

The Relationship between Physicians' Qualifications and Experience and the Adequacy of Prenatal Care and Low Birthweight

ABSTRACT

Objectives. The purpose of this study was to examine the relationship between physicians' qualifications and experience and rates of completion of the recommended number of prenatal visits and delivery of a low-birthweight infant.

Methods. All deliveries performed by a permanently licensed physician in Massachusetts in 1990 (n = 80 537) were examined. Qualification was measured by board certification. Experience was measured by both volume of deliveries and duration of practice.

Results. Women cared for by a non-board-certified physician were less likely to receive the recommended number of prenatal visits (odds ratio [OR] = 0.67, 95% confidence interval [CI] = 0.54, 0.85) and were more likely to have a low-birthweight infant (OR = 1.20, 95% CI = 1.00, 1.42). Physicians with a smaller volume of deliveries or a shorter duration of practice were more likely to deliver a low-birthweight infant.

Conclusions. The data show an association of board certification with rates of the recommended number of prenatal visits and low birthweight. In addition, volume and duration of practice were significantly associated with low birthweight. Further research should examine whether these associations are related to differences in patient referral or to physicians' judgment and efficiency in provision of prenatal care. (*Am J Public Health.* 1995;85:1087-1091)

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Introduction

Improved prenatal care and neonatal health status have been targeted as national goals.¹ The role of physicians' qualifications and experience in mediating differences in the adequacy of prenatal care and low birthweight has not been determined.

Previous studies have demonstrated an inconsistent relationship between physicians' qualifications or experience and the quality of medical care or health outcome. Some studies have indicated that board-certified physicians provide better quality care than non-board-certified physicians^{2,3}; others have not demonstrated this relationship.⁴⁻⁶ Although previous studies have demonstrated that hospitals that perform a higher volume of surgical procedures⁷⁻¹⁰ or discharge a higher volume of patients with certain medical conditions^{11,12} have lower rates of in-hospital mortality, the relation of physicians' practice volume to quality of care and health outcomes is less clear.¹³⁻¹⁸ For example, Hannan et al.¹⁶ demonstrated an inverse association between physicians' practice volume and mortality for coronary artery bypass grafting but not for cholecystectomy. Prior perinatal studies have focused on the relationship between volume and mortality without examining any indicators of the quality of care.¹⁹ This approach neglects important and possibly remediable events in the process of prenatal care.

Prenatal care is an ideal area in which to examine the relationship of physicians' qualifications and experience with the quality of care and health outcomes. Both low birthweight and neonatal mortality have been shown to be associated with the process of prenatal care.^{20,21} In addition, low birthweight is a

more common outcome than mortality and is associated with substantial developmental sequelae in addition to mortality.²²

In this study, we examined the relationship between physicians' qualifications and experience and the recommended number of prenatal visits and low birthweight for women in Massachusetts in 1990. We examined board certification (in either obstetrics and gynecology or family practice) as a measure of physicians' qualifications. We also examined two markers of physicians' experience: the number of deliveries performed in 1990 and the length of time a physician had been licensed to practice medicine in Massachusetts.

Methods

Patient Selection and Data Sources

The Massachusetts Birth Registry was used to obtain information about all live births in Massachusetts during 1990. We included all in-hospital deliveries performed by a permanently licensed physician on a Massachusetts resident. The birth registry includes information about maternal age, race, level of education, insurance status, marital status, parity, and self-reported cigarette and alcohol use. It also contains information about the number and timing of prenatal

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TABLE 1—Description of All Deliveries Performed by a Permanently Licensed Physician, Massachusetts, 1990

	Sample (n = 80 537)
Maternal age, y, (range)	28.1 (11–50)
Maternal race, no. (%) ^a	
White	66 278 (82.4)
African American	5 826 (7.2)
Latino	5 380 (6.7)
Asian	2 792 (3.5)
Native American	133 (0.2)
Less than high school education, no. (%) ^b	12 527 (15.6)
Married, no. (%)	62 212 (77.2)
Primiparous, no. (%) ^c	35 217 (43.7)
Multiple gestation, no. (%)	2 145 (2.7)
Payer, no. (%) ^d	
Private	61 468 (77.0)
Medicaid	17 009 (21.3)
Uninsured	1 350 (1.7)
Site of prenatal care, no. (%) ^e	
Private practice	58 748 (73.3)
Hospital clinic	8 235 (10.3)
Health maintenance organization	8 668 (10.8)
Health center/other	4 525 (5.7)
Completed recommended minimum amount of prenatal visits, no. (%) ^f	74 007 (93.8)
Low-birthweight delivery, no. (%) ^g	4 376 (5.4)

^aInformation on race was missing for 128 women.

^bInformation on education was missing for 367 women.

^cInformation on parity was missing for 157 women.

^dInformation on payer was missing for 710 women.

^eInformation on site of prenatal care was missing for 361 women.

^fInformation on number of prenatal visits was missing for 1653 women.

^gInformation on birthweight was missing for 38 deliveries.

visits and the birthweight of the infant. Finally, it includes the license number of the physician who performed each delivery. We excluded births performed by nonphysicians (e.g., midwives) because we could not ascertain information about qualifications and experience. These births

constituted 6.8% of births in Massachusetts in 1990. There were 84 452 eligible births; we excluded 3148 records (3.7%) with a missing or implausible license number. Finally, we excluded 767 deliveries performed by 57 resident physicians.

Measurement of Physicians' Qualifications and Experience

Information on specialty board certification was obtained from the American Board of Medical Specialties directory of board-certified medical specialists.²³ Since only 1020 deliveries (1.3%) were performed by a board-certified family practitioner, we did not examine differences between providers certified in obstetrics and gynecology and those certified in family practice.

The total number of deliveries performed by each physician during 1990 was used as one measure of experience. Physicians were divided into terciles (i.e., low, medium, and high volume) based on the number of deliveries performed. In our data, a low-volume provider performed between 1 and 24 deliveries per year, a medium-volume provider performed between 25 and 118 deliveries per year, and a high-volume provider performed between 119 and 523 deliveries per year.

Medical license numbers are assigned sequentially in Massachusetts. Therefore, physicians with lower license numbers have been in practice longer. As a second measure of experience, physicians were divided into terciles based on license number (i.e., short, medium, and long duration of practice). In our data, physicians licensed after 1988 had been in practice for the shortest duration, and those licensed before 1979 had been in practice for the longest duration.

Outcome Measures

We examined whether a woman had completed the minimum number of prenatal visits (adjusted for length of gestation) recommended by the US Public Health Service Expert Panel on the Content of Prenatal Care.²⁴ This panel recommends that a woman have a minimum of nine visits for a term pregnancy. For the analyses of the content of prenatal care, we excluded women with missing information about the number of prenatal visits (n = 1029 [1.3%]). Similarly, women who did not initiate care until the third trimester could not fulfill the panel's recommendations, regardless of their physician's intentions; thus, they were also excluded from these analyses (n = 1653),

as were women with no prenatal care (n = 422).

Low birthweight was defined as a birthweight of less than 2500 g. Thirty-eight deliveries with missing information for birthweight were excluded from the analyses of low birthweight.

Statistical Analysis

Generalized estimating equation analyses controlling for interphysician correlations²⁵ were used to examine the relationship between physicians' qualifications and experience and the recommended number of prenatal visits and low birthweight. Adjustment was made for maternal age, parity (primiparous, multiparous), race (White, African American, Latino/other), multiple gestation, level of education (less than 12 years, more than 12 years), marital status (married, other), insurance status (uninsured, Medicaid, or private insurance, which included indemnity and prepaid plans), site of care (private practice, health maintenance organization, hospital-affiliated clinic, community health center), and patient-reported cigarette and alcohol use (present, absent). The overall model controlled simultaneously for board certification, practice volume, and duration of practice. The adjustment for correlations was important because our primary predictors were characteristics of physicians, while the database was composed of patients. If physicians are consistent in their practice patterns, then each individual patient does not truly represent an independent observation. Instead, the analysis must also estimate the degree of correlation among patients seen by the same physician and use this information to increase the apparent variability of the parameter estimates. These models, as well, controlled simultaneously for all three measures of physician experience.

Results

Study Population

Table 1 describes the study population. The 80 537 deliveries involved 20 243 (25.2%) women who reported some cigarette use during their pregnancy and 8906 (11.1%) women who reported some alcohol use. A total of 924 permanently licensed physicians performed one or more deliveries in Massachusetts during 1990. Of these physicians, 451 were board certified in obstetrics and gynecology, and 62 were board certified in family practice. The remainder were physicians beyond

residency who were not board certified. Board-certified obstetricians performed 58 587 (72.7%) of the 80 537 deliveries, and board-certified family practitioners performed 1020 (1.3%).

Relationship between Physicians' Qualifications and Experience and the Recommended Number of Prenatal Visits and Low Birthweight

After adjustment for maternal age, parity, race, multiple gestation, level of education, marital status, payer, site of care, and maternal cigarette and alcohol use, non-board-certified physicians were significantly less likely to provide the recommended number of prenatal visits and were more likely to deliver a low-birthweight infant (Table 2). Physicians' experience was also associated with low birthweight. Physicians with a shorter duration of practice or a smaller volume of deliveries were significantly more likely to deliver a low-birthweight infant, although there were no differences by physician experience in provision of the recommended number of prenatal visits.

Effects of Practice Volume and Duration of Practice

Among board-certified physicians, a lower practice volume and shorter duration of practice were both significantly associated with a higher odds ratio (OR) for low birthweight (Table 3). For these physicians, there was no association between the duration or volume of practice and the odds of completion of the recommended number of visits.

Among physicians who were not board certified, a shorter duration of practice was significantly associated with a higher odds ratio for low birthweight. There was no relationship between practice volume and the recommended number of prenatal visits or low birthweight.

Relationship between Recommended Number of Visits and Low Birthweight

Women who completed the recommended number of prenatal visits (corrected for length of gestation) were significantly less likely to have a low-birthweight infant after adjustment for age, parity, race, multiple gestation, level of education, marital status, payer, site of care, and maternal cigarette and alcohol use (OR = 0.53, 95% confidence interval [CI] = 0.45, 0.61).

TABLE 2—The Relationship between Physicians' Qualifications and Experience and the Recommended Number of Prenatal Visits and Low Birthweight

	Adjusted ^a Odds Ratio (95% Confidence Interval)	
	Recommended No. of Prenatal Visits	Low Birthweight
Board certification		
No	0.67 (0.54, 0.85)	1.20 (1.00, 1.42)
Yes	1.0 ...	1.0 ...
Duration of practice^b		
Short	0.92 (0.65, 1.30)	1.66 (1.32, 2.09)
Medium	1.15 (0.93, 1.44)	1.14 (1.01, 1.29)
Long	1.0 ...	1.0 ...
Volume of practice^c		
Low	1.31 (0.92, 1.86)	1.54 (1.10, 2.16)
Medium	1.00 (0.80, 1.25)	1.19 (0.98, 1.44)
High	1.0 ...	1.0 ...

^aAdjusted for maternal age, parity, race, multiple gestation, level of education, marital status, payer, cigarette and alcohol use, and site of care and for physicians' qualifications (board certification) and experience (volume of practice and duration of practice).

^bDuration of practice: long (licensed before 1979); medium (licensed 1979–1988); short (licensed after 1988).

^cVolume of practice: low (1–24 deliveries/year); medium (25–118 deliveries/year); high (119–523 deliveries/year).

TABLE 3—The Effects of Physicians' Practice Volume and Duration of Practice on Prenatal Visits and Birthweight, after Stratification for Board Certification

	Adjusted ^a Odds Ratio (95% Confidence Interval)	
	Recommended No. of Prenatal Visits	Low Birthweight
Board-certified physicians		
Volume of practice^b		
Low	0.84 (0.54, 1.32)	1.56 (1.04, 2.33)
Medium	1.00 (0.80, 1.25)	1.21 (1.04, 1.41)
High	1.0 ...	1.0 ...
Duration of practice^c		
Short	1.06 (0.75, 1.51)	1.33 (1.08, 1.64)
Medium	1.27 (0.97, 1.66)	1.05 (0.93, 1.19)
Long	1.0 ...	1.0 ...
Non-board-certified physicians		
Volume of practice^b		
Low	1.70 (0.99, 2.92)	1.44 (0.82, 2.52)
Medium	1.04 (0.65, 1.65)	1.09 (0.98, 1.21)
High	1.0 ...	1.0 ...
Duration of practice^c		
Short	0.73 (0.39, 1.37)	2.54 (1.63, 3.95)
Medium	0.87 (0.59, 1.29)	1.68 (1.24, 2.30)
Long	1.0 ...	1.0 ...

^aAdjusted for maternal age, parity, race, multiple gestation, level of education, marital status, payer, cigarette and alcohol use, and site of care.

^bVolume of practice: low (1–24 deliveries/year); medium (25–118 deliveries/year); high (119–523 deliveries/year).

^cDuration of practice: long (licensed before 1979); medium (licensed 1979–1988); short (licensed after 1988).

Discussion

Our study suggests that physicians' qualifications and experience, as measured by board certification, time in practice, or practice volume, are associated with the quality of prenatal care and birth outcomes. Specifically, women whose deliveries are performed by a non-board-certified physician are less likely to complete the recommended number of prenatal visits and more likely to have a low-birthweight infant. Physicians with a smaller practice volume or who have been in practice for a shorter duration are also more likely to deliver a low-birthweight infant. Among board-certified physicians, a smaller practice volume or shorter duration of practice was significantly associated with higher rates of low birthweight. Among noncertified physicians, practice volume was not associated with either the recommended number of prenatal visits or low birthweight.

These findings have implications for health policies directed at improving the quality of prenatal care and birth outcomes. This work suggests that if prenatal care is provided by more qualified or experienced physicians, birth outcomes might improve. Board certification and volume and duration of practice are crude markers for physicians' qualifications and experience. Further research should examine the specific skills and judgments associated with better quality care and outcomes.

We examined a crude measure of the content of prenatal care. Unfortunately, our data did not contain detailed clinical information about the actual prenatal services provided (i.e., screening for diabetes, use of ultrasound). Our measure was based on national recommendations for the content of prenatal care. Physician behavior may be reflected by this indicator. More experienced physicians may have the judgment to provide prenatal care more efficiently. They may provide more systematic care that enables women to enter prenatal care earlier, or they may offer more structured follow-up (e.g., of women who miss an appointment or have an antenatal problem). Since the point at which a woman initiates care may have more to do with her own health beliefs and behaviors than the practices of her physician, we excluded women who did not initiate care until the third trimester. The observed relationship between physicians' qualifications and experience and the adequacy of prenatal care was independent of site of care, which may be an

important determinant of when a woman initiates care as well as the continuity of the care that she receives.

Our findings differ from those of a prior study that examined the relationship between physicians' practice volume and perinatal mortality in Missouri and did not demonstrate an association.¹⁹ This prior study excluded deliveries performed at all hospitals with a Level III nursery to avoid bias associated with the transport of women in labor with premature infants. We did not exclude these births because we believed that most high-risk pregnancies are identified antenatally and, therefore, the physician performing the delivery may have participated in the prenatal care. Although the Missouri sample was large, neonatal mortality is a very rare outcome. We chose to examine low birthweight because it is a more common occurrence and has substantial developmental sequelae beyond mortality.²² Finally, the Missouri study did not examine other measures of physicians' qualifications or experience.

Our findings may also be due, however, to self-selection. Prior work suggests that patients may choose "better quality" hospitals²⁶; they may also select "better" physicians. Patients who are motivated to receive early and continuous prenatal care may choose established board-certified physicians with large practices. Our findings may also be due to referral bias. Older physicians may refer high-risk patients to younger colleagues with subspecialty training. This is an unlikely explanation of our findings, however, since these subspecialists would be more likely to be board certified.

Our study has several limitations. Since we measured time in practice in Massachusetts, we may have underestimated duration of practice for physicians who initially practiced outside of the state. Birth certificates record the license number only of the physician who performed the delivery, and this physician may not have provided the majority of a woman's prenatal care. This lack of continuity may be more problematic in teaching hospitals, health maintenance organizations, and large group practices. Although our analyses controlled for site of care, our findings may have been biased. We did not examine the relationship between experience and birth outcomes for nonphysician providers. These providers perform a relatively small proportion of deliveries in Massachusetts. We could not control for the type of specialty training, since few deliveries were performed by board-

certified family practitioners. Finally, since this was an observational study, we cannot assume a causal relationship between these markers of physicians' qualifications and experience and outcome.

In conclusion, our study suggests that physicians' qualifications and experience are associated with the content of prenatal care and birth outcomes. Further research will be required to determine the extent to which the observed association is due to differences in patient self-referral or to physicians' judgment and efficiency in provision of prenatal care. □

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