

## Pregnancy, Work, and Stress



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## Background



- Increase in women's employment → parallel increase in pregnant workers
  - More working, more working longer into preg. (under age 44 having child while working has increased by >40% since 1960)
- Increased participation in traditionally men's jobs

## Background

Overall, pregnancy outcomes better in working than non-working mothers

- Benefits (financial stability, insurance)
- Social support and structure
- ? Healthy worker effect
- ? Work a marker for higher SES, other positive attributes

## Background

- Occupational hazards in pregnancy difficult to ascertain and quantify
  - Limited data on reproductive outcomes: primarily animal toxicology extrapolated to humans
  - Exposure limits are usually tailored to health effects in nonpregnant workers
  - Maternal and fetal physiology differ in significant ways that may increase toxicity

## Background

Within working populations, however, there are discrepancies in outcomes

Savitz (1996):

- Increased risk for all adverse outcomes in textile workers (1.5)
- PTD and stillbirth in janitors (2.0)
- Some increased risks in food service workers, electrical equip. operators
- Reduced risks in teachers and librarians

Potential sources of work effects on pregnancy outcomes:

- Toxic exposures
- Physical demands of workplace
- Psychosocial demands and stressors

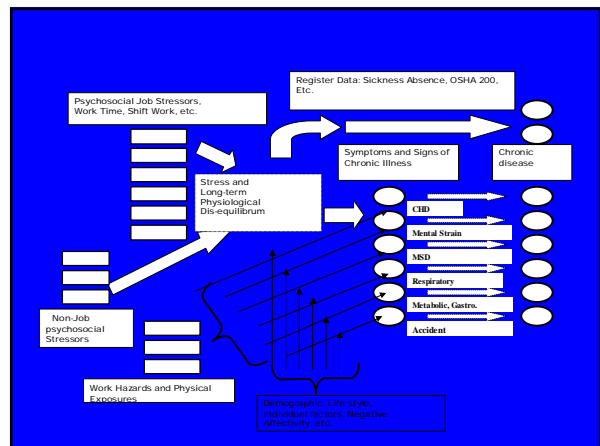
## Physical Demands

Mozurkewich (2000) summarized physical demands and pregnancy outcomes in large meta-analysis:

- Physically demanding work (aggregate): OR 1.22 for preterm delivery (PTD)
  - Prolonged standing: 1.26
  - Shift/night work: 1.24
  - High cumulative work fatigue: 1.63
- No association with long work hours

## Stress

- Of increasing interest: work and pregnancy as two subsets of overall stress research
- Conceptualization of 'stress' difficult:
  - external events (objective),
  - personal responses (subjective)
  - ? physiologic pathways through which operates
  - other psychosocial factors (anxiety, depression)
  - buffers (social support)
  - enhancers (adverse economic conditions)



## Stress & Pregnancy

- Mechanisms?
  - Stress → release of hormones/neuroendocrine mediators → altered uterine blood flow, increased contractility → LBW, SGA, HTN
  - Stress → altered immune regulation → infections/inflammation → adverse outcomes
  - Stress → poor health behaviors → adverse outcomes

## Occupational Stress

- 1970's -1980's as concern with work organization and relation to chronic disease came to fore
- Adverse physical conditions of work (noise, lifting, noxious exposures) may be decreasing while psychological demands increasing:
  - Decrease in manufacturing, transition to service economy, automation/computerization, better controls on hazards and physical conditions

## Occupational Stress

Karasek: *Demand-Control Model*

Examined organization of work in two axes:

1. **Psychological Job Demands:**
2. **Decision Latitude (Control)**
  - Skill utilization
  - Authority over decisions w/r/t work tasks

## Psychological Job Demands:

- Excessive work
- Conflicting demands
- Insufficient time
- Need to work fast
- Work hard

## Decision Latitude (Control)

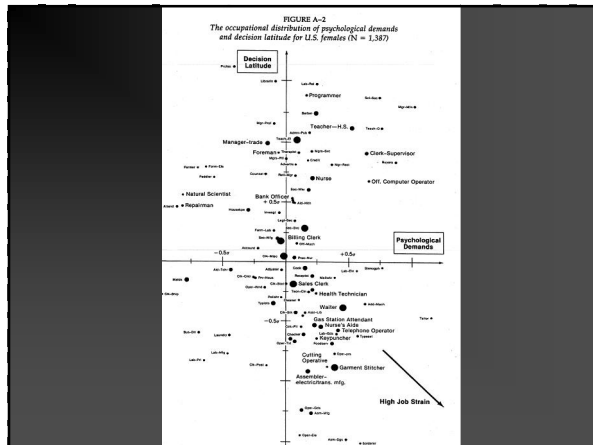
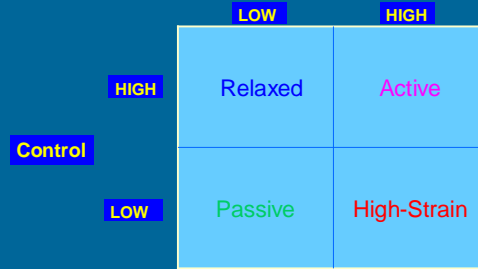
### Skill Discretion

- Learn new things
- Repetitive work
- Requires creativity
- High skill level
- Variety
- Develop own abilities

### Decision Authority

- Freedom to make decisions
- Choose how work gets performed
- Lot of say on the job

## Psychological Demands



## Av. Systolic and Diastolic Ambulatory BP\* at Work by Job Strain (n=264 males)

		Psychological Job Demands	
		Low	High
Job Decision Latitude	High	129 / 83 (n=56) <b>Low Strain</b>	132 / 83 (n=60) <b>Active</b>
	Low	129 / 82 (n=93) <b>Passive</b>	137 / 85 (n=55) <b>High Strain</b>

\* controlling for age, body mass, race, Type A behavior, education, 24-hour sodium, smoking, alcohol use, and work site  
Source: Schnall et al. (1992), *Hypertension*, 19:488-94.

## 3-Year Change in Mean WORK Ambulatory Systolic Blood Pressure

	Time 1 (baseline)	Time 2 (3 years)	Change in BP (mm Hg)
Yes		Yes (n=15)	-0.3
		No (n=25)	-4.7 (p=.04)
No		Yes (n=17)	+2.9
		No (n=137)	+0.2

(controlling for change in body mass and baseline 24-hour urinary sodium)

Work Site BP Study

## Demand-Control Model & Pregnancy

- Homer (1990): Applied D-C scores to youth labor survey and pregnancy outcomes
  - Crude risk of 2.0 for PTD/LBW in High Demand/Low Control job
  - Reduced to 1.3 when adjusted for physical exertion

## Demand-Control Model & Pregnancy

- Brandt & Nielsen (1992): Denmark
  - Retrospective questionnaire study: (2.5-4.5 yrs postpartum)
  - Elevated risk (1.46) for term LBW in high-strain job
  - No elevated risk when used imputed scores from job-exposure matrix (rather than survey answers) – suggested recall bias

## Demand-Control Model & Pregnancy

- Brett (1997): Retrospective case-control study in large pregnant population
  - OR for PTD 1.3 overall (NS)
  - Increased in subgroups w/ signif. ORs:
    - Full-time work
    - Black women
    - Work after 30<sup>th</sup> week of pregnancy

## Objectives

### Primary Objectives:

- Using a large birth dataset, evaluate risk for LBW/SGA and PTD by occupation
- Evaluate the risk in work that presents a combination of increased psychosocial stressors and physical demands

### Secondary Objectives:

- Evaluation of the utility of coding occupational information in CT birth certificate registry
- Assess the validity of imputing indices of job strain to occupational information in a public health dataset

## Procedures

1. Coding of occupation/industry data from CT Birth Certificate Registry for Y 2000
2. Application of indices that reflect physical and psychosocial demands of work to dataset
3. Validation:
  1. occ information on birth cert.
  2. imputed indices of job strain
4. Analysis: Risk for LBW, SGA, PTD

## 1. Coding

- CT Birth Registry dataset for 2000
  - Mother's work collected for years, never analyzed
  - ~40,000 live births: 70%+ have occup noted
  - Gestational age, birth weight
- NIOSH coding software: industry & occ coded to 2000 census
  - Demonstrable utility in death certificate coding; not been used in birth data
- Additional risk and demographic information collected:
  - age, race & ethnicity, parity, education level, tobacco, ETOH, initiation of prenatal care

## 2. Application of stress/strain indices

- Data from Karasek and colleagues: large-scale US workforce surveys
- Demand, control, physical exertion scores derived for occupations: Occupational mean score on job characteristics and strain.
  - Psychological workload (Demand)
  - Control over work/decision latitude
  - Physical exertion

### 3. Validation

- Survey of current births (4-6 weeks postpartum)
  - Occupation same as on birth certificate?
  - Shortened version of JCQ: physical/psychosocial demands

### 4. Analysis

#### Tabulations

- Jobs, occupational groupings, industries at risk

#### Regression analysis

- Outcome variables: PTD and LBW
- Occupation (high psychosocial/physical demands)
- Other variables as noted earlier

Occupation	Industry
CONSULTANT	CONSULTANT
DIR. PARTNERSHIP SVCS	IMPROVENET.COM
SOCIAL WORKER	MEDIPLEX OF STAMFORD
MOTHER	N/A
REGISTERED NURSE	NORWALK HOSPITAL
HUMAN RESOURCE DIR.	-
MRKTG & PROMOTING PRES	LILY-PAD INC
HOMEMAKER	N/A
VETERINARY ASSISTANT	BROAD RIVER ANIMAL HOSPIT
NAIL TECHNICIAN	LAMPHER DAY SPA
CASHIER	THE WIZ
DIRECTOR OF SALES	PENGUIN PUTNAM PUBLISHING
HOTEL MANAGER	HYATT CORPORATION
MED. SECRETARY	NEW CANAAN MED. GROUP
PARALEGAL	WOFSEY, ROSEN, KWESKIN & KU
FINANCIAL ADVISOR, DIR	SECURITIES
FINANCE	UNIMIN CORP.
HOUSEWIFE	N/A
TEACHER	GRAY FARMS NURSERY SCHOOL
COORDINATOR	PURDUE PHARMACEUTICAL
STUDENT	N/A
CONTROLLER	EDGAR ONLINE, INC

### CT Birth Dataset: 2000

- 43,075 live births
- 42,212 mothers
- 26,768 with an occupation noted (63.4%)

#### In addition:

- 7388 Homemaker/housewife/SAHM
- 1078 Student
- 964 Unemployed/None
- 6014 (14.3%) unknown (includes 'unknown,' blank or not completed)

### Birth statistics

Mean BW (singleton pregnancies): 3376 g

	BW	N	SEM	
Working:	3392 g	26,414	3.6	
Non-working	3346 g	14,830	4.9	p<0.001 vs Work
Home	3428 g			
Student	3269			
Unemp/None	3336			
Unknown	3258			

Mean birth weight:  
Single pregnancies by occupational group; N>100

Occ Minor Group	Mean (g)	Dev from Mean	N
Postsecondary teachers	3545	+154	133
Sales reps, wholesale & manufacturing	3508	117	196
Art and design workers	3488	97	335
Other teachers and instructors	3472	81	183
Advertising, marketing, promotions, public relations, & sales	3466	75	424
<b>MEAN (working)</b>	<b>3391</b>	<b>0</b>	<b>26,414</b>
Food & beverage serving workers	3307	-84	640
Other sales and related workers	3290	-101	177
Materials moving workers	3272	-119	104
Assemblers and fabricators	3272	-119	207
Retail sales workers	3270	-121	1438

### Low Birth Weight cases (<2500 g)

Single pregnancies by occupational group; N ≥10

Occupation	N	Rate /1000 deliveries
Other food prep and serving related workers	13	144
Material recording/distributing workers	28	83
Personal appearance workers	43	83
Retail sales workers	114	79
Food & beverage serving workers	50	78
Nursing & home health aides	86	77
<b>Overall</b>	<b>1441</b>	<b>55</b>

### Odds of low birth weight by occupational group

Occupation	Adjusted OR*	95% CI
Other food prep and serving workers	2.54	1.30 – 4.97
Personal appearance workers	1.63	1.13 – 2.35
Nursing & home health aides	1.42	1.06 – 1.89
Retail sales workers	1.42	1.08 – 1.86

LBW: <2500 g  
Office/Administrative workers as referent group

\* Adjusted for maternal age, race, smoking, initiation of prenatal care (trimester), parity, educational level

### Preterm delivery cases (<37 weeks gest)

Single pregnancies by occupational group; N ≥10

Occupation	N	Rate /1000 deliveries
Other food prep and serving related workers	13	144
Textile and apparel workers	10	131
Supervisors of food prep and serving related workers	21	120
Assemblers & fabricators	23	114
Nursing & home health aides	124	112
Retail sales workers	156	110
<b>Overall</b>	<b>2195</b>	<b>84</b>

### Risk of low birth weight by job strain (Demand-Control axes)

Demand / Control Quadrant		Non-LBW	LBW	OR
		Relaxed (Ref.)	5440	269
	Passive	6751	436	1.31
	Active	6759	315	0.94
	High-Strain	6011	421	1.42

Bivariate OR for LBW in High-strain job: **1.29 (1.13 – 1.47)**

Adj for maternal age, education, smoking, race, trimester prenatal care started, physical demands: **1.09 (0.95 – 1.25)**

### Risk of premature delivery by job strain (Demand-Control axes)

Demand / Control Quadrant		OR
		Relaxed (Ref.)
	Passive	1.21
	Active	0.93
	High-Strain	1.36

Bivariate OR for prematurity in high-strain job: **1.30 (1.13 – 1.47)**

Adj for maternal age, education, smoking, race, trimester prenatal care started, physical demands: **1.17 (1.04 – 1.32)**

### LBW and prematurity by Control

	ALL LBW			Premature Birth		
	Crude OR	Adjusted OR *	95% CI	Crude OR	Adjusted OR *	95% CI
<b>High Control</b>	Ref.	-	-	Ref.	-	-
<b>Intermediate Control</b>	1.14	1.07	0.92 – 1.25	1.22	1.18	1.04 – 1.33
<b>Low Control</b>	1.60	1.27	1.09 – 1.49	1.45	1.27	1.11 – 1.44

## Conclusions

- Occupational data in birth registries represents a potentially useful source for evaluation of reproductive hazards
- Risk for low birth weight, prematurity suggested in some service-sector jobs:
  - ↑ Risk in retail, personal service, and food service - persist when adjusted for other maternal risk factors
  - These jobs not previously described as at-risk for poor pregnancy outcomes
- Significant risk for adverse outcomes in low control job
  - Persists when adjusted for maternal factors and physical demands of job

THE ROANOKE TIMES  
Monday, September 20, 2004



STEPHANIE KLEIN-DAVIS 1 The Roanoke Times  
Mellisa Williamson, 35, a Bullitt Avenue resident, worries about the effect on her unborn child from the sound of jackhammers.

## Challenges

- Extent of misclassification in dataset not well known
- Not possible to ascertain from dataset when worked/ quit in pregnancy
- Limited covariates / confounders/ effect modifiers in dataset
  - though known risks (eg smoking) were in right magnitude/direction
- "Drift" in parameters of D-C model?
  - Changes in nature of job / job duties
  - Changes in larger economy: IT jobs vs manufacturing
- Is "job" a marker for SES or a bunch of other deleterious exposures?

## Future work

- **Improvement in data**
  - Both reporting and coding arms of data collection & analysis
- **Newer, more detailed descriptors of job tasks**
  - Interactions – Job may entail both physical and psychosocial hazards
- **Pilot longitudinal studies**
  - Possibility of a critical period
  - ? Subsets of workers who have different stress trajectories, or can't modify the job
- **Effort-Reward Imbalance model**
  - Newer construct of work stress – may reflect economic climate differently than the D-C model

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