Shift work and pregnancy outcomes

Bonzini Matteo MD MPH
University of Insubria,
Varese, Italy

Toronto, April 12th, 2010

About shift work

- Today, in Europe and North America, about 1/5 of workers are employed in shift work.
- The traditional three shifts start at 6.00 am, 12.00 pm and 10.00 pm
- Many variations in speed of rotation and direction of rotation

Towards the "24-hour society"

- Increasing need for 24-h services and emergency coverage
- Technical need for maintaining continuous process industries
- Globalization of business
- Increased demand for services has extended 24h work from "factory based" workers to "white collar" occupations

Working women

- Women represents a substantial and increasing proportion of the workforce: 40% of the total (1.1 billions)
- The number of women that keep on working late during pregnancy is increasing worldwide
- Pregnant women must be considered subjects temporarily hyper-susceptible to a large number of occupational risks, including shift work

Biological plausibility

- Hormonal disturbances as effect of sleep deprivation or circadian rhythm disruption, may interfere with reproductive function
- Increased stress from the conflicts created by night shift and family life may affect placental exchanges and pregnancy course

Resulting in baby growth retardation, prematurity, spontaneous abortion and sub-fertility.

Legislative context

- In many countries legislation (e.g. EU Dir 85/1992) requires employers to assess health and safety risks for pregnant women and to minimize them
- Specific laws usually give pregnant women the legal right to be assigned to other tasks or to withdraw from working condition dangerous for themselves or for the fetus (e.g. Health and Work Security Act, Gov of Quebec)
- Legal condition about shift working women varies across countries

Search strategy

Systematic review of the epidemiological evidence in MEDLINE database (1966-Feb 2010) about the association between

shift work exposure during pregnancy

and risk of:

- preterm delivery (PTD)
- low birthweight (LBW)
- Small for Gestational Age (SGA)
- Gestational hypertension and pre-eclampsia

Outcomes definition

Preterm delivery: "the birth of a living fetus before 37 weeks of gestation" (WHO definition)

LBW: baby weight at birth <2500 g

SGA: baby weight under the 10th percentile of the normal gender specific weight distribution

Gestational hypertension: elevation of blood pressure after 20th week, resolving after gestation, sometimes complicated by proteinuria or edema (pre-eclampsia)

High clinical relevance:

- Health endpoints are the main responsible for peri-natal morbidity and mortality or with maternal risk (pre-eclampsia)
- LBW is related to chronic illnesses in adult life (diabetes, hypertension, CV diseases)

Quality assessment 1

Completeness of reporting

Graded on a 9-point scale according to clear definition of:

1. Study design
2. Sampling procedures
3. Inclusion and exclusion criteria
4. Main characteristics of the study population
5. Sample size and response rate
6. Method of exposure assessment
7. Method of outcome assessment
8. Method of statistical analysis
9. Measure of association and CI reported

Quality assessment 2

Potential for significant confounding

When a relevant risk factor is not properly addressed:

1. associated with large RR (>=1.5)
2. prevalent in the working population
3. differently distributed according to occupational exposures

Potential for overestimating bias

Possible overestimation of the RR because of recall-bias:

1. Self-reported exposure collected retrospectively
2. Clearly adverse outcome (i.e. pre-eclampsia or preterm delivery)

Meta-analysis

For studies with similar definition of exposure time window and outcomes

- Random effect model assuming heterogeneity of effects
- Sensitivity analysis excluding poor quality studies
- Exploring possible publication bias using funnel plots

Results- overview

- 17 studies investigating PTD and shift work (3 published after 2005)
- 9 studies about SGA risk (4 after 2005)
- 7 concerning LBW (only 1 after 2005)
- Only 3 studies (1 after 2005) about pre-eclampsia

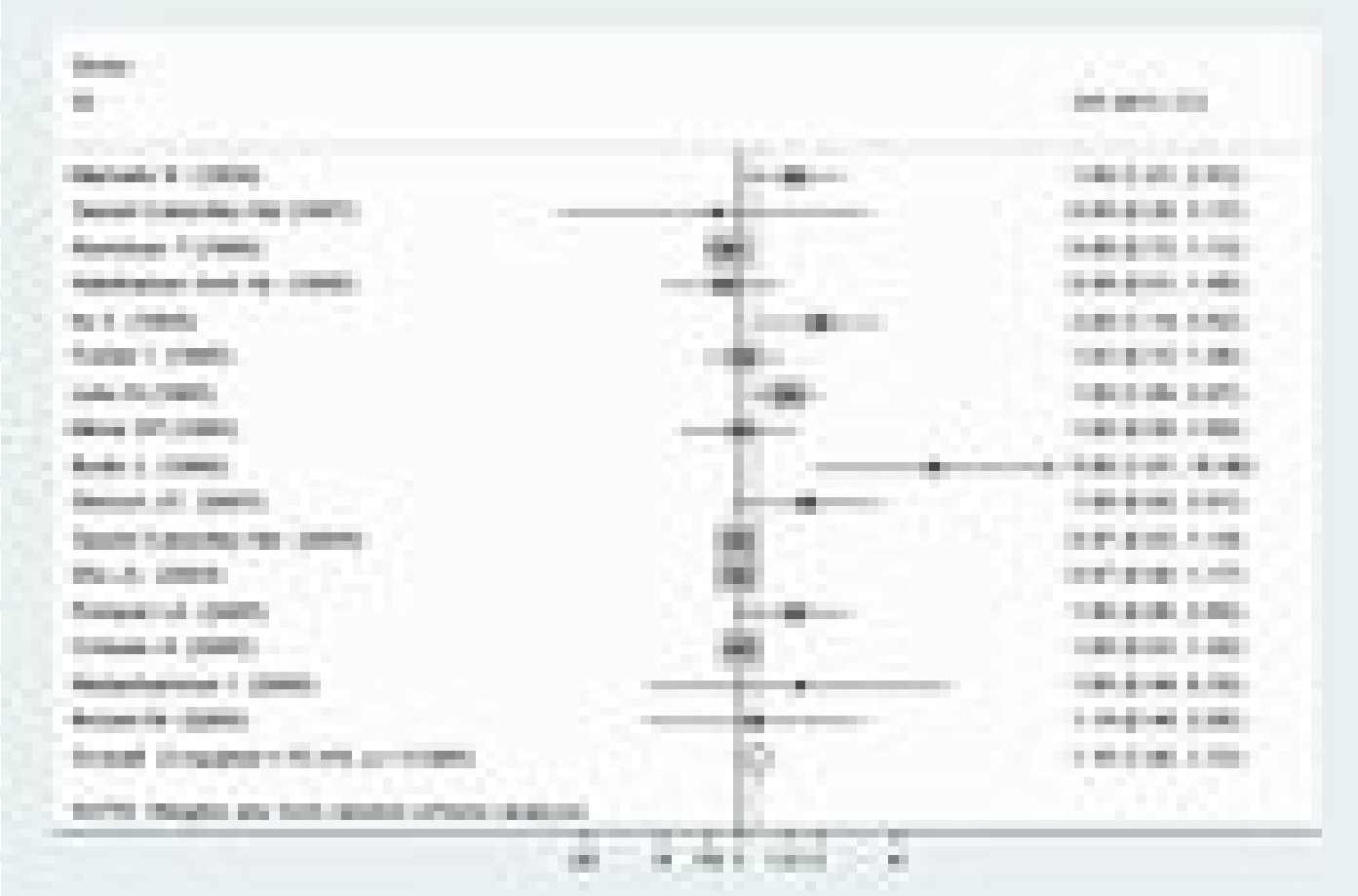
Results – general considerations

- Sample size largely varies across studies (from 500 to >35,000)
- The proportion of pregnant women exposed to shift work is overall declining
- Exposure assessment was collected before delivery only in 8 prospective cohort studies
- Type of shift work considered varies across studies and is often not clearly specified

Results- Preterm delivery

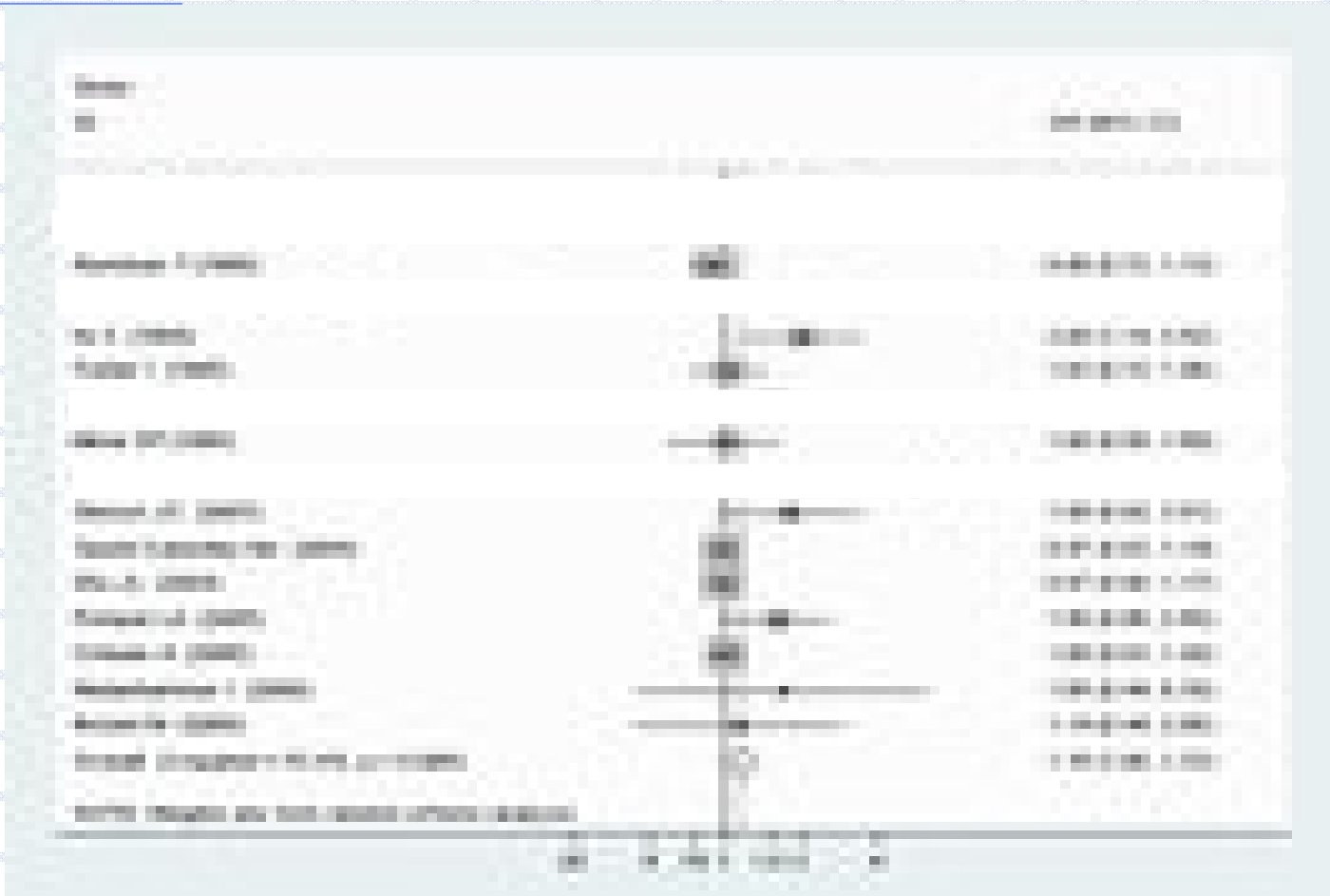
- Sufficient number of studies (17), 7 of them prospective
- Most studies (and all -1 cohort) reported OR>1.00
- Only two studies with OR >2.00
- Pooled risk estimates: 1.158 (95%CI= 1.01-1.42, test for heterogeneity p=0.006).
- Positive studies tend to be smaller

Results- Preterm delivery



Risk estimates (16 st.)=1.158 (95%CI= 1.01-1.42)

Sensitivity analysis

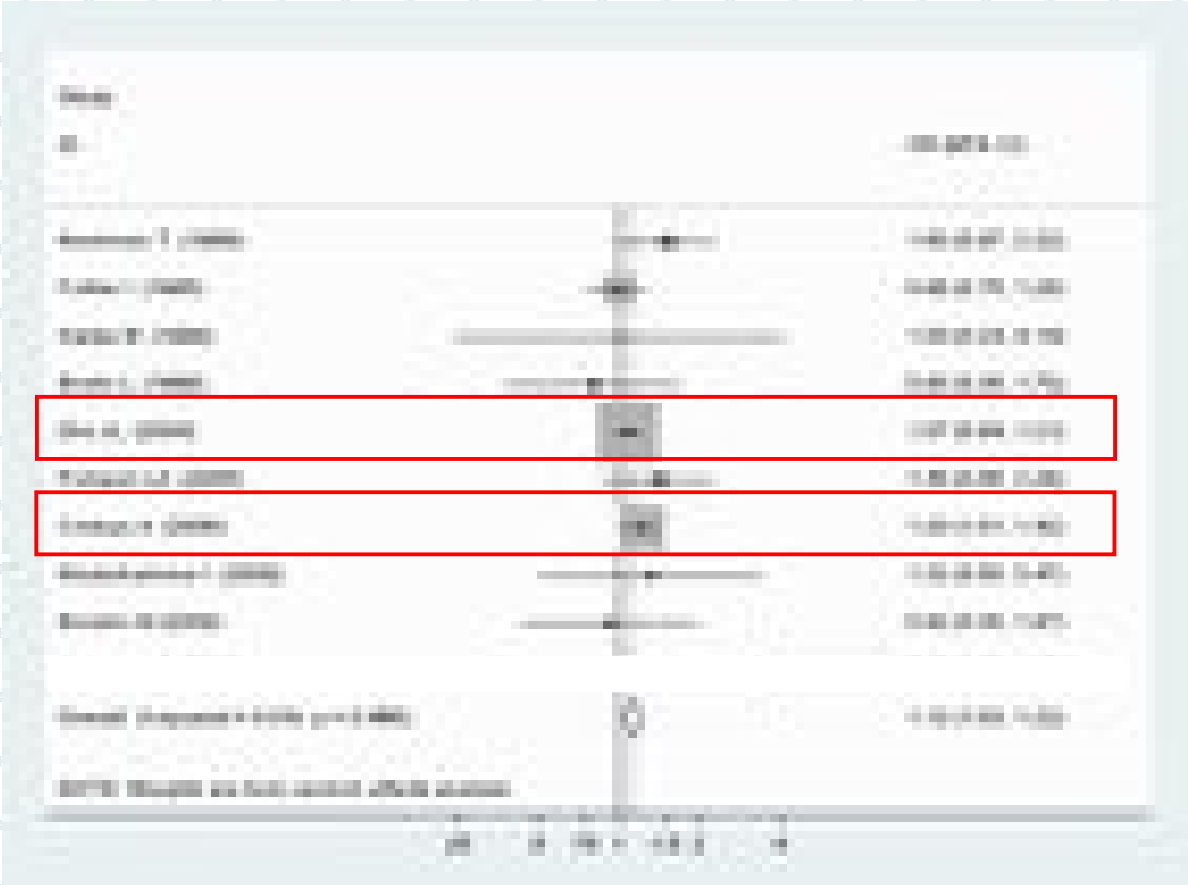


Risk estimate (11 st.)=1.03 (95%CI=0.93-1.14)

Results- SGA

- 10 studies, 5 of them prospective
- Results are more homogeneous and tend to indicate only a moderate but significant adverse effect
- Pooled risk estimates: 1.112 (95%CI= 1.025-1.224, test for heterogeneity p=0.338).
- Only one study with poor quality. Abeysena et al in Sry Lanka investigated women exposed to shift work and other occupational hazards (not defined!)
- No clear evidence of publication bias

Results-SGA



Risk estimate (10 st.)=1.112 (95%CI=1.025-1.224)

Risk estimate (9 st.)=1.104 (95%CI=1.002-1.204)

Results- LBW

- Only 7 studies, 3 of them prospective
- Same trend as for SGA suggesting a moderate adverse effect
- Pooled risk estimates= 1.27 (95%CI=0.93-1.74).
- Only one study with poor quality did not adjust for smoking, social class, maternal height and pre-pregnancy weight (Saurell-Cubizzoles); its exclusion did not change results
- No clear evidence of publication bias

Results- pre-eclampsia

- Only 3 studies, none prospective
- Too few to draw any definitive conclusion or to perform formal meta-analysis
- None of the studies showed a statistically significant increase of risk

Discussion

- Epidemiological evidence suggests a moderate adverse effect on baby growth associated with work shift exposure
- For preterm delivery we retrieved more studies but less high quality and there is some evidence of publication bias
- Studies usually did not distinguish among different types of shift work, so no hint of which one could be more detrimental (rotating, night…)

Discussion: comparison with previous meta-analysis

Mozurkewich et al. 2000 and Bonzini M et al 2007

- Concordant results regarding low birthweight
- The effect on PTD progressively tends to decrease:
  - Mozurkewich 2000 (6 studies) pRR=1.24
  - Bonzini 2007 (13 studies) pRR=1.20
  - Bonzini 2010 (16 studies) pRR=1.15
  - Bonzini 2010 high qual. only (11 st.) pRR=1.03
- Probably related to progressive extension of maternal leave during late pregnancy (not so relevant for effects on baby growth)

The importance of maternal leave

- The case control study by Croteau and coll. in Quebec showed that shift work are associated with adverse effect in women whose work condition did not changed during pregnancy
- We observed the same trend in Southampton (UK) for shift work exposure and for other occupational hazards
- Saurel-Cubizzoles et al. compared different European countries: increased PTD risk where maternal leave was not legally guaranteed

tant methodological issue: the "healthy pregnant woman effect"

Shift work, which women may suspect to be detrimental for their pregnancy, could be voluntarily suspended when there is a protective legislative context (becoming more an more common worldwide)

If healthier women without pregnant complications or previous history of adverse outcomes tend to maintain shift work condition

Important underestimation of risk among exposed women (because of self selection)!

Other adverse outcomes

- Some evidence about spontaneous abortion (among hospital workers) [Axelsson 1996; Whelan 2007]
- Shift work increases prevalence of pelvic pain and related sickness absence [Juhl 2005]
- Shift work is associated with lower job satisfaction and higher frequency and duration of sick leaves [Kristensen 2008; Meyer 2007]

Conclusions

Despite the methodological limitations that make our review still not conclusive and despite the evidence that a more than moderate effect could be ruled out:

- Women expectations
- Observed effect on absenteeism, baby growth and perceived stress
- Increasing adverse effects when exposure continue during pregnancy

It would be saf er to advise women against unf ixed work schedules during pregnancy and to always allow to change to daytime work

Thanks