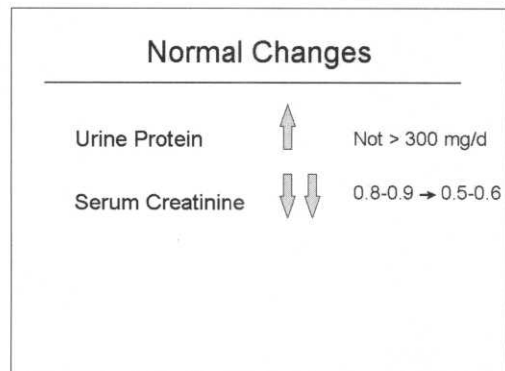
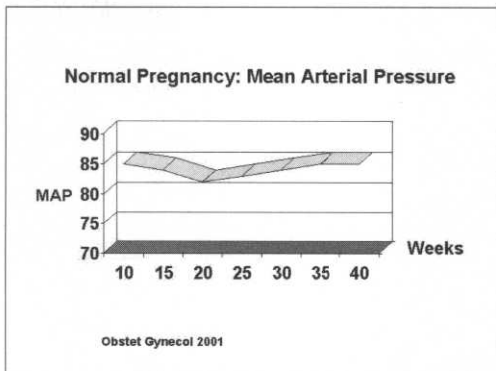
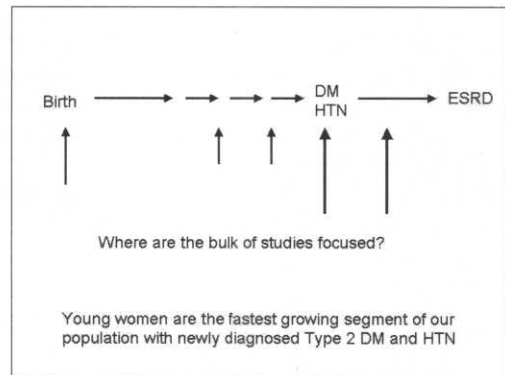
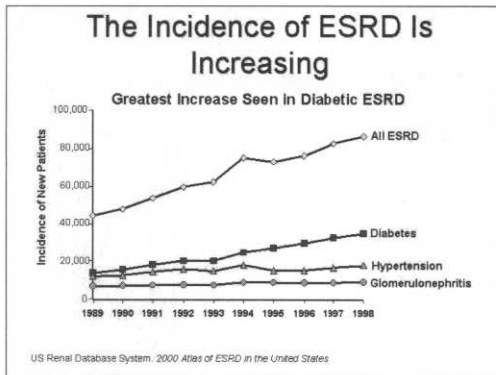


# Hypertension During and after Pregnancy

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- ### Hypertensive Disorders of Pregnancy
1. Chronic Hypertension
  2. Chronic Hypertension with Preeclampsia
  3. Transient Hypertension of Pregnancy
  4. Preeclampsia

### Maternal Mortality

Horon and Cheng reviewed 247 maternal deaths in Maryland from 1993-1998 (JAMA, March 2001)

Cause of Death	Percentage
Homicide	20.2%
Cardiovascular disorders	19.4%
Embolism	8.5%
Accidents	7.3%
Hemorrhage	6.9%
Hypertensive disorders	6.5%

### Transient Hypertension of Pregnancy (THP)

- BP > 140/90 after the 20th week of pregnancy

Risk factors

- Nulliparous status
- Elevated body mass index
- Increasing age
- Family history of hypertension

### Preeclampsia

- Elevation of BP as with THP

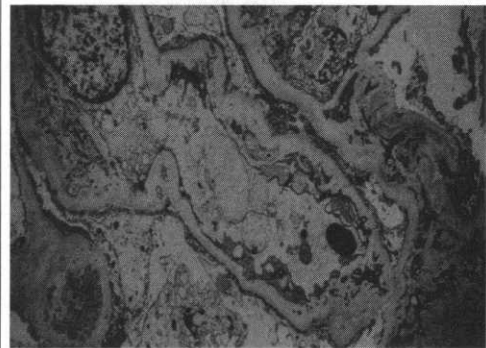
- Proteinuria:  $\geq 2+$  or  $> 300\text{mg}/24\text{ hrs}$

- HELLP Syndrome:

- Microangiopathic hemolytic anemia
- LDH  $> 600\text{ U/L}$
- SGOT/SGPT  $> 70\text{ U/L}$
- PLT  $< 100,000/\text{mm}^3$

### Preeclampsia - End-organ damage

Brain	Hemorrhage (petechial)
Liver	Hemorrhage and necrosis
Adrenal	Hemorrhage and necrosis
Heart	Subendocardial necrosis
Kidney	Glomeruloendotheliosis

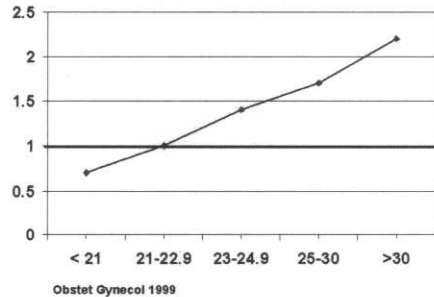


### Risk Factors for- Preeclampsia

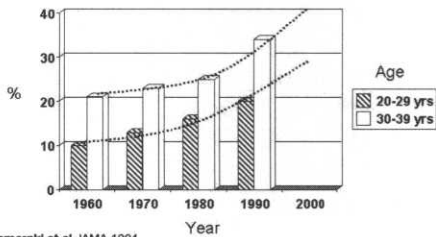
Nulliparous status  
Increasing body mass index  
Increasing age

Twin pregnancy  
History of preeclampsia  
African American race ?  
Chronic hypertension  
In-vitro fertilization

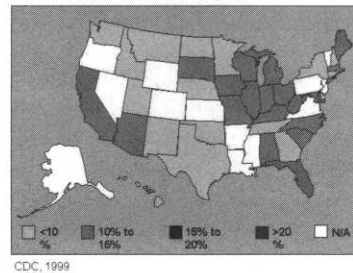
### Risk of HDP According to Pre-Pregnancy BMI

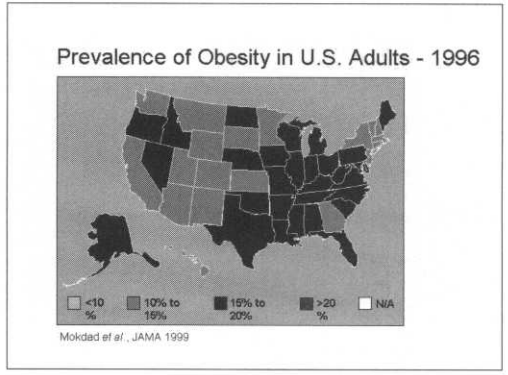
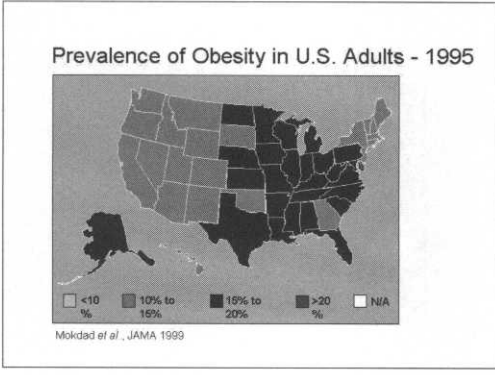
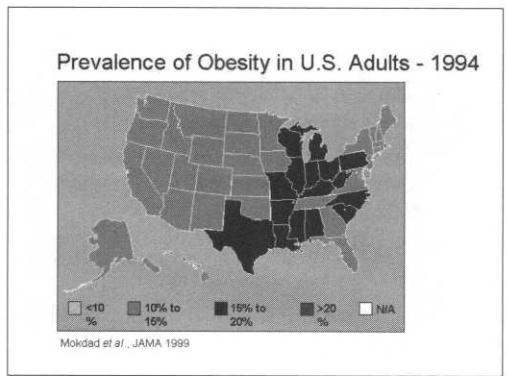
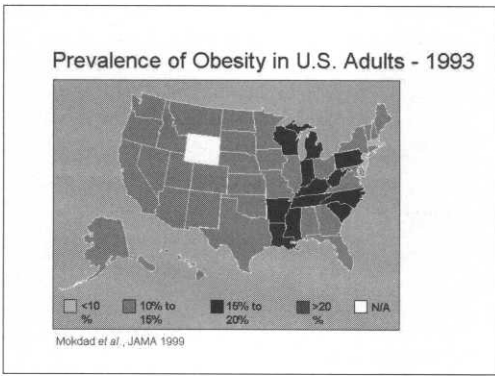
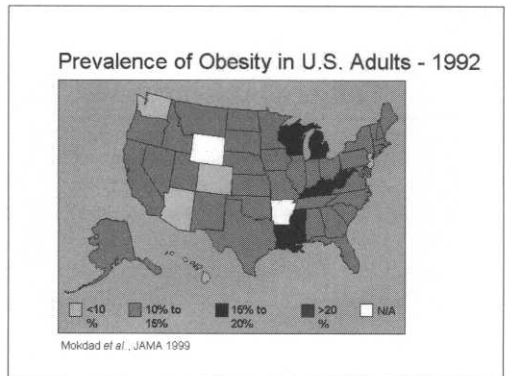
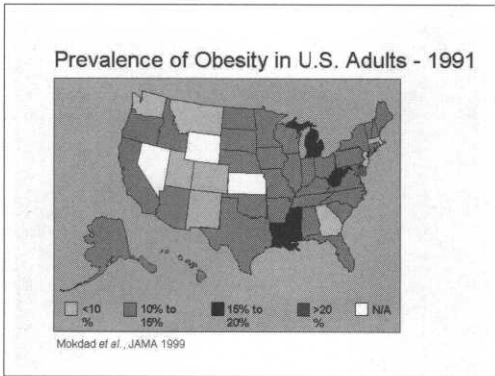
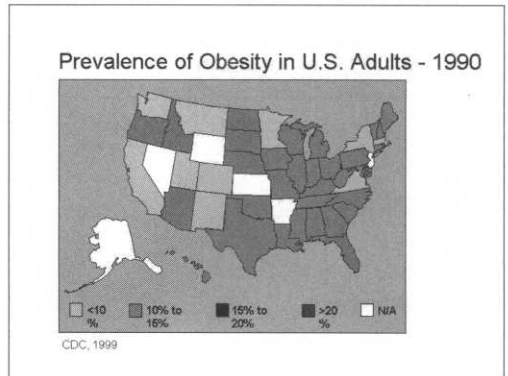
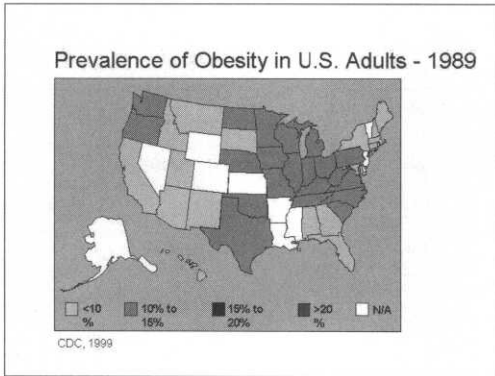


### Prevalence of Overweight Women in the US

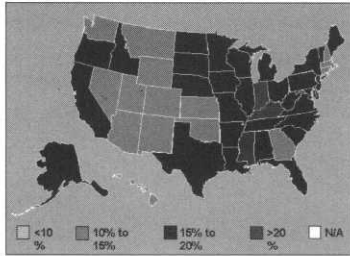


### Prevalence of Obesity in U.S. Adults - 1988



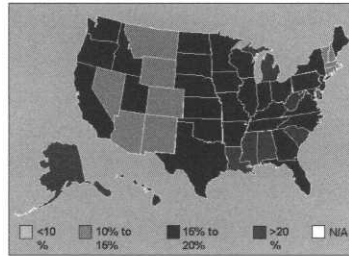


**Prevalence of Obesity in U.S. Adults - 1997**



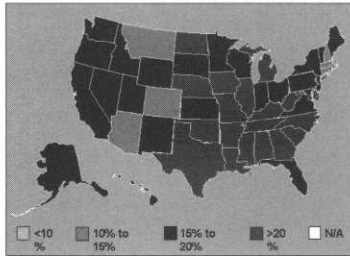
Mokdad et al., JAMA 1999

**Prevalence of Obesity in U.S. Adults - 1998**



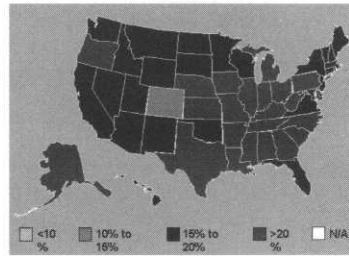
Mokdad et al., JAMA 1999

**Prevalence of Obesity in U.S. Adults - 1999**



Mokdad et al., JAMA 2001

**Prevalence of Obesity in U.S. Adults - 2000**



Mokdad et al., JAMA 2001

**Hypertensive disorders of pregnancy - A precursor disorder?**

Risk of Chronic Hypertension in women with a history of HDP

	THP	PE	NL
Nisell et al BJOG 1995	37%	20%	2%

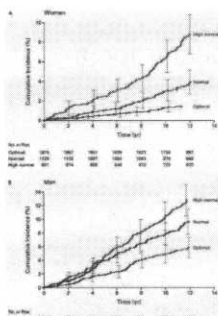
Incidence of HTN in women in US ≈ 6%  
Arch Int Med 2002

**Hypertensive disorders of pregnancy - A precursor disorder?**

Risk of AMI among current OC users (WHO, Lancet 1997)

Case-control study (368 cases, 942 controls) of women living in Asia, Africa, Europe, and Latin America

Characteristic	OR
All women	5.0
HTN in pregnancy	10.0



Risk of Coronary Artery Events Among different Categories of Blood Pressure

- 130-139/85-89
- 120-129/80-84
- <120/80

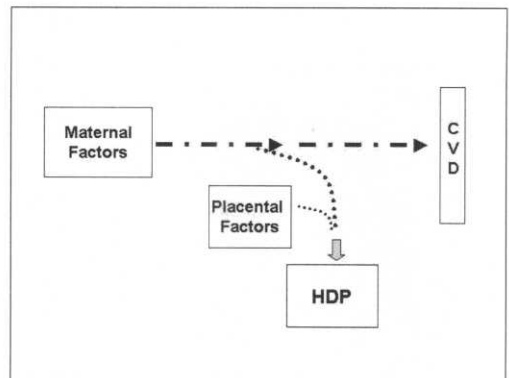
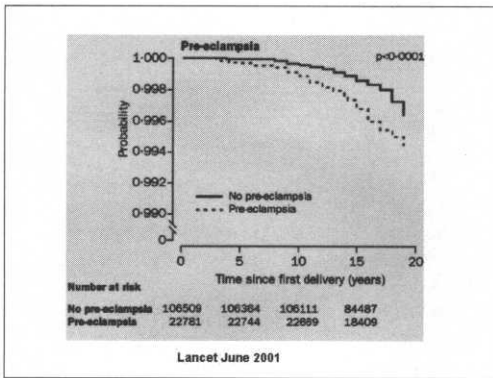
Vasan et al NEJM 2002 345.1291

**Hypertensive disorders of pregnancy - A precursor disorder?**

6 Weeks Post- Partum

	NL	GH	PE
SBP	110	120	117
DBP	71	82	79
MAP	85	93	91

Obstet Gynecol 2001



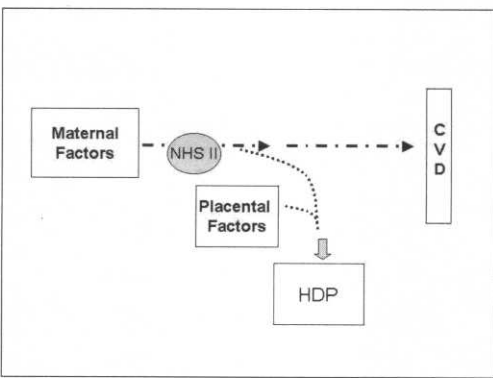
### Maternal Factors

Diabetes  
Hypertension  
Obesity  
Collagen Vascular Diseases

14% of all cases of preeclampsia

### Lipids

- Plasma lipids increased before and during preeclampsia
- Foam cells in the walls of placental vessels
- Increased levels of lipid peroxidation products
- Elevated cholesterol is associated with high endothelin
- Lipids directly toxic to endothelial cells



### Nurses' Health Study II

- > 116,000 US female registered nurses followed since 1989
- aged 26-46 in 1991
- all women who gave birth between 1991-1995
- all responded to the 1993 and/or 1995
- Exposures obtained before pregnancy

### Nurses' Health Study II

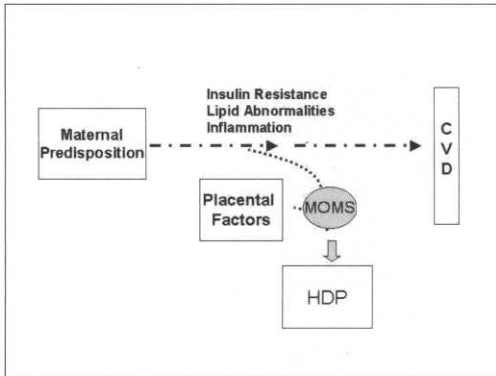
Baseline Characteristic	Non-cases n=14,980	THP n=216	Preeclampsia n=86
Age (yr)	33	32	33
BMI	23	25	24
History of Elevated Cholesterol	10%	11%	22%
Nulliparity	23%	64%	75%

### Lipids in Preeclampsia

Risk of Preeclampsia According to History of Elevated Cholesterol

	No	Yes
THP (95% CI)	1.0 (ref)	1.1 (0.7 - 1.7)
Preeclampsia (95% CI)	1.0 (ref)	<b>2.0</b> (1.2 - 3.3)

Obstet Gynecol 1999



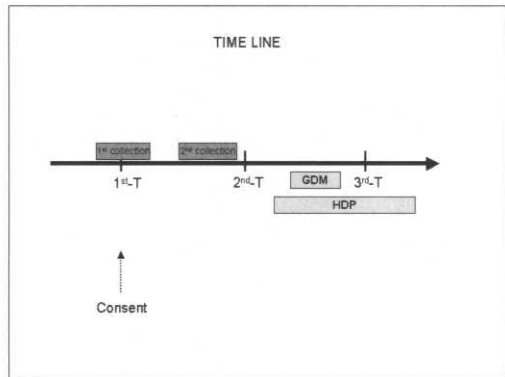
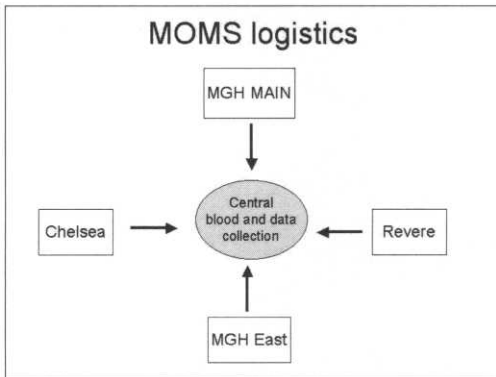
### Cross-sectional studies

Small cross sectional studies showed ASA was protective

ASA reduces thromboxane, alters the ratio of prostacyclin/thromboxane (vasodilators/vasoconstrictors)

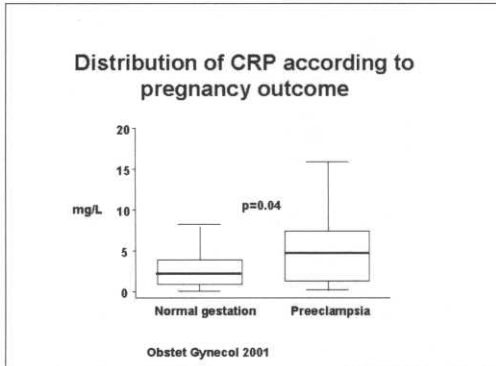
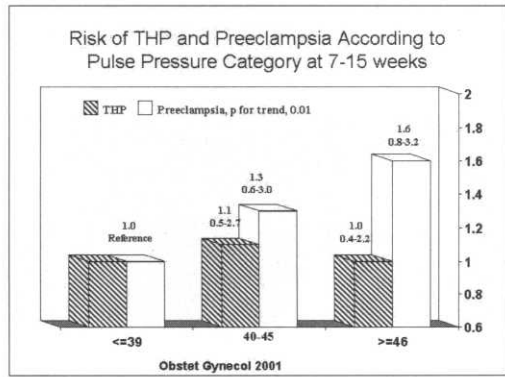
Large clinical trials did not show ASA to be of general benefit

Prospective study found that reduction in prostacyclin and not an increase in thromboxane was present in affected women



### Pulse Pressure and Risk of Preeclampsia

- Pulse pressure is a measure of arterial compliance
- Is early pregnancy pulse pressure associated with risk for developing preeclampsia?

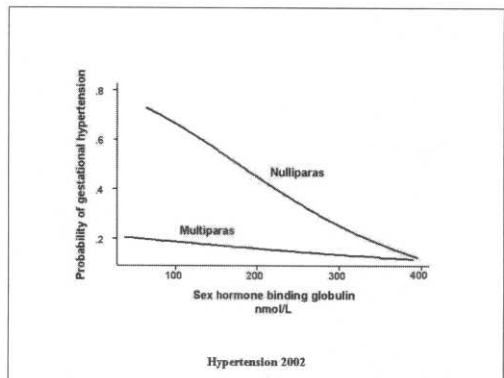
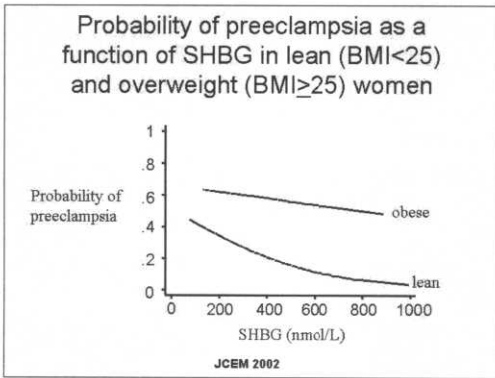


### Pregnancy and Diabetes

11 women with type 1 DM and Diabetic Nephropathy (Purdy et al Diabetes Care 1996)

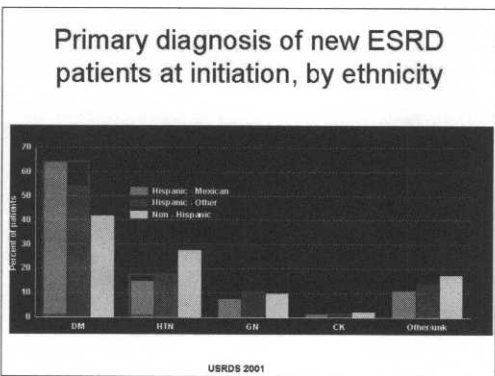
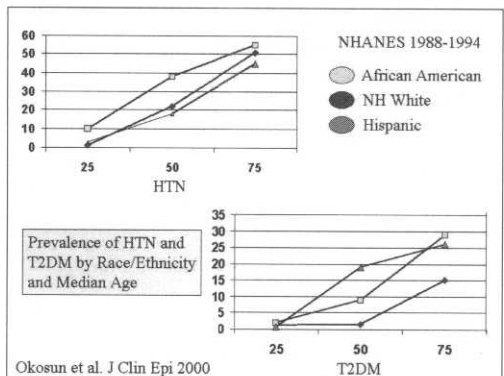
Initial pregnancy creatinine (μmol/l)	159 ± 62 (124-362)
Initial pregnancy creatinine clearance (ml/s)	0.68 ± 0.22 (0.32-1.12)
Initial 24-h urine protein (g/24 h)	2.4 ± 2.4 (0.2-8)
Number in nephrotic range	2 (18.2)
Final pregnancy creatinine (μmol/l)	221 ± 80 (133-371)
Final pregnancy creatinine clearance (ml/min)	0.53 ± 0.22 (0.25-1.12)
Final 24-h urine protein (g/24 h)	5.6 ± 3.9 (0.8-14.4)
Number in nephrotic range	8 (73)
Worsening proteinuria	9 (82)
Number progressing to dialysis	7 (63.6)
Months from parturition to dialysis	26 ± 16.4 (6-57)
UTI in pregnancy	5 (45.4)
Recurrent UTIs in pregnancy	4 (36.4)
Exacerbation of hypertension in pregnancy	8 (72.7)
Preeclampsia/eclampsia	5-10% vs 3 (27.3)

Data are n (%) or mean ± SD (range). All data refer to the 11 index pregnancies. Creatinines are given in μmol/l, conversion factor from SI units to mg/dl is 0.0113.



### Different Incidence of Gestational Hypertension By Ethnicity

Demographic Characteristics	Hispanic n=30	Caucasian n=60
<b>First Trimester</b>		
Age (yrs)	26.8 ± 5.3	31.6 ± 4.7
Gestational age of serum tests (wks)	10.8 ± 2.4	10.6 ± 1.5
Body mass index (kg/m <sup>2</sup> )	25.4 ± 5.9	23.4 ± 3.5
Mean Systolic Blood pressure (mmHg)	105 ± 12	112 ± 12
<b>Third Trimester</b>		
Incidence of Gestational Hypertension	4%	18%
Incidence of Preeclampsia	3.5%	4%



### Protein Arrays

- Low volume
- Simultaneous processing of many proteins

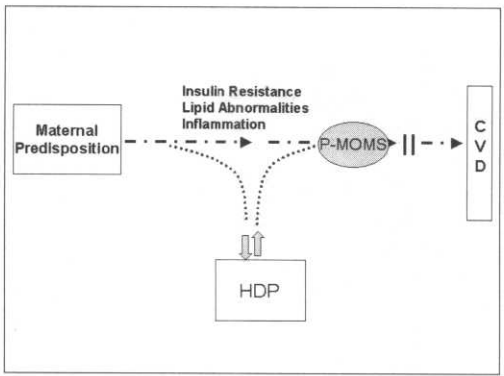
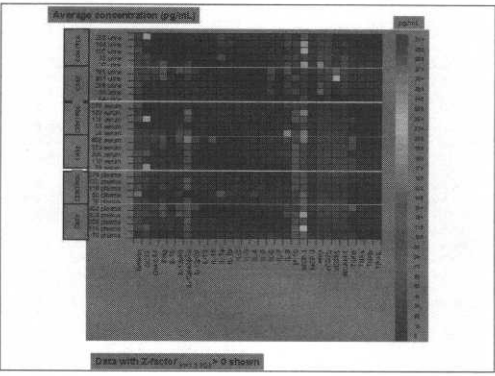
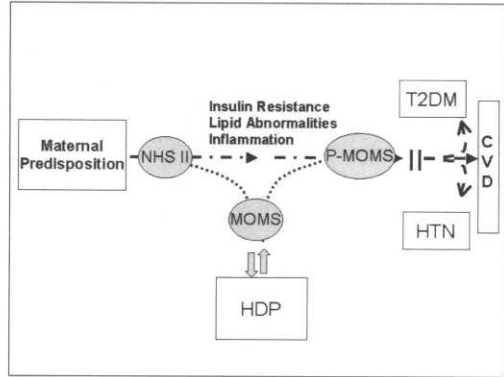


Table 1: Postpartum Characteristics		
	Cases	Controls
Age (yrs)	29.5	34
BMI (kg/m <sup>2</sup> )	29.2	21.8
Waist-hip ratio	.86	.78
SBP (mm-Hg)	106	101
Cholesterol (mg/dL)	201	150
HDL (mg/dL)	53	71
LDL (mg/dL)	126	110
Triglycerides (mg/dL)	110	50
Uric acid (mg/dL)	4.7	3.7
Urine albumin-creatinine ratio (mg/g)	9.0	2.0
Fasting glucose (mg/dL)	92	81
Fasting insulin (μU/mL)	16.4	11.5
HOMA <sub>IR</sub>	3.5	2.3
Insulin area under the curve (μU/mL·2h)	137.6	58.5



### MOMS Investigative Team

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