

Do state breastfeeding laws in the USA promote breast feeding?

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ABSTRACT

Objectives Despite the passage of state laws promoting breast feeding, a formal evaluation has not yet been conducted to test whether and/or what type of laws may increase breast feeding. The enactment of breastfeeding laws in different states in the USA creates a natural experiment. We examined the impact of state breastfeeding laws on breastfeeding initiation and duration as well as on disparities in these infant feeding practices.

Methods Using data from the Pregnancy Risk Assessment Monitoring System, we conducted differences-in-differences models to examine breastfeeding status before and after the institution of laws between 2000 and 2008 among 326 263 mothers from 32 states in the USA. For each mother, we coded the presence of two types of state breastfeeding laws. Mothers reported whether they ever breast fed or pumped breast milk (breastfeeding initiation) and, if so, how long they continued. We defined breastfeeding duration as continuing to breast feed for ≥ 4 weeks.

Results Breastfeeding initiation was 1.7 percentage points higher in states with new laws to provide break time and private space for breastfeeding employees ($p=0.01$), particularly among Hispanic mothers (adjusted coefficient 0.058). While there was no overall effect of laws permitting mothers to breast feed in any location, among Black mothers we observed increases in breastfeeding initiation (adjusted coefficient 0.056). Effects on breastfeeding duration were in the same direction, but slightly weaker.

Conclusions State laws that support breast feeding appear to increase breastfeeding rates. Most of these gains were observed among Hispanic and Black women and women of lower educational attainment suggesting that such state laws may help reduce disparities in breast feeding.

INTRODUCTION

The health, psychosocial and economic benefits of breast feeding are well known.^{1 2} Despite increases in breastfeeding initiation and duration over the past few decades,³ White and Hispanic mothers have higher rates than Black mothers and mothers from more disadvantaged circumstances are less likely to start and continue breast feeding.⁴ Among the known barriers to breast feeding, returning to work and embarrassment about breast feeding, particularly in public, remain challenges for many women.¹ These findings suggest that for women to successfully breast feed outside the home, whether at work or in public, additional support is needed.

Substantial progress in breastfeeding promotion at both the political and structural levels has been

made in recent years.^{3 5} The passage of the Patient Protection and Affordable Care Act represents the first federal legislation in the USA to protect breast feeding, requiring employers to provide mothers with break time and private space to express milk for 1 year after their child's birth.⁶ However, not all women who are employed may be covered as there are possible exemptions for small businesses and the federal law generally includes only hourly employees. Most laws supporting breast feeding are currently enacted at the state level.^{7 8} State laws can fill gaps in the federal policy, for example, by covering salaried employees or prohibiting employer discrimination based on breast feeding, and also protect women who are not employed. Legislation can allow women to breast feed in any public or private location, exempt breast feeding from public indecency laws, and exempt breastfeeding women from jury duty. A recent review found that the number of state breastfeeding laws has increased over the past decade, but the coverage of legislation varies widely.⁷

Despite the passage of laws promoting breast feeding, a formal evaluation has not yet been conducted to test whether and/or what type of laws may increase breast feeding.⁷⁻⁹ Kogan and colleagues found that states with multiple pieces of breastfeeding legislation in 2003 had higher levels of breastfeeding initiation and continuation to 6 months than states with none.⁹ However, a cross-sectional study cannot determine whether it was the laws influencing breastfeeding levels or states with higher breastfeeding levels were more likely to introduce laws. It was also not possible in this study to discern which type of legislation was related to breast feeding.

The enactment of breastfeeding laws in different states creates a natural experiment which can be exploited by comparing changes in infant feeding practices among mothers both within and across states. Furthermore, state level legislation supporting breast feeding may not affect all mothers similarly. Our aim was to examine the impact of state breastfeeding laws in the USA on breastfeeding initiation and duration as well as on disparities in these infant feeding practices.

METHODS

The Pregnancy Risk Assessment Monitoring System (PRAMS) is a state level surveillance system designed to monitor maternal health behaviours and outcomes before, during and after pregnancy.¹⁰ PRAMS selects mothers at random approximately 4 months post partum, with oversampling of mothers at a higher risk for adverse pregnancy outcomes. Questionnaires are standardised across all

states. Initial survey administration is by mail and followed-up by phone call if necessary to increase response. States receive questionnaires from 1300–3400 mothers per year, and they link survey data with data from infants' birth certificates.

From 2000 to 2008, 349 780 mothers participated in PRAMS from 31 states plus NYC (32 'states') with 2 or more years of data (Alaska, Alabama, Arkansas, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Louisiana, Massachusetts, Maryland, Maine, Michigan, Minnesota, Mississippi, North Carolina, Nebraska, New Jersey, New Mexico, New York, New York City, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Washington, Wisconsin, West Virginia, Wyoming). Not all states participate in PRAMS and four states were excluded because data were only collected for 1 year over this time period. Table 1 presents the years in which data were collected for the 32 states. We excluded mothers if there was missing information on breastfeeding initiation (18 277), race/ethnicity (1547), education (4866) or age (33), or the sampling stratum had only one mother (3). Mothers were more likely to be excluded if they were from an ethnic minority group, younger and had fewer years of education ($p < 0.01$); however, the absolute differences between groups were small. Analyses on breastfeeding initiation included 326 260 mothers. We excluded a further 6829 mothers with missing data on breast feeding for

at least 4 weeks. Analyses on breastfeeding duration included 319 431 mothers.

The Harvard School of Public Health Institutional Review Board reviewed this study and considers it exempt.

Breastfeeding initiation and duration

On PRAMS questionnaires, mothers reported whether they ever breast fed or pumped breast milk and fed it to their baby after delivery. We defined breastfeeding initiation as a response of yes. At the time of the questionnaire, mothers were asked if they were still breast feeding or feeding their baby pumped milk and if not, the number of weeks or months they had done so. Since mothers reported how long they breast fed, either in weeks or months, the smallest unit for breastfeeding duration was 4 weeks (combining ≥ 4 weeks and ≥ 1 month). We defined breastfeeding duration as continuing to breast feed for at least 4 weeks.

Breastfeeding laws

Based on previous work, we coded the following laws for each state (yes/no): (1) employers are encouraged or required to provide break time and private space for breastfeeding employees and (2) breast feeding is permitted in any public or private location.⁷ Women's breastfeeding intention during pregnancy is

Table 1 Breastfeeding initiation and breast feeding for at least 4 weeks across states participating in Pregnancy Risk Assessment Monitoring System from 2000–2008

	Years data available	Breastfeeding initiation no. (weighted %)		Breast feeding for at least 4 weeks no. (weighted %)	
		2000 (N=30 899)	2008 (N=36 512)	2000 (N=30 209)	2008 (N=35 655)
AK	2000–2008	1293 (88.9)	1144 (92.0)	1255 (78.4)	1117 (80.5)
AL	2000–2003	1449 (55.4)		1427 (39.6)	
AR	2000–2008	1591 (60.0)	1581 (66.8)	1554 (44.0)	1551 (47.5)
CO	2000–2008	2034 (85.4)	1954 (90.6)	1978 (75.0)	1900 (79.2)
DE	2007–2008		1189 (74.0)		1172 (58.3)
FL	2000–2005	1910 (77.3)		1863 (61.8)	
GA	2004–2008		946 (71.9)		926 (59.1)
HI	2000–2008	2349 (89.5)	1674 (92.5)	2234 (77.3)	1618 (81.7)
IL	2000–2008	1898 (68.9)	1599 (77.8)	1852 (55.7)	1565 (65.7)
LA	2000–2004	2038 (46.2)		1981 (35.7)	
MA	2007–2008		1433 (81.6)		1395 (70.5)
MD	2001–2008		1607 (81.1)		1581 (67.5)
ME	2000–2008	1085 (75.6)	1092 (78.6)	1074 (62.6)	1066 (64.6)
MI	2001–2008		1547 (73.7)		1517 (57.1)
MN	2002–2008		1399 (84.8)		1370 (73.9)
MS	2003–2004; 2006; 2008		1362 (49.5)		1313 (35.3)
NC	2000–2005; 2007–2008	1688 (63.1)	1334 (73.2)	1669 (50.3)	1312 (60.4)
NE	2000–2008	2050 (71.8)	1545 (80.7)	1993 (59.0)	1510 (66.9)
NJ	2002–2008		1462 (80.1)		1424 (67.6)
NM	2000–2005	1503 (79.7)		1486 (65.9)	
NY	2000–2008	1174 (69.1)	1076 (75.5)	1161 (56.6)	1055 (62.8)
NYC	2004–2007				
OH	2000–2003; 2005–2008	1552 (63.0)	1381 (70.5)	1525 (50.5)	1358 (56.8)
OK	2000–2008	1785 (67.4)	1852 (79.1)	1765 (53.7)	1801 (58.3)
OR	2003–2008		1550 (93.8)		1532 (84.1)
RI	2002–2008		1134 (74.9)		1120 (61.6)
SC	2000–2007	1366 (52.8)		1339 (38.5)	
UT	2000–2008	1500 (87.7)	1663 (91.3)	1472 (78.9)	1620 (81.2)
WA	2000–2008	1393 (88.5)	1490 (92.2)	1363 (77.5)	1432 (78.8)
WI	2007–2008		993 (78.6)		946 (68.0)
WV	2000–2008	1241 (53.7)	1623 (58.5)	1218 (38.1)	1594 (45.0)
WY	2007–2008		882 (85.3)		860 (72.9)

Note: Missing values indicate that data were not collected that year.

strongly associated with infant feeding practices.¹¹ Using the law's effective date, for each mother we coded whether there was a law in place in her state 6 months prior to birth. Between 2000 and 2008, seven of the 32 states in the PRAMS data had laws come into effect which encouraged or required employers to provide break time and private space for breastfeeding employees (Colorado, Illinois, New York, New York City, Oklahoma, Oregon, Rhode Island) and 11 states had laws come into effect that permitted breast feeding in any public or private location (Arkansas, Colorado, Hawaii, Illinois, Louisiana, Maryland, Maine, Mississippi, Ohio, Oklahoma, Wyoming).

Socio-demographic characteristics

We obtained maternal socio-demographic characteristics from infants' birth certificates. Each mother reported her race/ethnicity, years of education, age, marital status, number of previous live births, whether she was on the Special Supplemental Program for Women, Infants, and Children (WIC) during pregnancy, and the number of babies born.

Statistical analyses

We conducted analyses using STATA statistical software, V.12.0 SE. We used the analysis weights provided with the dataset to calculate weighted percentages and included them in all regression analyses. We estimated differences-in-differences models, a quasi-experimental causal inference technique, to examine the impact of changes in breastfeeding laws on changes in breastfeeding initiation and, separately, on a mother's probability of breast feeding for at least 4 weeks. This type of model compares breast feeding within a state before and after a policy change as well as across states during the same time period. The model explicitly allows for time-invariant differences in breastfeeding practices across states as well as overall nationwide time trends in the prevalence of breast feeding, both of which are known to be important.^{3 12} We examined laws for workplace provisions (yes/no) and, separately, breast feeding in any location (yes/no). The ordinary least squares regression models included the analysis weights provided by PRAMS and year and state fixed effects. The estimated coefficients on the policy variables in ordinary least squares models with a dichotomous outcome are interpreted as the percentage point increase/decrease in breast feeding, given a change in policy. State fixed effects account for the unobserved state-specific characteristics that do not change over time, while year fixed effects allow us to account for underlying national time trends in breastfeeding rates. SEs were clustered at the state level to account for differences in error variance across states. All models were adjusted for maternal race/ethnicity, education, age, marital status, previous live births, WIC status and multiple births. In addition to examining the overall effect of each policy on all mothers (Model 1), we estimated interactions between each policy and maternal race/ethnicity (Model 2), education (Model 3) and age (Model 4) to investigate whether these policies had differential effects on women according to subgroups of each of these three covariates.

RESULTS

Across all states breastfeeding initiation increased over the period from 2000 to 2008 (table 1); 69.4% of mothers reported giving their infant any breast milk in 2000 compared with 78.0% in 2008. Similarly, breast feeding for at least 4 weeks increased from 56.3% to 64.9%. Black mothers, mothers with

Table 2 Maternal characteristics of breastfeeding initiation and breast feeding for at least 4 weeks

	Breastfeeding initiation no. (weighted %)		Breast feeding for at least 4 weeks no. (weighted %)	
	2000 (N=30 899)	2008 (N=36 512)	2000 (N=30 209)	2008 (N=35 655)
Maternal race/ethnicity				
White	17 236 (71.2)	19 484 (78.6)	16 915 (58.8)	19 119 (65.7)
Hispanic	3851 (82.7)	5538 (87.1)	3717 (66.4)	5318 (74.2)
Black	5586 (47.9)	6004 (61.9)	5491 (34.3)	5865 (46.2)
Other	4226 (80.1)	5486 (86.4)	4086 (68.3)	5353 (75.9)
Maternal education				
0–11 years	6136 (57.1)	6349 (65.7)	5993 (40.8)	6162 (49.9)
12 years	10 919 (60.1)	10 616 (70.2)	10 677 (45.5)	10 377 (53.3)
13–15 years	7038 (73.8)	8941 (80.6)	6880 (59.9)	8725 (66.6)
16+ years	6806 (86.5)	10 606 (89.6)	6659 (78.4)	10 391 (82.0)
Maternal age				
<17–19 years	4757 (57.0)	3687 (63.6)	4659 (36.3)	3607 (39.0)
20–24 years	8280 (63.4)	8781 (72.8)	8113 (47.8)	8580 (55.4)
25–29 years	8108 (71.9)	10 225 (80.5)	7926 (60.0)	9967 (68.8)
30–34 years	6137 (76.5)	8097 (83.5)	5986 (66.8)	7907 (74.8)
35+ years	3617 (76.3)	5722 (81.9)	3525 (67.8)	5594 (73.2)

less education and younger mothers had lower rates of breastfeeding initiation and duration over this period (table 2).

We found that breastfeeding initiation was 1.7 percentage points higher in states with laws which provided break time and private space for breastfeeding employees after such laws were in place (p=0.01) (Model 1, table 3A). Since the prevalence of breastfeeding initiation in 2000 was 69.4%, on average, nationwide this would represent an additional 2.4% relative increase in breastfeeding initiation in states in which such policies were implemented. We also observed a significant interaction between laws for workplace provisions and maternal race/ethnicity (Model 2). The sign and statistical significance of the estimated interaction term for Hispanic mothers indicates that the increase in breastfeeding initiation associated with laws for workplace provisions was driven by an increase in breast feeding among Hispanic mothers. These mothers had a 5.8 percentage point (0.048 Hispanic+0.010 reference) increase in breastfeeding initiation in states with new laws for workplace provisions. All models were repeated to examine the impact of changes in laws for workplace provisions on breast feeding for at least 4 weeks (table 3B). While the patterns of the results were similar for both the overall effect as well as the interaction with maternal race/ethnicity, the strength of the associations was attenuated slightly.

We did not observe any interactions between the policy change and maternal age for breastfeeding initiation; however, there was a significant interaction for breastfeeding duration. We found that mothers aged 20 years and older were more likely to breast feed for at least 4 weeks in states with new laws for workplace provisions after such laws came into effect. We did not find any interactions between the policy and maternal education for breastfeeding initiation or duration.

While on average there was no overall association between laws for breast feeding in any public or private location with breastfeeding initiation (Model 1, table 4A), we observed interactions with maternal race/ethnicity (Model 2) and, separately, education (Model 3). States with new laws permitting breast feeding in any location saw an increase in breastfeeding initiation by 5.6 percentage points for Black mothers (0.060 Black+–0.004 reference).

Table 3 Differences-in-differences models of state breastfeeding laws for workplace provisions* on (A) breastfeeding initiation (N=326 260) and (B) breast feeding for at least 4 weeks (N=319 431)

	Model 1† Coefficient (95% CI)	Model 2† Coefficient (95% CI)	Model 3† Coefficient (95% CI)	Model 4† Coefficient (95% CI)
(A) Breastfeeding initiation				
Employment policy	0.017 (0.00 to 0.03)	0.010 (−0.01 to 0.03)	0.020 (−0.00 to 0.04)	−0.002 (−0.03 to 0.03)
Policy* Race/ethnicity				
White		0.0 (ref)		
Hispanic		0.048 (0.01 to 0.09)		
Black		−0.019 (−0.07 to 0.03)		
Other		0.001 (−0.06 to 0.06)		
Policy* Education				
0–11 years			0.0 (ref)	
12 years			−0.002 (−0.03 to 0.02)	
13–15 years			−0.004 (−0.04 to 0.03)	
16+ years			−0.003 (−0.04 to 0.03)	
Policy* Age				
<17–19 years				0.0 (ref)
20–24 years				0.017 (−0.00 to 0.04)
25–29 years				0.018 (−0.01 to 0.05)
30–34 years				0.023 (−0.01 to 0.06)
35+ years				0.030 (−0.00 to 0.06)
(B) Breast feeding for at least 4 weeks				
Employment policy	0.008 (−0.00 to 0.02)	−0.005 (−0.02 to 0.01)	0.014 (−0.01 to 0.03)	−0.015 (−0.03 to 0.00)
Policy* Race/ethnicity				
White		0.0 (ref)		
Hispanic		0.062 (0.01 to 0.12)		
Black		−0.00 (−0.04 to 0.04)		
Other		0.019 (−0.07 to 0.11)		
Policy* Education				
0–11 years			0.0 (ref)	
12 years			−0.002 (−0.03 to 0.02)	
13–15 years			−0.018 (−0.04 to 0.01)	
16+ years			−0.003 (−0.04 to 0.03)	
Policy* Age				
<17–19 years				0.0 (ref)
20–24 years				0.024 (0.00 to 0.04)
25–29 years				0.016 (−0.02 to 0.05)
30–34 years				0.029 (0.00 to 0.06)
35+ years				0.042 (0.02 to 0.06)

*7/32 states had new laws for workplace provisions: CO, IL, NY, NYC, OK, OR and RI.

†Models adjusted for maternal race/ethnicity, education, age, marital status, previous births, WIC status and multiple births; models included analysis weights and year and state fixed effects.

There was also evidence of an interaction between laws for breast feeding in any location with maternal education (Model 3). While breastfeeding initiation among mothers with 0–11 years of education increased on average after the implementation of policies, the association between the policy implementation and initiation rates diminished for mothers in the two highest educational groups. For mothers with 13–15 years or 16+ years of education, rates of breastfeeding initiation were still higher than those for less educated mothers; however, the differences between these groups decreased after the implementation of policies. Similar patterns of results were seen for breast feeding for at least 4 weeks (table 4B). There was no significant interaction between the policy and maternal age for breastfeeding initiation or duration.

We repeated Model 1 including laws for workplace provisions and location together and the results were the same for breastfeeding initiation and duration (results not shown).

DISCUSSION

We found that state laws that support breast feeding in the workplace and in other locations appear to increase

breastfeeding initiation and duration. Most of these gains were observed among Hispanic and Black women and women of lower educational attainment, suggesting that such state laws may help reduce disparities in breastfeeding rates. To our knowledge, this evaluation provides the first longitudinal, quasi-experimental evidence that state laws may promote breast feeding.

Previously cross-sectional studies reported that states with breastfeeding laws had higher levels of breast feeding.^{9 13} However, using this approach it was not possible to rule out reverse causation. The differences-in-differences approach we undertook allowed us to evaluate laws through a natural experiment in a situation in which randomised controlled trials are difficult to conduct. These quasi-experimental methods allowed us to model the causal effects of breastfeeding laws as well as identify which mothers are affected by the laws.

We found that the introduction of new breastfeeding laws was most likely to benefit mothers from ethnic minority groups and those who are the most at-risk for not starting or continuing breast feeding. Specifically, laws for workplace provisions increased breastfeeding initiation and duration overall

Table 4 Differences-in-differences models of state breastfeeding laws for location policies* on (A) breastfeeding initiation (N=326 260) and (B) breast feeding for at least 4 weeks (N=319 431)

	Model 1† Coefficient (95% CI)	Model 2† Coefficient (95% CI)	Model 3† Coefficient (95% CI)	Model 4† Coefficient (95% CI)
(A) Breastfeeding initiation				
Location policy	0.008 (−0.00 to 0.02)	−0.004 (−0.02 to 0.01)	0.038 (0.01 to 0.06)	0.019 (−0.01 to 0.05)
Policy* Race/ethnicity				
White		0.0 (ref)		
Hispanic		0.012 (−0.04 to 0.06)		
Black		0.060 (0.01 to 0.11)		
Other		−0.003 (−0.06 to 0.05)		
Policy* Education				
0–11 years			0.0 (ref)	
12 years			−0.014 (−0.03 to 0.01)	
13–15 years			−0.039 (−0.07 to −0.01)	
16+ years			−0.060 (−0.11 to −0.01)	
Policy* Age				
<17–19 years				0.0 (ref)
20–24 years				0.005 (−0.03 to 0.04)
25–29 years				−0.015 (−0.06 to 0.02)
30–34 years				−0.023 (−0.07 to 0.02)
35+ years				−0.021 (−0.06 to 0.02)
(B) Breast feeding for at least 4 weeks				
Location policy	0.00 (−0.01 to 0.01)	−0.012 (−0.03 to 0.01)	0.025 (0.00 to 0.05)	0.002 (−0.02 to 0.03)
Policy* Race/ethnicity				
White		0.0 (ref)		
Hispanic		0.016 (−0.04 to 0.08)		
Black		0.056 (0.02 to 0.10)		
Other		−0.001 (−0.06 to 0.06)		
Policy* Education				
0–11 years			0.0 (ref)	
12 years			−0.009 (−0.04 to 0.02)	
13–15 years			−0.033 (−0.06 to −0.01)	
16+ years			−0.053 (−0.09 to −0.02)	
Policy* Age				
<17–19 years				0.0 (ref)
20–24 years				0.012 (−0.02 to 0.04)
25–29 years				0.001 (−0.03 to 0.03)
30–34 years				−0.015 (−0.05 to 0.02)
35+ years				−0.015 (−0.05 to 0.02)

*11/32 states had new laws for breast feeding in any location: AR, CO, HI, IL, LA, MD, ME, MS, OH, OK and WY.

†Models adjusted for maternal race/ethnicity, education, age, marital status, previous births, WIC status and multiple births; models included analysis weights and year and state fixed effects.

and for Hispanic mothers. In addition, laws which permit women to breast feed in any location increased breastfeeding initiation and duration among Black mothers and mothers with less than a high school degree. Given that these mothers have the lowest levels of breast feeding, our results suggest that state policies may help reduce disparities. While location policies do not seem to have had a positive impact on breastfeeding initiation for mothers in the two highest educational groups, our models suggest that they were associated with a narrowing of the gap between breastfeeding rates for high and low education women. In particular, the policies were associated with a smaller *additional* likelihood of breast feeding for high education mothers, a group of women who already have some of the highest rates of breast feeding nationally (table 2). While the empirical models suggest a potential narrowing of the education gradient in breastfeeding practices, information in PRAMS unfortunately does not allow us to uncover the mechanisms for these changes. State laws promoting breast feeding may be improving workplace conditions to allow mothers greater access or flexibility at work to continue breast feeding. Alternatively, or in addition to the above, the

passage of such laws may change cultural norms around seeing women breast feed in public. Further research is needed to understand why specific breastfeeding laws may support breast feeding differently across racial/ethnic and educational groups.

Current breastfeeding laws vary across states, particularly laws in the workplace.⁷ Fewer than half of states have laws to provide break time and private space for breastfeeding employees, and the majority of those do not require the provisions if they would disrupt operations. Furthermore, the legislation often specifies that employers are only encouraged but not required to comply.⁷ Nevertheless, we found that breastfeeding initiation and duration were higher in states with new laws to provide break time and private space for breastfeeding employees, particularly among Hispanic mothers. Indeed, given the potential weakness of the laws, the fact that it may take time before their effects are fully observed in the population and that PRAMS does not collect information on maternal employment, our results may be an underestimation of the true effect of laws for workplace provisions on breast feeding among working mothers.

Healthy People 2020 calls for an increase in the proportion of employers who have lactation support programmes to 38%.¹⁴ There is some evidence that a supportive workplace and provisions for breastfeeding employees may help women to continue breast feeding after returning to work.^{15–17} However, a survey in 2011 found that only 28% of companies reported having an on-site lactation room and 5% offered lactation support services.¹⁸ Despite the new federal legislation⁶ and state laws to promote breast feeding in the workplace,^{7,8} not all women are protected. Furthermore, federal regulations for implementing these provisions have not been issued and there are no penalties for non-compliance.¹⁹ Laws to provide stronger workplace provisions that fill these gaps will further support women who wish to successfully combine employment and breast feeding.

Over 90% of states currently have laws to permit mothers to breast feed in any public or private location.⁷ However, the 2010 HealthyStyles Survey found that only 59% of adults agreed with a statement that women should have the right to breast feed in public places.²⁰ There is clearly a gap between the proportion of women whose right to breast feed in public is protected and public opinion. Further work is needed to understand this disconnect and what actions can be taken in addition to legislation to increase support for breast feeding outside the home.

Breastfeeding laws are only effective if mothers, employers and the public know that they exist. As of 2009, seven states had legislation for campaigns to promote breast feeding or raise the public's awareness about women's legal rights related to breast feeding.²¹ Nevertheless, some businesses may violate state laws because they are not aware of the legislation. Despite women's legal right to breast feed in any public or private location, mothers have been asked to stop breast feeding or leave a range of establishments.²² Furthermore, even if a state encourages or requires employers to provide break time and private space for breastfeeding employees, the translation of these laws into workplace provisions and the implementation of these policies are likely to vary by employment sector and/or size of employer. Since little is known about how state laws promote breast feeding, the next steps may be a qualitative study or further survey work with mothers, employers, lactation support personnel or policy makers.

While the PRAMS dataset does not include all states, it provides detailed information on infant feeding practices during a time of active policy change. Although mothers reported on their infant feeding practices approximately 4 months after birth, others have shown mothers' recall of breast feeding is reliable and valid within 3 years post partum.²³ We found slightly higher estimates for the impact of state breastfeeding laws on breastfeeding initiation than for duration. This suggests that laws in place during a woman's pregnancy may be influencing decisions to start breast feeding, but less so for continuing. In a previous study, we identified three additional state breastfeeding laws: exempting breast feeding from public indecency laws, exempting breastfeeding women from jury duty and prohibiting employer discrimination based on breast feeding.⁷ However, too few states with these policies participated in PRAMS to be able to include them in this evaluation. Although we also cannot account for other state level policies, such as educational campaigns, which may have been implemented at the same time and potentially upwardly bias our results, year and state level fixed effects account for much of the time and state-invariant differences we may observe. Our analyses should be repeated in other samples, particularly among women who are employed outside the home, to corroborate the findings.

Breastfeeding initiation rates vary widely across the USA, ranging from 49% in Louisiana to 91% in Oregon, with a similar pattern for continuation to 6 months.¹² Disparities in breastfeeding initiation and duration persist across maternal race/ethnicity, education and age. However, the Healthy People 2020 targets for breastfeeding initiation and duration do not capture these differences across states and socio-demographic characteristics.¹⁴ We have shown that state laws can help address some of the barriers to breast feeding that many mothers experience. Currently, there are few population level interventions to increase breast feeding.¹ Our results suggest that enacting state laws should be considered as a strategy to continue the momentum for breastfeeding support^{3,5} by helping to promote breast feeding, reduce disparities and achieve public health goals.

What is already known on this subject

- ▶ Although the passage of the Patient Protection and Affordable Care Act represents the first federal legislation to protect breast feeding, most laws supporting breast feeding are enacted at the state level.
- ▶ However, a formal evaluation has not yet been conducted to test whether and/or what type of laws may increase breast feeding.

What this study adds

- ▶ The differences-in-differences approach we undertook allowed us to evaluate laws through a natural experiment in a situation in which randomised controlled trials are difficult to conduct.
- ▶ We found that state laws that support breast feeding in the workplace and in other locations appear to increase breastfeeding initiation and duration. Most of these gains were observed among Hispanic and Black women and women of lower educational attainment, suggesting that such state laws may help reduce disparities in breastfeeding rates.
- ▶ Our results suggest that enacting state laws should be considered as a strategy to help promote breast feeding, reduce disparities and achieve public health goals.

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REFERENCES

1. **US Department of Health and Human Services.** *The surgeon general's call to action to support breastfeeding.* Washington, DC: US Department of Health and Human Services, 2011.
2. **Johnston M,** Landers S, Noble L, *et al.* Breastfeeding and the use of human milk. *Pediatrics* 2012;**129**:e827–841.
3. **Grummer-Strawn LM,** Shealy KR. Progress in protecting, promoting, and supporting breastfeeding: 1984–2009. *Breastfeed Med* 2009;**4**:S31–39.
4. **Centers for Disease Control and Prevention.** Racial and ethnic differences in breastfeeding initiation and duration, by state—National Immunization Survey, United States, 2004–2008. *MMWR Morb Mortal Wkly Rep* 2010;**59**:327–34.
5. **Perez-Escamilla R,** Chapman DJ. Breastfeeding protection, promotion, and support in the United States: a time to nudge, a time to measure. *J Hum Lact* 2012;**28**:118–21.
6. **Patient Protection and Affordable Care Act.** Public Law No. 111-148, Section 4207, 2010.
7. **Nguyen TT,** Hawkins SS. Current state of US breastfeeding laws. *Matern Child Nutr* Published Online First: 11 Jan 2012. doi: 10.1111/j.1740-8709.2011.00392.x
8. **Murtagh L,** Moulton AD. Working mothers, breastfeeding, and the law. *Am J Public Health* 2011;**101**:217–23.
9. **Kogan MD,** Singh GK, Dee DL, *et al.* Multivariate analysis of state variation in breastfeeding rates in the United States. *Am J Public Health* 2008;**98**:1872–80.
10. **Centers for Disease Control and Prevention.** *Pregnancy Risk Assessment Monitoring System (PRAMS).* <http://www.cdc.gov/prams/> (accessed 3 May 2010).
11. **Donath SM,** Amir LH. Relationship between prenatal infant feeding intention and initiation and duration of breastfeeding: a cohort study. *Acta Paediatr* 2003;**92**:352–6.
12. **Centers for Disease Control and Prevention.** *Breastfeeding Report Card—United States, 2011.* <http://www.cdc.gov/breastfeeding/pdf/2011BreastfeedingReportCard.pdf> (accessed 29 Aug 2011).
13. **Dozier AM,** McKee KS. State breastfeeding worksite statutes...breastfeeding rates...and. *Breastfeed Med* 2011;**6**:319–24.
14. **US Department of Health and Human Services.** *Healthy People 2020 Objective Topic Areas.* <http://healthypeople.gov/2020/topicsobjectives2020/pdfs/HP2020objectives.pdf> (accessed 16 Jan 2012).
15. **Cohen R,** Mrtek MB. The impact of two corporate lactation programs on the incidence and duration of breast-feeding by employed mothers. *Am J Health Promot* 1994;**8**:436–41.
16. **Cohen R,** Mrtek MB, Mrtek RG. Comparison of maternal absenteeism and infant illness rates among breast-feeding and formula-feeding women in two corporations. *Am J Health Promot* 1995;**10**:148–53.
17. **Ortiz J,** McGilligan K, Kelly P. Duration of breast milk expression among working mothers enrolled in an employer-sponsored lactation program. *Pediatr Nurs* 2004;**30**:111–9.
18. **Society for Human Resource Management.** *2011 Employee benefits: A Survey Report by the Society for Human Resource Management.* http://www.shrm.org/Research/SurveyFindings/Articles/Documents/2011_Emp_Benefits_Report.pdf (accessed 23 Jan 2012).
19. **Lichter AM.** It's the law: break time for nursing mothers. *Breastfeed Med* 2011;**6**:333–5.
20. **Centers for Disease Control and Prevention.** *HealthStyles survey—breastfeeding practices.* http://www.cdc.gov/breastfeeding/data/healthstyles_survey/survey_2010.htm#2010 (accessed 24 Oct 2011).
21. **Congressional Research Service.** *Summary of State Breastfeeding Laws and Related Issues, June 2009.* <http://maloney.house.gov/sites/maloney.house.gov/files/documents/women/breastfeeding/062609%20CRS%20Summary%20of%20State%20Breastfeeding%20Laws.pdf> (accessed 31 Oct 2011).
22. **The New York Times.** 'Lactivists' taking their cause, and their babies, to the streets. June 7, 2005. <http://www.nytimes.com/2005/06/07/nyregion/07nurse.html?scp=1&sq=breastfeeding%20public&st=cse> (accessed 5 Dec 2011).
23. **Li R,** Scanlon KS, Serdula MK. The validity and reliability of maternal recall of breastfeeding practice. *Nutr Rev* 2005;**63**:103–10.