Obstetricians' Rising Liability Insurance Premiums and Inductions at Late Preterm Gestations

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Objective: To estimate the association between professional liability insurance premiums for obstetricians and late preterm induction (LPI) rates.

Design: Data from the National Center for Health Statistics were used to identify all Illinois women pregnant with singletons at 34 weeks' gestation from 1991 to 2003. The independent association between LPI (induction between 34 and 37 weeks' gestation) rates and the previous year's obstetric malpractice insurance premiums was evaluated using linear regression.

Results: The mean annual LPI rate (5.4/1000 in 1991 to 15.2/1000 in 2003, $P < 0.001$) nearly tripled, and obstetricians' professional liability insurance premiums ($55,480 to $110,613, $P < 0.001$) approximately doubled. After adjusting for race, previous cesarean delivery, marital status, and the presence of antepartum risk factors for indicated preterm delivery, LPI rates increased by 1/1000 births ($P = 0.004$) for each annual $10,000 increase in the county's obstetric malpractice insurance premium.

Conclusions: Rising premiums are associated with increased frequency of LPI among women with singleton gestations.

Key Words: late preterm, induction of labor, professional liability

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Since 1991, the rate of preterm birth has increased from 1 in 11 to nearly 1 in 8 of all births in the United States.[1,2] Three-quarters of these preterm infants are delivered in the late preterm period, which occurs between $34^{0/7}$ and $36^{6/7}$ weeks' gestation.[3] The National Institute of Child Health and Human Development (NICHD) recently held a consensus conference outlining an agenda to elucidate factors contributing to the recent rise in late preterm deliveries.[4] This conference called for further evidence to suggest strategies that may reduce the incidence of late preterm birth.[1,2]

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A number of studies demonstrate that infants born during the late preterm period have more neonatal morbidities, higher mortality rates, and even greater cause-specific mortality rates compared with infants born at term.[5–12] Wang and others also have found more severe morbidities among late preterm infants, suggesting that the biology, maturation, and care of these infants are substantially different from children born at term.[13,13a] Also, because of the sheer number of infants (about 350,000 annually in the United States) delivered during these gestational ages, the cost and morbidity attributable to these infants are significant healthcare burdens.

The National Institute of Child Health and Human Development Consensus Conference was unable to determine definitively the reasons for the increase in these deliveries.[2] Physician practice patterns and decision-making may affect the frequency of delivery of late preterm gestations and one contributing factor to this decision-making may be the medico-legal climate. Physicians have reported that their decisions are influenced by this climate and have stated that they have performed tests and procedures that are not clearly medically necessary because of medico-legal pressures.[14,15] Indeed, obstetricians, in particular, have claimed to be affected by the medico-legal climate, a finding not surprising given the relatively large monetary awards that have been granted for birth injury cases.[16] This perceived pressure may reduce obstetricians' threshold to intervene. The suggestion of this reduced threshold has already been demonstrated with respect to cesarean delivery, as obstetricians in climates with greater medico-legal pressures are more likely to proceed with cesarean delivery.[17]

It is also possible that medico-legal pressures may lead obstetricians, faced with a complicated obstetric situation, to intervene more readily and move toward delivery during late preterm period gestations.[18] There are several obstetric complications, such as mild pre-eclampsia or intrauterine growth restriction, for which the optimal gestational age for delivery remains uncertain. The benefits of expectant management, such as the diminishing risks of prematurity associated with rising gestational ages, must be balanced with the risks of expectant management, such as maternal or fetal adverse outcomes. Even if uncommon, there is the potential for adverse outcomes such as an intrauterine demise or permanent brain injury to be profound and perhaps the genesis of subsequent malpractice claims. Because of the recent dramatic improvements in neonatal care,[19,20] obstetricians may

be less willing to accept the risks of expectant management, particularly without unequivocal evidence of the effectiveness of this strategy. Thus, we hypothesize that greater malpractice pressures will be one reason for obstetric practitioners to alter practice styles and to be more likely to initiate labor iatrogenically during the late preterm period for maternal or fetal indications. Correspondingly, the aim of this study is to estimate whether the late preterm induction (LPI) rate is independently associated with the observed increase in professional liability insurance premiums over the study period.

METHODS

Using birth certificate data from the National Center for Health Statistics (NCHS), we identified all deliveries occurring in Illinois from 1991 through 2003. In summary, these data are extracted from a standardized national registry of birth certificate data that records maternal demographic information, antepartum and intrapartum characteristics, and neonatal birth information about all births occurring within the United States.[21] This registry is coordinated between each state's public health department and the Centers for Disease Control and Prevention. From this data set, women who delivered a singleton at or after $34^{0/7}$ weeks of gestation were identified. Women who were reported to have delivered after the 44th week of gestation (due to the concern of misreporting), who had an unreported gestation at delivery, who had an unknown initiation of labor, who had a breech presentation, or who had a placenta previa were excluded from the analysis. Women with prolonged rupture of membranes during late preterm gestations also were excluded, as these women would not typically be candidates for expectant management.

The LPI rate was calculated as the number of late preterm inductions per 1000 eligible women pregnant at each of the individual late preterm gestational ages (34, 35, and 36 weeks) less the women that delivered in the previous week from the denominator for each Illinois county. Gravid women undergoing inductions were identified using the "induction of delivery" field in the NCHS data set; this field is defined as "the initiation of uterine contractions before the spontaneous onset of labor by medical and/or surgical means for the purpose of delivery." Labor augmentation, which is the stimulation of a previously established labor, was identified in the data set by the field "stimulation of labor," and was not used to identify women who underwent labor induction. The LPI rate was determined for each year of the study and differences in the annual rates were evaluated using analysis of variance (ANOVA). Univariable analyses were performed, using the Student t test and χ^2 analysis, to determine the demographic and antepartum medical characteristics that were significantly associated with LPI. A woman was considered to have at least 1 antepartum risk for induction if she had at least one of the following conditions: maternal anemia, cardiac disease, acute/chronic pulmonary disease, diabetes mellitus, previous infant born greater than 4 kg, chronic/pregnancy-associated hypertension, renal disease, Rh sensitization, or maternal hemoglobinopathy. Intrapartum characteristics were excluded from the analysis as these factors are expected to develop after inducing labor, and thus, these factors would be noncontributory in any risk-adjusted model.

Annual professional liability insurance premiums for obstetrician-gynecologists within Illinois were determined for each county in Illinois (N = 18) and were used as a proxy measure for the professional liability pressures experienced by the obstetric clinicians. County-specific premiums were derived from the Illinois State Medical Inter-Insurance Exchange Mutual Insurance Company (ISMIE). The insurance company determines the premiums rate charges in a 2-step process. The first step involves determining the overall premium rate for the next policy year with the goal of covering anticipated losses, based on settlement and legal defense costs. The second step involves determining the distribution of rates among physicians in different geographical areas and from different medical specialties. After adding administrative costs, the premium rates are then set for the upcoming policy year. ISMIE does not disclose individual physician surcharges and discounts and only county-level estimates of premiums were measured. Thus, each county was used as the unit of analysis.

ISMIE underwrites approximately 60% of liability insurance policies for Illinois obstetricians (Alan Allphin, VP Underwriting, ISMIE, personal communication). All premiums were adjusted to 2004 dollars using the medical care component of the Consumer Price Index. Comparisons between the annual mean insurance premiums during the period of study were performed using ANOVA.

The characteristics of the gravid population were calculated also at the county level. However, to ensure confidentiality of the de-identified data, women's county of residence is identified in the NCHS data set only in counties with a population greater than 100,000 residents or for 17 counties in Illinois. Residents from counties with fewer than 100,000 residents (from the remaining 85 remaining counties) cannot be specifically identified in the NCHS data, and thus, these counties were placed into 1 group and their "county-level" characteristics were aggregated. However, these counties accounted for approximately 10.4% of the births over the study period. The insurance premium for this collective group was determined as an average of the county-level insurance premiums weighted by the mean population of residents in 1997, the midpoint of the study period. The variability in these counties' insurance premiums was minimal.

The association between county-level LPI rates and professional liability insurance premiums was evaluated using a cross-sectional time series model with a first-order autoregressive disturbance. This type model was used because in addition to controlling for potential confounding factors, this regression equation isolates the relationship between insurance premiums (the independent variable) and the LPI rate (the outcome variable) over time.[22] Premiums within each county from the year prior to the birth were used as an independent variable. The previous year's premiums are used because we hypothesize that physician behavior would be influenced by premiums they had already been "experienced" and paid. Other demographic and obstetric variables were evaluated in the regression analysis, and those that changed

the estimated effect on the change in the mean induction rate by at least 20% were included in the final model. The potential covariates, measured at the county-level, are as follows: maternal age, race, marital status, mean annual income (adjusted to 2004 dollars) within each Illinois county,[23] parity, educational level, previous cesarean delivery, and the presence of at least 1 obstetrical risk factor for induction of labor, as determined from the univariable analyses. All tests were 2-tailed and $\alpha = 0.05$ was used to define statistical significance. Statistical analyses were performed with Stata v9.2 (Stata, Inc., College Station, TX). The study was exempt from review by the Chair of the Children's Memorial Research Center Institutional Review Board.

RESULTS

There were 2,303,737 singleton births in Illinois during the study period (1991–2003). Of these, 25,453 were delivered after 44 weeks' gestation and 73,362 were delivered before 34 weeks' gestation. Of the 2,204,992 remaining births between $34^{0/7}$ and $44^{6/7}$ weeks' gestation, 7418 had placenta previa, 61,556 were in breech position, 3706 had an unknown gestation, 8442 had an unknown initiation of labor, 8734 had preterm premature rupture of membranes at late preterm gestations, and 419 were missing one of the relevant variables. The remaining 2,120,080 singleton births (92.0% of the original sample) were eligible for the analysis. Of note, there were 171,733 births (7.6% of the eligible cohort) that were delivered at late preterm gestations, of which, 20,158 (11.7%) were born after a late preterm induction. Figure 1 shows the rising proportion of late preterm births that were induced before delivery in Illinois.

The LPI rate more than doubled (from 5.4 per 1000 in 1991 to 15.2 per 1000 eligible women in 2003, $P < 0.001$) during the study period. A graphical depiction of this rise is presented in Figure 2. As shown in Figure 3, a similar increase was found when examining the professional liability insurance premiums. To the nearest dollar, mean (±SD) annual rate charges were $55,480 (±$14,572) in 1991 and rose to $110,613 (±$24,539) in 2003 ($P < 0.001$), that nearly doubled during the study period.

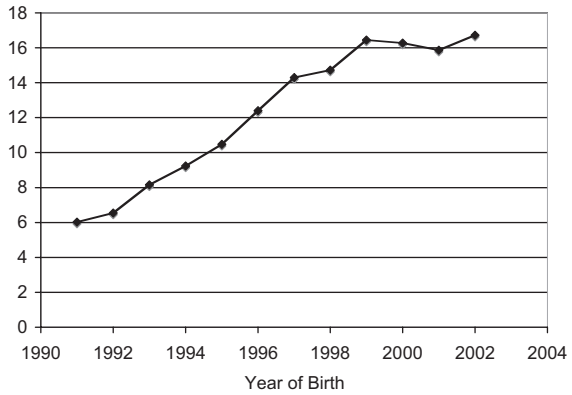

FIGURE 1. Proportions of late preterm births that were induced, Illinois 1991–2003.

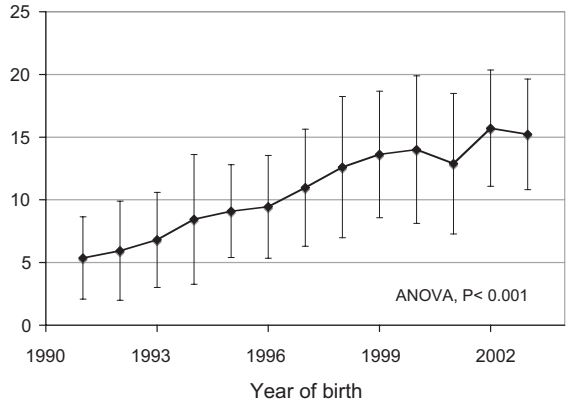

FIGURE 2. Mean LPI rates among singleton pregnancies in Illinois from 1991 through 2003. Error bars represent ±1 SD.

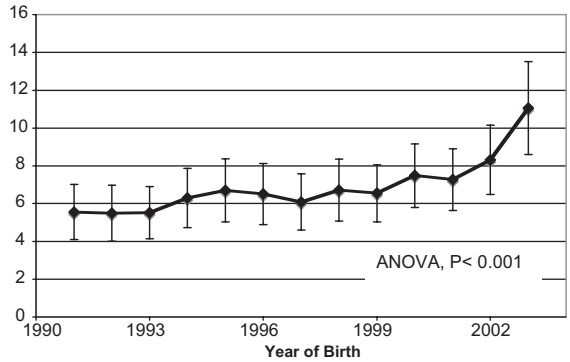

FIGURE 3. Obstetricians' mean professional liability insurance premiums in Illinois from 1991 through 2003. Error bars represent ±1 SD. Premiums provided by the ISMIE Mutual Insurance Company.

Table 1 depicts the maternal demographic and obstetrical characteristics evaluated for their univariable association with LPI. Significant differences were found between women who had an LPI and those who did not in all characteristics including maternal race, age (both as continuous and categorical measures), marital status, educational level, nulliparity, previous cesarean delivery, and the presence of at least one antepartum risk factor for induction.

Regression analysis accounting for auto-correlation demonstrates that for each $10,000 annual increase in a county's insurance premium, the LPI rate increases by 1.2 per 1000 eligible women [95% confidence interval (CI), 0.6/1000 to 1.7/1000; $P < 0.001$]. Adjusting for the presence of at least 1 antepartum risk factor for preterm delivery, maternal racial groups, marital status, and previous cesarean delivery, LPI rates remain associated with insurance premiums, increasing by 1 per 1000 eligible women for each $10,000 annual increase in insurance premiums (Table 2).

DISCUSSION

This analysis reveals a significant relationship between obstetricians' professional liability insurance premiums and the LPI rate. Moreover, this relationship is present after

TABLE 1. Maternal Characteristics Stratified by LPI in Illinois, 1991–2003

Characteristic* (N)	LPI (21,773)	No LPI (2,098,574)
Maternal race group		
White	83.7	85.2
African American	14.5	11.3
Other	1.8	2.3
Maternal age (yrs)	26.5 ± 5.2	27.3 ± 5
Advanced maternal age	11.5	10.6
Teen pregnancy	14.0	12.0
Married	64.5	68.2
Education >12 yrs	44.3	47.2
Nulliparity	47.6	38.8
Previous cesarean delivery	4.7	11.9
Any antepartum risk factor	37.0	11.6

All comparisons are significant to the level of $P < 0.001$ except advanced maternal age ($P = 0.006$).
*All data presented as either % or mean ± SD.
LPI indicates late preterm induction.

TABLE 2. Results of the County-Level Longitudinal Multivariable Analysis of the Factors Associated With Late Preterm Induction

Variable	ß*	95% CI	*P*
Previous year's professional liability insurance premiums†	1	0.3 to 1.3	0.004
Any antepartum risk factor	28	12 to 45	0.001
Maternal white race	27	9 to 44	0.003
Other races (nonwhite/non-AA race)	101	39 to 162	0.001
Married	−42	−60 to −24	<0.001
Previous cesarean delivery	−54	−95 to −12	0.011

Analysis accounts for auto-correlation and is based on late preterm induction rates at the county level.
*Coefficients shown represent change in LPI rate per 1000 eligible women.
†Per $10,000 annual increase.
AA indicates African American.

adjusting for other demographic and medical factors that are associated with LPI. The magnitude of the association (1 LPI per 1000 women for each annual $10,000 increase in premiums) may seem, at first impression, to be small. Yet, the clinical relevance of the association becomes more apparent when considering that the LPI rate more than doubled during the study period, which translates to an increase of nearly 10 additional LPIs per 1000 women, and insurance premiums rose by approximately $50,000 during this time. Thus, approximately half of the increase (or 5 LPIs per 1000 women over the study period) in the frequency of LPI can be accounted for by the increase in insurance premiums.

This association does not imply a causal relationship, yet we believe that it is plausible that such a relationship exists. The possibility of a causal relationship rests on the concept that some types of obstetrical care, particularly those with an uncertain optimal practice, may be influenced by nonmedical factors, such as professional liability insurance premiums. Specifically, greater liability pressures may lead obstetricians to avoid the inherent uncertainties of the fetal period. We are not implying that obstetric providers practice with intent to avoid future litigation. Rather, we suggest that medico-legal pressures may raise the obstetricians' awareness of about certain potential adverse outcomes, particularly when the best practice for any given clinical situation is not well established. For example, for mild pre-eclampsia, between 34 and 37 weeks of gestation, there is a lack of agreement regarding the optimal gestational age at which expectant management should no longer be employed.[24] The neonatal adverse consequences associated with late preterm delivery are typically temporary and, clinically, relatively benign compared with less common, but potentially catastrophic obstetric outcomes that clinicians may be seeking to avoid more deliberately. In addition, although obstetricians are considerably more cognizant of adverse obstetrical outcomes, they are likely to be less familiar with common neonatal adverse outcomes associated with late preterm birth.

Although obstetric providers may not know the exact amount of their own premiums, these practitioners are likely to be sensitized to their local medico-legal climate. In the present analysis, we assume that for all obstetricians, county-level professional liability insurance premiums represent a reasonable proxy measure for the general climate of malpractice liability pressure. Indeed, studies have shown a positive relationship between malpractice concerns among physicians and cesarean delivery rates, which supports the notion that obstetricians may change their practices in response to professional liability pressures.[14,17,25,26] Also, obstetricians have reported that they have increasingly practiced more "defensive" medicine and that they steer away from and even avoid high-risk patients and procedures as professional liability pressures have increased.[15] Indeed, given the very large increases in obstetric insurance premiums that have accompanied the increase in monetary awards in birth-injury cases,[16] it seems plausible that obstetricians would be particularly vulnerable to professional liability pressure-mediated changes in practice patterns.

We chose each county as the unit of analysis because county-level professional liability insurance premiums were available and because an association between both induction and cesarean delivery rates and insurance premiums has been previously demonstrated.[17,27] We chose not to investigate the relationship between county-level insurance premiums and individual patients' outcomes of induction because it assumes that premiums are constant within each county, and this assumption is known to be false (Alan Allphin, VP Underwriting, ISMIE, personal communication). Moreover, when applying a single county-level measure to each individual provider-mother pair, the variance associated with the measure (ie, no variance between individual providers in a county) would grossly underestimate the variability of the relationship between premiums and induction. Thus, the use of county-level analyses and LPI rates were chosen because this approach represents a more valid predictive measure.

The study has several strengths. First, we used longitudinal panel regression models to demonstrate trends over time; this technique is particularly advantageous because it limits the potential that the observed association is merely a

reflection that counties may have high insurance rates as a consequence, and not a cause, of practice patterns such as LPI. The use of the previous year's insurance premiums further help to establish a temporal relationship between the associated measures, as the change in insurance premiums was present before the decision to proceed with induction. Within the regression models, we have included multiple potential confounding factors in an effort to isolate the independent association of LPI with liability premiums. Also, this association was insensitive to effects of unmeasured annual trends secondary to auto-correlation.

We have not, in these models, incorporated other obstetric (eg, antenatal steroid use) or neonatal practices that may have changed during the study period. Although such practices have likely changed during the study period and may account for the general trend of increasing LPIs, there is little reason to believe that these practices have changed differentially over both time and between the counties that were analyzed in the study. Thus, the use of the longitudinal model limits this type of confounding.

Neither these data nor the results of this study can address the role of the health care system in the change in LPI. Certainly differences in obstetrical practice may have occurred at the patient, provider, or institutional levels, and these practices may have contributed to the findings. Determining the level or manner in which factors at each of these levels may be contributing to the rise in inductions at late preterm gestations is an important topic of further exploration. Nevertheless, this study shows that both the rise in LPI and the association to rising insurance premiums has occurred.

Nonetheless, this study has some limitations. The analysis uses data from a single state and the professional liability environment in Illinois does not necessarily reflect the circumstances throughout the United States. However, as the 5th most populous state, Illinois contributes nearly 5% of the nation's annual births adding confidence that these results may be externally valid. Second, the premium data were obtained from a single insurance provider. The observed association potentially could be biased if the insurance premiums were not representative of the changes in the premiums of other insurers in Illinois or reflective of the general malpractice environment. However, the insurance company, ISMIE, from which the premium data were derived, provides insurance to the majority of obstetricians-gynecologists in Illinois. There is no evidence that obstetric practitioners who are not covered by this company are exposed to significantly different premiums.[28] Other investigators have used insurance premiums to represent the medical malpractice environment in which physicians practice.[29,30] For this study, we also chose to use premiums instead of claims or settlements because the outcomes of these claims would be unknown to the practitioner before the physician's decision to begin an LPI. Finally, given that this study is an analysis of secondary data, unknown or unmeasured factors–and even the possibility of coding errors[31,32]–may modify the reported association.

Though these results require confirmation, we present a novel explanation to account for a portion of the increase in late preterm inductions and thus, preterm births. The health consequences of preterm birth are well documented and a growing body of literature specifically addresses the sequelae of late preterm gestations.[5] Nevertheless, though delivery during the late preterm period increases adverse neonatal and infant outcomes,[10,13,33,34] and has recently been described to account for a higher risk of infant mortality,[5] the public health consequences of an increasing tendency to deliver via LPI are largely unknown. The alternative to a late preterm delivery is not necessarily continued fetal health. A continued pregnancy has risks of deteriorating fetal status or intrauterine fetal demise, and it remains uncertain if the increase in LPIs results in decreasing adverse perinatal events. Thus, the effect of the increase in LPIs on perinatal outcomes is in need of further exploration.

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