity between the states being compared. We excluded banking cycles resulting in the cryopreservation of all oocytes or embryos and research cycles evaluating new procedures. An ART use ratio was calculated as the number of cycles performed per 1,000 women in the population aged 15–44 years. We compared the percentage change in each measure from the year the mandate passed to the following year between the mandate and non-mandate states.

We generated 2-year pre- and post-mandate periods for each mandate state to explore ET procedures started directly before and after the mandates were passed for fresh non-donor cycles resulting in transfer. We used a 2-year period to provide enough time for a transition period after the mandates went into effect, but also to limit other changes in ART practice and birth outcomes in this rapidly changing field. For New Jersey, the periods were September 1, 1999 through August 31, 2001 and September 1, 2001 through August 31, 2003; for Connecticut, they were October 1, 2003 through September 30, 2005 and October 1, 2005 through September 30, 2007. We included the birth outcomes for all transfers started during these time periods, even if the birth outcome occurred later. Data for the same time periods in the non-mandate states were used for comparison. A 4-year pre-and post-mandate period was explored to assess sensitivity to time period length; stratification by the female patient’s age at the time the cycle was started was explored to assess sensitivity to patient

population; and a comparison group of all 35 states and the District of Columbia without infertility insurance mandates was explored to assess the impact of using a limited comparison group vs. all non-mandate states.

We looked at the associations between mandate period (pre-/post-mandate) and ART patient characteristics for mandate and non-mandate states using a Rao-Scott χ^2 test to account for clinic-level clustering. We explored associations between mandate period and ART use using Poisson regression for the number of cycles started per year, accounting for the female 15–44-year population. Because we had annual population estimates, we approximated the population using the year that covered the majority of the time period. For example, in New Jersey, for the number of cycles that occurred between September 1, 1999 and August 31, 2000, we approximated the population size using the 2000 population estimate. We explored associations between mandate period and ART practice and outcomes using Poisson regression for the number of days between retrieval and transfer (to determine whether any shift in cleavage vs. blastocyst transfers), number of embryos transferred, and number of embryos cryopreserved, and log-binomial regression for transfers of more than two embryos, assisted hatching, ICSI, live births, multiple live births resulting in the birth of more than one infant, preterm live births, and low birth weight live births. Generalized estimating equations with an independent correlation matrix were used to account for clinic-level clustering for all regression models except those assessing ART use. All models included an indicator for mandate period, an indicator for whether the transfer occurred in the mandate state, and an interaction term to assess whether the relationship between each outcome and the mandate period differed by state mandate status; the latter measure was included to account for possible changes occurring in ART practice and outcomes overall apart from the mandate. All analyses were conducted using SAS version 9.3 (SAS Institute). Statistical significance was set at $P<.05$. This study was approved by the institutional review board of the Centers for Disease Control and Prevention.

RESULTS

Trends in ART use, Practice, and Birth Outcomes

The ART use ratios were higher for the entire study period in New Jersey and Connecticut than in the non-mandate states (Fig. 1A). From 2001 to 2002, the ART use ratio in New Jersey increased by 27.9% (3.0–3.9) and in the non-mandate states by 9.8% (1.4–1.5). From 2005 to 2006, the ART use ratio in Connecticut increased by 23.4% (3.8–4.7), whereas the ratio in the non-mandate states decreased by 7.0% (1.8–1.7). New Jersey, Connecticut, and the non-mandate states all experienced a downward trend in the percentage of transfers of more than two embryos (Fig. 1B). The percentage decrease from 2001 to 2002 was larger in New Jersey at 16.1% (62.6%–52.5%) than in the non-mandate states at 8.1% (69.2%–63.6%). The percentage decrease from 2005 to 2006 was similar in Connecticut at 13.1% (45.9%–39.9%) and the non-mandate states at 14.0% (47.4%–40.8%). The percentage of transfers resulting in a multiple live birth decreased by 5.9% (13.8%–13.0%) from 2001 to 2002 in New Jersey and increased by 8.2% (8.9%–9.6%) from 2001 to 2002 in the non-mandate states (Fig. 1C). From 2005 to 2006, the percentage of multiple births decreased by 7.0% (10.7%–10.0%) in Connecticut and by 5.1% (8.9%–8.5%) in the non-mandate states.

ART Patient Characteristics

After the New Jersey mandate passed, there was a significant increase in New Jersey in the percentage of transfers among women older than 40 years (10.5%–12.5%) and a significant decrease among patients with endometriosis (16.7%–14.1%) (Table 1). Both in New Jersey and the non-mandate states, there was a significant decline in the percentage of transfers after a retrieval of five or more oocytes (New Jersey: 92.7%–90.0%; non-mandate: 90.2%–88.7%), and among patients with tubal factor (New Jersey: 25.7%–22.9%; non-mandate states: 27.5%–23.9%). In the non-mandate states, there was a significant increase in the percentage of transfers among patients with diminished ovarian reserve (7.9%–13.2%).

After the Connecticut mandate passed, there was a significant increase in Connecticut in the percentage of transfers to non-Hispanic blacks (3.8%–6.5%) and Hispanics (suppressed for confidentiality); in the non-mandate states, there was a significant increase in the percentage of transfers among Asians/Pacific Islanders (4.3%–5.6%). Connecticut experienced a significant increase in the percentage of transfers among patients with diminished ovarian reserve (8.2%–11.1%) and a decrease in the percentage of transfers among patients with two or more ART cycles (29.6%–24.2%). The non-mandate states experienced an increase in the percentage of transfers among patients with ovulatory dysfunction (13.8%–15.7%) or with unexplained infertility (13.6%–10.9%) and a decrease in the percentage of transfers among patients with no prior pregnancies (51.5%–43.9%), no prior births (72.5%–69.5%), or endometriosis (15.5%–13.5%).

Note that decreases in the percentage of transfers after the mandates were often associated with increases in the number of transfers owing to the increased number of cycles conducted after the mandates.

ART use

The number of cycles per 1,000 females aged 15–44 years of age significantly increased after the mandate in New Jersey (risk ratio [RR] 1.45, 95% confidence interval [CI] 1.41–1.48) and in the non-mandate states (RR 1.26, 95% CI 1.22–1.30); however, the increase in ART use in New Jersey was larger than the increase in the non-mandate states (interaction $P<.001$) (Table 2). After the mandate passed in Connecticut, ART use significantly increased in Connecticut (RR 1.22, 95% CI 1.18–1.27) (Table 3). No significant change was observed in the non-mandate states. The increase in ART use observed in Connecticut was significantly larger than in the non-mandate states (interaction $P<.001$).

ART Practice

The changes in ART practice across mandate periods in New Jersey were not significantly different from those in the non-mandate states (Table 2). In New Jersey, after the mandate passed, the mean number of days between retrieval and transfer significantly increased (RR 1.04, 95% CI 1.005–1.07) (Table 2). This increase was not significantly greater than in the non-mandate states, where there was no significant change. The percentage of transfers using ICSI increased significantly in the non-mandate group only (RR 1.11, 95% CI 1.04–1.19) but not significantly more than the non-significant increase in New Jersey. The mean number of embryos transferred and the percentage of transfers of more than two embryos

decreased significantly in New Jersey (RR 0.89, 95% CI 0.86–0.93; and RR 0.80, 95% CI 0.72–0.90, respectively); however, these decreases were not significantly different than the decreases in the non-mandate states. Neither group saw a significant change in embryo cryopreservation or assisted hatching.

The changes in ART practice across mandate periods also were not significantly different between Connecticut and the non-mandate states (Table 3). After the mandate passed, the percentage of transfers using ICSI increased in Connecticut (RR 1.07, 95% CI 1.02–1.12), but the increase was not significantly greater than the non-significant increase in the non-mandate states. The mean number of embryos transferred and the percentage of transfers of more than two embryos decreased significantly in Connecticut (RR 0.95, 95% CI 0.91–0.99; and RR 0.83, 95% CI=0.73–0.93, respectively); these decreases in embryos transferred were not significantly different than the decreases in the non-mandate states. Neither group saw a significant change in the mean number of days between retrieval and transfer, embryo cryopreservation, or assisted hatching.

ART Birth Outcomes

There were no significant changes in New Jersey in the percentages of transfers resulting in live birth, multiple, preterm, or low birth weight live birth after the mandate; however, the non-mandate states experienced significant increases in live births (RR 1.14, 95% CI 1.06–1.23) and multiple births (RR 1.21, 95% CI 1.07–1.37) (Table 2), which were significantly larger than the non-significant increase and decrease in New Jersey (P=.049 and P=.005, respectively).

Both Connecticut and the non-mandate states experienced an increase in the percentage of transfers resulting in a live birth (Connecticut: RR 1.07, 95% CI 1.02–1.12; non-mandate states: RR 1.10; 95% CI 1.05–1.16); however, there was no significant difference in the increases between Connecticut and the non-mandate states (Table 3). The non-mandate states also experienced a significant increase in low birth weight live births (RR 1.14, 95% CI 1.02–1.27), but it was not significantly different than the non-significant decrease observed in Connecticut. There were no significant changes in multiple or preterm live births for either Connecticut or the non-mandate states.

Subanalysis

When the pre- and post-mandate periods were expanded to 4 years, the decreases in the average number of embryos transferred and the percentage of transfers of more than two embryos in the non-mandate states were significantly larger than in New Jersey. A similar result occurred in Connecticut, where the decrease in the average number of embryos transferred in the non-mandates states was now significantly larger than the decrease in Connecticut. New Jersey also now observed a significant increase in the percentage of transfers using ICSI. However, the increase in the non-mandate states was significantly larger than in the mandate states. There was a significant difference in all of the ART birth outcomes between New Jersey and the non-mandate states, with the non-mandate states experiencing a significant increase in live births, multiple live births, preterm live births, and

low birth weight live births whereas New Jersey experienced no significant changes in any of the birth outcomes.

When stratified by age group, the increase in ART use in the mandate states was no longer significantly larger than the increase in use in the non-mandate states for those aged 40 years and older in New Jersey and those aged 35–39 years in Connecticut. With regard to ART practice, in Connecticut, for those aged 35–39 years, the significant increase in ICSI was now significantly higher than the increase in ICSI in the non-mandate states. In addition, the decrease in the average number of embryos transferred in the non-mandate states now was significantly larger than in Connecticut for those aged 35–39 years, whereas for those aged 40 years or older there was no significant decrease in the average number of embryos transferred. Similarly, among those aged 40 years and older, New Jersey experienced a significant decrease in the percentage of transfers of more than two embryos that was significantly larger than the decrease in the non-mandate states. With regard to birth outcomes, although the analysis combining all age groups showed an increase in live births and multiple live births among non-mandates states that was significantly larger than in New Jersey, the differences were not statistically significant when explored by age group.

When all states and the District of Columbia without an insurance mandate were included in the control group, rather than just those states in the Northeast, the increase in the percentage of transfers resulting in live births among the non-mandate states was no longer significantly larger than the change in live births in New Jersey. In addition, there was a significant increase in the mean number of days between retrieval and transfer in the non-mandate states that was significantly larger than the non-significant increase in Connecticut.

DISCUSSION

After the infertility mandates, both New Jersey and Connecticut experienced an increase in ART use greater than in the non-mandate states. Connecticut and New Jersey also experienced some decrease in the percentage of transfers of more than two embryos and the average number of embryos transferred; however, these improvements in ET practices were not different from the improvements in the non-mandate states, suggesting overall improvements across the ART community vs. improvements due to the mandate. Our results also do not indicate a mandate effect on ART outcomes, with the possible exception of fewer live births and multiple births in New Jersey compared with the non-mandate states. When analyzed by age group, the live birth and multiple birth RRs did not indicate a significant difference between New Jersey and the non-mandate states. Thus, the fewer live births and multiple births may be due to the larger proportion of cycles among women aged 41 years or older in New Jersey after the mandate.

Other studies in the United States have compared ET practices and treatment outcomes in states with insurance mandates with those in states without insurance mandates, but results are mixed. Several studies found states with mandates had higher ART use (10, 11) and transferred fewer embryos (8,11–13), some reported a decrease in multiple birth rates but also pregnancy rates (8, 10, 11), and others did not see any conclusive effect on pregnancy or birth rates (6, 12, 13). A study by Hamilton et al. (7) found that only states with universal

mandates with no employer exceptions saw increased treatment access and improved ET practices, whereas states with other types of mandates (including New Jersey and Connecticut) experienced little effect. Other countries, including Belgium and Canada, found ART coverage effective at increasing ART use while reducing multiple births when coverage is comprehensive and accompanied by ET restrictions (19–21).

Although the infertility mandates may lead to wider access to ART treatment, increased use may lead to increased multiples: Connecticut and New Jersey now have some of the highest proportions of multiple infants among all infants born to state residents, at 4.2% and 4.5%, respectively (22). Although an increase in use was observed in Connecticut and New Jersey after the mandates were passed, there were no notable changes in ET practices, and fewer live births and multiple births, but only in New Jersey. It is possible that insurance coverage for ART may not positively affect ET practices and birth outcomes; however, the lack of an observed effect may be due to other factors. The mandates in New Jersey and Connecticut both exclude religious employers and employers that self-insure; New Jersey's mandate also excludes employers with fewer than 50 employees, thereby limiting those employees to whom the mandate applies. In 2002, after the New Jersey mandate passed, 72.2% of New Jersey's private sector employees were employed by a company employing at least 50 employees. Of those employed by a company of 50 or more, 98.1% were offered insurance; of those offered, 66.0% enrolled; of those that enrolled, 33.0% enrolled in a plan that was not self-insured (23). In 2006, after the Connecticut mandate passed, 93.6% of private sector employees were offered insurance; of those offered, 63.3% enrolled; of those that enrolled, 51.9% enrolled in a plan that was not self-insured (24). Another factor possibly contributing to the lack of effect is the increase in ART use that may mask improvement in ET practices. Although decreases in the percentage of cycles conducted with certain patient or cycle characteristics or with certain outcomes were observed after the mandate, these decreases in percentages often coincided with an increase in the raw number of cycles due to the increase in ART use. Finally, limitations in infertility coverage in the mandate states (lack of coverage for some ART patients, out-of-pocket costs remaining after insurance coverage, exhaustion of insurance benefits before treatment is completed) also may have contributed.

This study has several strengths. It includes data before and after insurance mandates were passed, accounting for differences between states. It also accounts for major changes in the field of ART by making comparisons with non-mandate states. However, it did not include information on which ART cycles were covered by the mandate in light of the employer exclusions or which ART cycles were paid for with insurance, and it did not include all states with ART insurance mandates. It is also dependent on the specifics of the mandates themselves, including coverage of ART treatment and other infertility treatments, which vary by state. In addition, the mandate coverage was determined by state of residence, whereas state of the employer actually determines whether the mandate is applicable. In the Northeast, the small size and close proximity of states may result in some patients being misclassified with regard to mandate group; the direction of the bias from this possible misclassification is unknown, because it would depend on how many people residing in states with and without a mandate were working in a state with a different mandate status. Finally, differences in outcomes per transfer are more difficult to detect statistically than differences in ET practices because a large proportion of transfers do not result in pregnancy.

Although our study does suggest that the infertility insurance mandates in New Jersey and Connecticut were associated with increased ART use, the results do not suggest that the mandates were effective at improving overall ET practices or reducing adverse ART birth outcomes in these states. However, the mandates studied here only apply to a small proportion of employees in the private sector. Universal mandates with a restriction on the number of embryos transferred may still be effective in reducing the number of embryos transferred and adverse ART birth outcomes.

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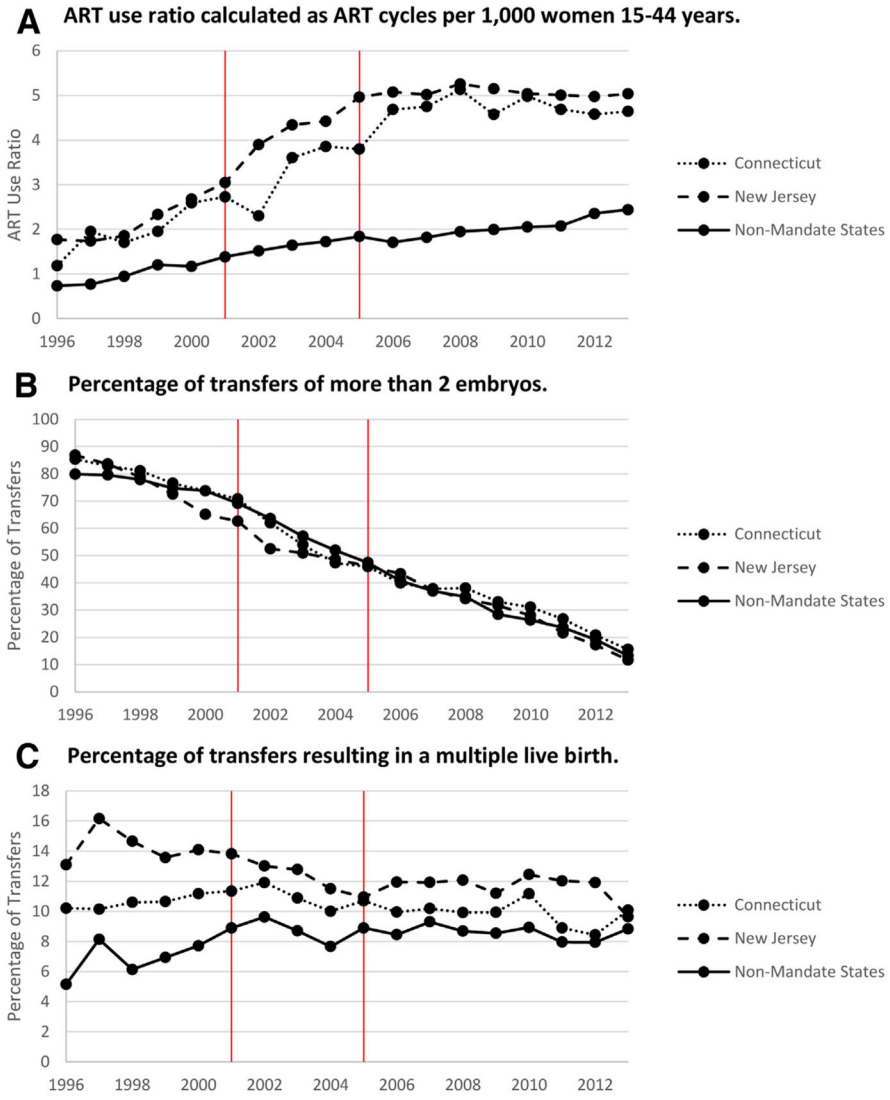

FIGURE 1.

Trends in ART, 1996–2013. (**A**) Trends in the use of ART; (**B**) trends in the transfer of more than two embryos; (**C**) trends in multiple live births from 1996 through 2013. Panel (**A**) excludes ART cycles in which all oocytes or embryos were cryopreserved (banking cycles) or new procedures were evaluated (research cycles), whereas (**B**) and (**C**) exclude cycles not resulting in the transfer of at least one embryo. The ART use ratio is calculated as the number of cycles performed per 1,000 women in the population aged 15–44 years, or in the age group specified. The vertical line indicates the passing of an infertility mandate with ART coverage in New Jersey or Connecticut. “Non-mandate” refers to states without mandates for infertility coverage during the study period located in the Northeast census region, including Maine, New Hampshire, Pennsylvania, and Vermont.

TABLE 1

ART patient characteristics for fresh non-donor cycles resulting in transfer, by mandate status and mandate period.

	New Jersey			Non-Mandate[a]			Connecticut			Non-Mandate[a]		
Characteristic	**Pre[b] % (n = 5,719)**	**Post[b] % (n = 8,624)**	***P* value**	**Pre[b] % (n = 4,532)**	**Post[b] % (n = 5,764)**	***P* value**	**Pre[b] % (n = 3,275)**	**Post[b] % (n = 4,081)**	***P* value**	**Pre[b] % (n = 6,416)**	**Post[b] % (n = 6,180)**	***P* value**
Maternal age, y			.02			.84			.23			.57
<30	9.9	10.3		10.8	11.2		7.6	9.6		12.2	12.0	
30–34	34.7	33.2		37.0	37.6		30.4	29.5		35.9	34.4	
35–37	24.5	23.3		24.2	23.2		23.9	25.3		24.0	25.0	
38–40	20.4	20.6		18.3	18.2		22.4	21.7		17.8	18.3	
≥41	10.5	12.5		9.7	9.8		15.7	13.9		10.1	10.4	
Maternal race[c,d]			.11			.38			.01			.02
Non-Hispanic white	83.7	80.8		92.0	91.4		86.0	81.2		90.5	89.6	
Non-Hispanic black	5.7	6.7		3.8	3.5		3.8	6.5		3.4	2.9	
Asian/Pacific Islander	6.1	7.9		2.1	3.3		6.5	6.6		4.3	5.6	
Hispanic	_[e]	_[e]		_[e]	_[e]		_[e]	_[e]		_[e]	_[e]	
Other	_[e]	_[e]		_[e]	_[e]		_[e]	_[e]		_[e]	_[e]	
Prior ART cycles[c,d]			.65			.25			.001			.12
0	51.8	52.9		51.6	51.4		48.6	51.5		52.4	54.3	
1	23.2	22.8		23.0	21.6		21.8	24.3		20.9	19.3	
2+	25.0	24.4		25.4	27.0		29.6	24.2		26.6	26.4	
Gravidity[c,d]			.17			.82			.39			<.001
0	45.3	44.5		48.0	48.0		44.7	42.0		51.5	43.9	
1–2	42.6	41.7		40.0	40.7		41.1	42.3		38.4	41.4	
3–4	9.8	11.1		9.8	9.2		11.8	12.9		8.1	11.7	
5+	2.3	2.8		2.3	2.1		2.4	2.8		1.9	3.0	
Parity[c,d]			.33			.65			.76			.002
0	73.9	72.6		74.9	73.9		67.6	66.6		72.5	69.5	
1	20.3	21.5		18.5	19.3		25.0	25.1		20.6	22.7	
2+	5.8	6.0		6.6	6.8		7.4	8.3		6.9	7.7	
Reasons for ART												

Characteristic	New Jersey			Non-Mandate[a]			Connecticut			Non-Mandate[a]		
	Pre[b]% (n = 5,719)	Post[b]% (n = 8,624)	*P* value	Pre[b]% (n = 4,532)	Post[b]% (n = 5,764)	*P* value	Pre[b]% (n = 3,275)	Post[b]% (n = 4,081)	*P* value	Pre[b]% (n = 6,416)	Post[b]% (n = 6,180)	*P* value
Diminished ovarian reserve	13.1	15.9	.26	7.9	13.2	<.001	8.2	11.1	.04	16.1	19.0	.09
Endometriosis	16.7	14.1	<.001	18.6	17.6	.45	12.5	12.9	.78	15.5	13.5	.03
Ovulation disorder/PCOS	18.0	20.4	NC	11.3	12.9	.26	9.7	10.7	.35	13.8	15.7	.04
Tubal factors	25.7	22.9	<.001	27.5	23.9	.01	17.9	18.0	.95	20.3	18.4	.11
Uterine factor	6.8	6.4	.69	4.7	4.8	.89	3.6	3.7	.75	3.4	4.2	.18
Male infertility	39.7	40.0	.86	38.0	36.1	.16	26.4	26.9	.48	36.0	38.5	.06
Other	14.3	15.2	.79	14.8	10.9	.15	14.7	15.7	.82	11.0	12.7	.32
Unexplained	7.8	5.9	.37	10.2	11.6	.16	20.8	19.8	.53	13.6	10.9	.001
No. of oocytes retrieved[c,d]			.004			.04			.25			.62
1–2	1.7	3.1		2.3	3.3		2.4	2.6		3.4	4.0	
3–4	5.6	6.9		7.4	8.0		7.4	6.4		7.7	7.8	
5+	92.7	90.0		90.2	88.7		90.1	91.0		88.8	88.3	

Note: PCOS = polycystic ovarian syndrome.

[a] Refers to states without mandates for infertility coverage during the study period, including Maine, New Hampshire, Pennsylvania, and Vermont.

[b] The pre- and post-mandate periods were September 1, 1999 through August 31, 2001 and September 1, 2001 through August 31, 2003 in New Jersey and October 1, 2003 through September 30, 2005 and October 1, 2005 through September 30, 2007 in Connecticut.

[c] Missing values: New Jersey, pre-mandate: race 39%; New Jersey, post-mandate: race 68%, gravidity 2%, parity 2%; non-mandate, pre-mandate: race 38%; non-mandate, post-mandate: race 55%; all others: <1%.

[d] Missing values: Connecticut, pre-mandate: race 71%; Connecticut, post-mandate: race 69%; non-mandate, pre-mandate: race 40%; non-mandate, post-mandate: race 39%; all others: <1%.

[e] Cell suppressed for confidentiality owing to small counts.

TABLE 2

ART use, ET practices, and ART outcomes for fresh, non-donor ART cycles resulting in transfer in New Jersey and the non-mandate states, pre- and post-mandate.

	New Jersey			Non-mandate states[a]			
Parameter	**Pre-mandate[b] (n = 5,719)**	**Post-mandate[b] (n = 8,624)**	**RR (95% CI)**	**Pre-mandate[b] (n = 4,532)**	**Post-mandate[b] (n = 5,764)**	**RR (95% CI)**	**Interaction *P* value[c]**
No. of cycles (rate per 1,000 women 15–44 y)[d]	9,821 (2.7)	14,157 (3.9)	1.45 (1.41–1.48)	7,930 (1.2)	9,877 (1.6)	1.26 (1.22–1.30)	<.001
Mean no. of days from retrieval to transfer[e] (SD)	3.44 (0.93)	3.57 (0.97)	1.04 (1.005–1.07)	3.07 (0.65)	3.11 (0.59)	1.01 (0.98–1.04)	.25
Mean no. of embryos cryopreserved[e] (SD)	1.31 (2.87)	1.24 (2.69)	0.94 (0.81–1.09)	1.54 (3.16)	1.49 (3.00)	0.97 (0.84–1.11)	.79
Mean no. of embryos transferred (SD)	3.07 (1.11)	2.74 (1.05)	0.89 (0.86–0.93)	3.33 (1.30)	3.01 (1.21)	0.91 (0.87–0.94)	.66
No. of transfers of >2 embryos (%)	3,872 (67.7)	4,692 (54.4)	0.80 (0.72–0.90)	3,342 (73.7)	3,698 (64.2)	0.87 (0.82–0.93)	.26
No. of transfers using ICSI[e] (%)	3,133 (54.8)	4,965 (57.6)	1.06 (0.98–1.12)	2,196 (48.6)	3,114 (54.1)	1.11 (1.04–1.19)	.24
No. of transfers using assisted hatching (%)	3,693 (64.6)	5,542 (64.3)	1.00 (0.90–1.10)	1,731 (38.2)	2,421 (42.0)	1.10 (0.92–1.31)	.35
No. of live births (%)	2,126 (37.2)	3,276 (38.0)	1.02 (0.93–1.12)	1,267 (28.0)	1,841 (31.9)	1.14 (1.06–1.23)	.049
No. of multiple live births (%)	800 (14.0)	1,137 (13.2)	0.94 (0.84–1.06)	415 (9.2)	639 (11.1)	1.21 (1.07–1.37)	.005
No. preterm live births (%)	656 (11.5)	996 (11.6)	1.01 (0.91–1.11)	381 (8.4)	544 (9.44)	1.12 (0.997–1.26)	.15
No. of low birth weight live births (%)	655 (11.5)	981 (11.4)	0.99 (0.86–1.14)	385 (8.5)	559 (9.7)	1.14 (0.98–1.33)	.18

[a] Refers to states in the Northeast census region without insurance mandates for infertility coverage during the study period, including Maine, New Hampshire, Pennsylvania, and Vermont.

[b] The pre- and post-mandate periods were September 1, 1999 through August 31, 2001 and September 1, 2001 through August 31, 2003 in New Jersey and October 1, 2003 through September 30, 2005 and October 1, 2005 through September 30, 2007 in Connecticut.

[c] *P* value for whether there is a significant difference between mandate and non-mandate states in the difference between pre- and post-mandate values.

[d] Number of cycles excludes only ART cycles in which all oocytes or embryos were cryopreserved (banking cycles) or new procedures were evaluated (research cycles). It is not restricted to fresh non-donor transfers. Number of cycles represents the total number of cycles over the 2-year period while the rate represents the average ratio per year of cycles or transfers per 1000 women aged 15–44 y.

[e] Missing values: Non-mandate, pre-mandate: embryo days 2%, ICSI 1%; non-mandate, post-mandate: embryo days 1%, ICSI 1%; all others: <1%.

TABLE 3

ART use, ET practices, and ART outcomes for fresh, non-donor ART cycles resulting in transfer in Connecticut and the non-mandate states, pre- and post-mandate.

	Connecticut			Non-mandate states[a]			
Parameter	**Pre-mandate[b] (n = 3,275)**	**Post-mandate[b] (n = 4,081)**	**RR (95% CI)**	**Pre-mandate[b] (n = 6,416)**	**Post-mandate[b] (n = 6,180)**	**RR (95% CI)**	**Interaction *P* value[c]**
No. of cycles (rate per 1,000 women 15–44 y)[d]	5,411 (3.8)	6,546 (4.6)	1.22 (1.18–1.27)	11,048 (1.8)	10,965 (1.8)	1.00 (0.98–1.03)	<.001
Mean no. of days from retrieval to transfer[e] (SD)	3.39 (0.75)	3.40 (0.79)	1.00 (0.99–1.02)	3.20 (0.72)	3.23 (0.83)	1.01 (0.97–1.02)	.81
Mean no. of embryos cryopreserved[e] (SD)	1.19 (2.52)	1.25 (2.60)	1.05 (0.88–1.26)	1.51 (2.99)	1.60 (2.94)	1.06 (0.90–1.23)	.97
Mean no. of embryos transferred (SD)	2.66 (1.00)	2.53 (1.04)	0.95 (0.91–0.99)	2.70 (1.05)	2.49 (0.97)	0.93 (0.90–0.95)	.22
No. of transfers of >2 embryos (%)	1,643 (50.2)	1,693 (41.5)	0.83 (0.73–0.93)	3,296 (51.4)	2,637 (42.7)	0.83 (0.78–0.88)	.95
No. of transfers using ICSI[e] (%)	2,178 (66.5)	2,905 (71.2)	1.07 (1.02–1.12)	3,716 (57.9)	3,673 (59.5)	1.03 (0.95–1.11)	.38
No. of transfers using assisted hatching (%)	1,718 (52.5)	1,969 (48.3)	0.92 (0.82–1.04)	2,910 (45.4)	2,760 (44.7)	0.98 (0.87–1.12)	.45
No. of live births (%)	1,105 (33.7)	1,471 (36.1)	1.07 (1.02–1.12)	2,052 (32.0)	2,183 (35.3)	1.10 (1.05–1.16)	.38
No. of multiple live births (%)	304 (9.3)	404 (9.9)	1.07 (0.97–1.17)	667 (10.4)	676 (10.9)	1.05 (0.95–1.16)	.86
No. preterm live births (%)	302 (9.2)	371 (9.1)	0.99 (0.89–1.10)	578 (9.0)	594 (9.6)	1.07 (0.96–1.19)	.35
No. of low birth weight live births (%)	284 (8.7)	337 (8.3)	0.95 (0.88–1.03)	539 (8.4)	592 (9.6)	1.14 (1.02–1.27)	.08

[a] Refers to states without mandates for infertility coverage during the study period, including Maine, New Hampshire, Pennsylvania, and Vermont.

[b] The pre- and post-mandate periods were September 1, 1999 through August 31, 2001 and September 1, 2001 through August 31, 2003 in New Jersey and October 1, 2003 through September 30, 2005 and October 1, 2005 through September 30, 2007 in Connecticut.

[c] *P* value for whether there is a significant difference between mandate and non-mandate states in the difference between pre- and post-mandate values.

[d] Number of cycles excludes only ART cycles in which all oocytes or embryos were cryopreserved (banking cycles) or new procedures were evaluated (research cycles). It is not restricted to fresh non-donor transfers. Number of cycles represents the total number of cycles over the 2-year period while the rate represents the average ratio per year of cycles or transfers per 1000 women aged 15–44 y.

[e] Missing values: All <1%.