The influence of hospitals, providers, and patients in birth outcomes following induction of labor

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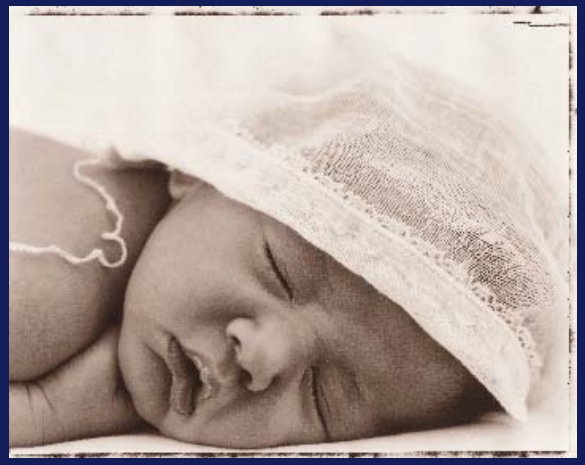
Introduction

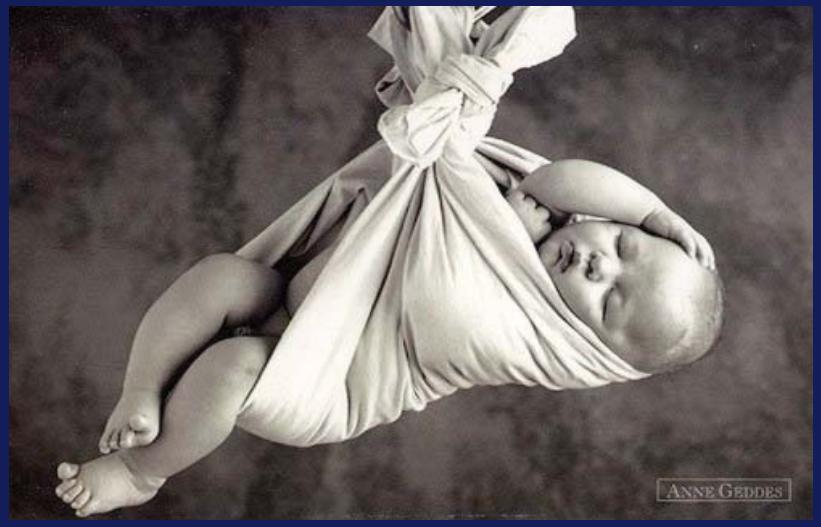


- Optimizing birth outcomes a national priority
- Need to evaluate influences on patient care outcomes (IOM, 1999)
- Cesarean rates now 30.2%

  (Hamilton et al., 2006)
- Long term impact on reproductive health (Allen et al., 2005; Liu et al, 2007)

Introduction

- Increase in labor induction may be influencing rise in cesarean births (Dublin et al., 2000; Seyb et al., 1999)
- Optimal labor management strategies unknown



Purpose

To determine how much variation in birth outcomes (using birth certificate records and information from provider licensing surveys) due to differences in:

- Hospital organizational characteristics
- Provider characteristics
- Patient socio-demographic characteristics

Background

Maternal Characteristics

- Known maternal influences on newborn morbidity and mortality (i.e., ethnicity, SES, PNV, age)

- Arizona's childbearing population unique
  - ✓ MA women with highest fertility rates
  - ✓ 21 Native American tribes: 82% reside in cities
  - ✓ Second-fasting growing state

(ADHS, 2005)

Provider / Hospital Characteristics

- Strongest predictors of physician decisions:
  * Gender
  * Length of time in practice
  * Where medical training obtained (Landon et al., 2001)

- Hospital - major determinant of delivery mode
- High volume services and teaching models with anesthesiology and OB specialists (MFM) associated with lower cesarean rates (Clark et al., 1998; Halm et al., 2002

Research Questions

- What hospital characteristics influence birth outcomes?
- What provider characteristics influence birth outcomes?
- What maternal characteristics influence birth outcomes?
- What are the synergistic effects and significant relationships among hospitals, providers, and clients on birth outcomes?

Hospital characteristics

- Ownership
- Teaching status
- Arizona Perinatal Trust (APT) certification
- Size

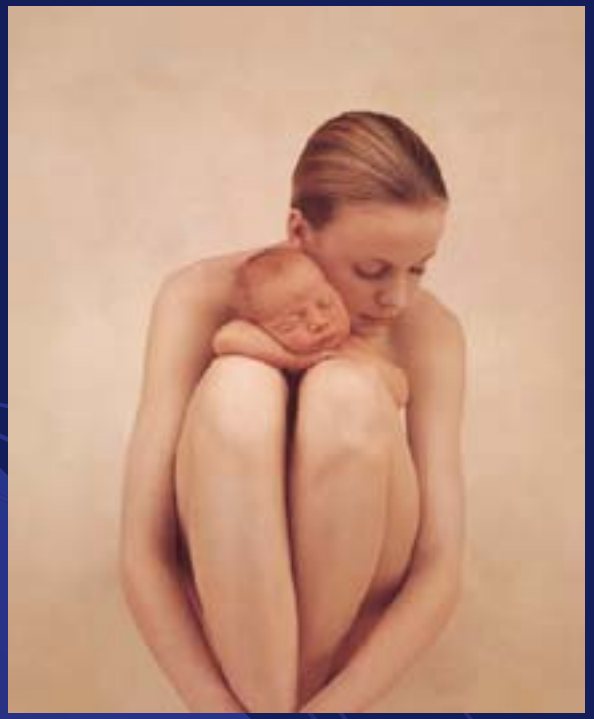
Provider characteristics

- Gender
- Type
- Years of practice
- Foreign or domestic medical training

Maternal characteristics

- Race / ethnicity
- SES (insurance as proxy)
- Maternal education
- Maternal age
- Number of prenatal visits

Outcome variables



MATERNAL:

- Prolonged labor
- Use of forceps
- Use of vacuum extractors
- Indication and outcome of delivery (medical versus elective)
- Mode of delivery

Outcome variables

NEWBORN:

- Apgar score at 1 minute
- Apgar score at 5 minutes
- ‘NICU’
  - NICU admission
  - Newborn transfer

1. Design, Setting, and Sample

- Descriptive cross-sectional secondary analysis using Arizona HealthQuery (AZHQ) dataset
  - Permission obtained from ADHS to utilize birth certificates
  - Physician Licensing Workforce Study
- Final sample size: 62,816 births in single AZ county in 2005

2. Abstracting the Data

- Data abstracted by two researchers with extensive experience with AZHQ
  - Unique patient and provider identifiers matched
- Partitioned the variation in outcomes to patients, providers, and hospitals

Independent variables	Intervening variables	Dependent variables	Risk indicators
Method of Payment	Month PNC*	Apgar: 1 min.*	Post dates
Zip Code*	# of prenatal visits*	Apgar: 5 min.*	Fetal demise
Maternal Education	Tobacco use	Birth weight*	Diabetes
Ethnicity	Alcohol use	Gestational estimate*	Abruptio placenta
Maternal Age*	Mother married	Vaginal delivery	Hypertension, chronic
Induction of Labor	Sex of the newborn	Primary cesarean section	Hypertension, pregnancy
Stimulation of labor	# of children living	Infant transferred	Lung disease
Date / time of del*		NICU Admission	Maternal cardiac disease
Dr last name/first name		Meconium aspiration	Other medical risks
Facility code		Plurality	Premature ROM
Facility type		Forceps	
No medical risk		Vacuum	
Sex of the newborn	* indicated numeric variables		

Results

1. Influence of Hospital Characteristics

- Considerable variability among hospitals beyond size or ownership
- 20% of births coded as labor induction
- Births at the county-owned hospital
  - more likely to be admitted to the NICU
  - lower Apgar scores at 1 and 5 minutes

- At federally-owned hospital, more likely to have:
  - Forceps used
  - Prolonged labor
  - Medically-indicated inductions
  - Less likely to have NICU admission / newborn transfer
  - Higher cesarean rates for NA women

- Teaching hospitals less likely to perform elective inductions than non-teaching hospitals; also less likely to perform a cesarean in first time moms
- For-profit hospitals less likely to have medically-indicated inductions than non-for-profit. Also less likely to have NICU admissions
- Larger hospitals more likely to have NICU admissions and lower Apgar scores

Q2. Influence of Provider Characteristics

- Sample = 59,337; 98% physician match
  - MD (87.4%)
  - DO (12.6%)
  - CNM (unknown)
- Physicians
  - Mostly male (65%)
  - 92% received medical training in US

- Experienced physicians more likely to use forceps
- Male physicians more likely to use vacuums

Q3. Influences of Patient Characteristics

- Women with elective inductions were :
  - Younger
  - Better educated
  - Non-Hispanic White
- Women with medically-indicated inductions:
  - Older
  - Native American
  - More prenatal visits
- SES was not a significant predictor of outcomes

Q4. Synergistic Effects

- Cesarean births positively correlated with:
  - Medical inductions
  - Number of prenatal visits
- Cesarean births inversely related to:
  - Women aged 19-39
  - Hispanic women

Q4. Synergistic Effects

- Forceps use :
  - Number of prenatal visits
  - Physician experience
- Vacuum use:
  - Elective induction
  - Women ≤18 years
  - Number of prenatal visits
  - Births by male physicians

Q4. Synergistic Effects

- Elective Inductions:
  - Increased likelihood of prolonged labor
  - Less likely to require NICU admission
  - Higher Apgar scores at 1 and 5 minutes than spontaneous labor or medically-indicated induction
  - Less likely in teaching hospitals
  - Positively related to maternal education and younger age

Q4. Synergistic Effects

Summary of Newborn outcomes

- NICU admissions more likely:
  - Larger hospitals
  - Being Black or NA
  - Medical inductions
- Lower Apgar scores:
  - Medical inductions
  - Mothers under 18
  - Being Black / non-Hispanic White

Implications

- Patient advocacy and education
- Clinical outcomes
- Financial implications for hospitals and healthcare delivery systems
- Evidence-based information for childbearing couple
- Optimal birthing models

Limitations

- Risks with large administrative datasets
- Variability in data collection
- Unable to abstract provider beyond MD or DO
- Insurance as proxy for SES
- Exclusion of possible significant variables

Future Studies

- Large administrative datasets are crucial for answering the large clinical questions (Perrin & Mitchell, 1997)
- Unique opportunity to examine specific systems or ethnic groups
- AZHQ allows us the opportunity to link significant patient outcomes with hospital and provider characteristics

Questions / Discussion