

Association between maternal stage 1 hypertension defined by ACC-AHA diagnostic criteria with neurodevelopment of infants

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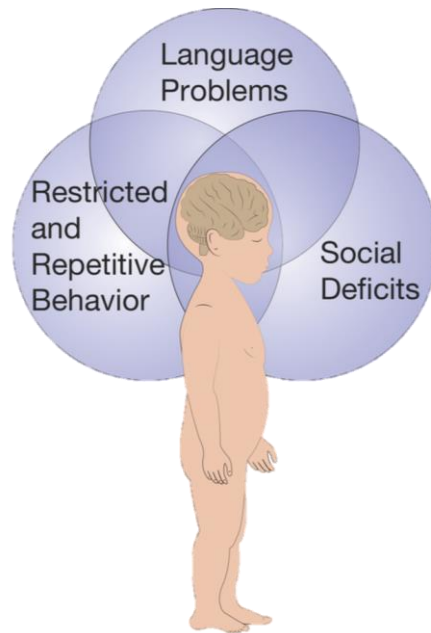
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Background

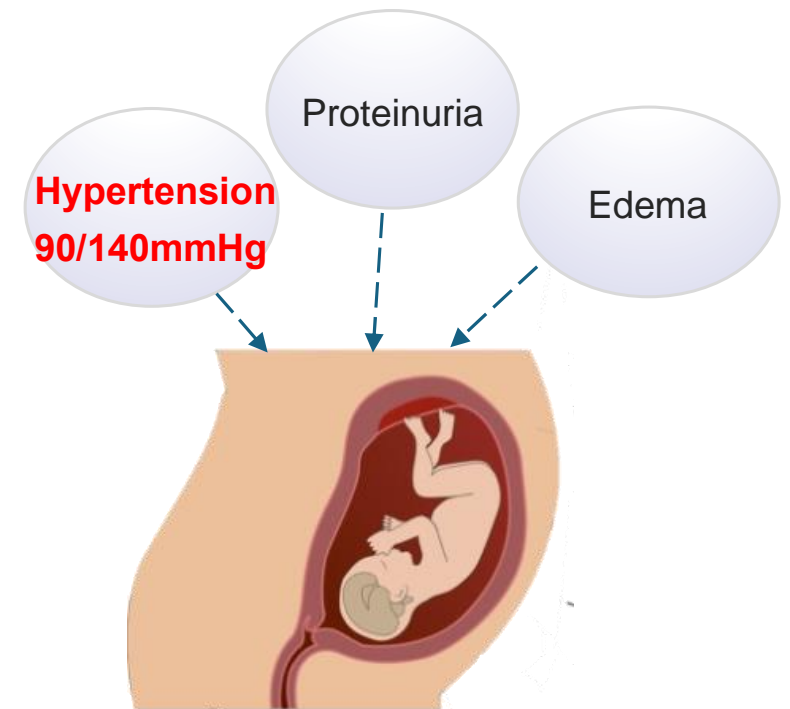
- The neurodevelopment is one of the most important aspects of children health.
- Notably, during the past decades, the prevalence of neurodevelopmental disorders (NDDs) have risen significantly



Neurodevelopmental disorders

BMJ. 2023
Trends Neurosci. 2020
JAMA Pediatr. 2015
JAMA Psychiatry. 2020

- Maternal hypertensive disorders of pregnancy (HDP) and children neurodevelopment



Maternal HDP

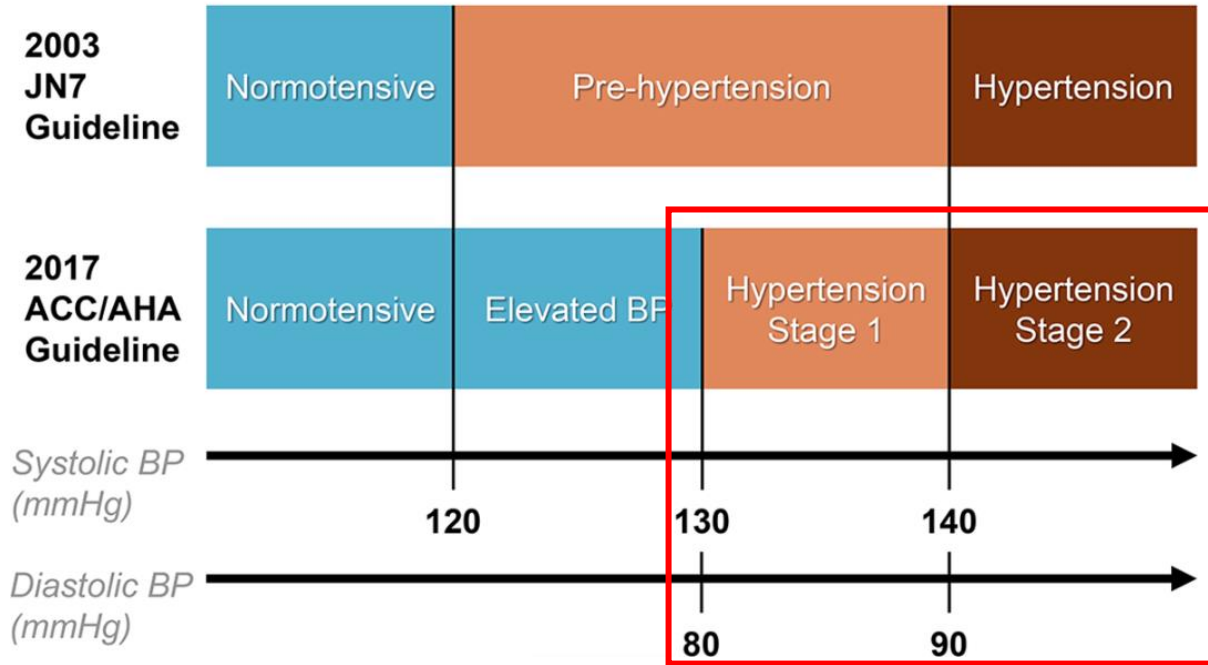
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Background

- Hypertension



□ Recommending a lower threshold of 130/80 mmHg for hypertension in nonpregnant adults.

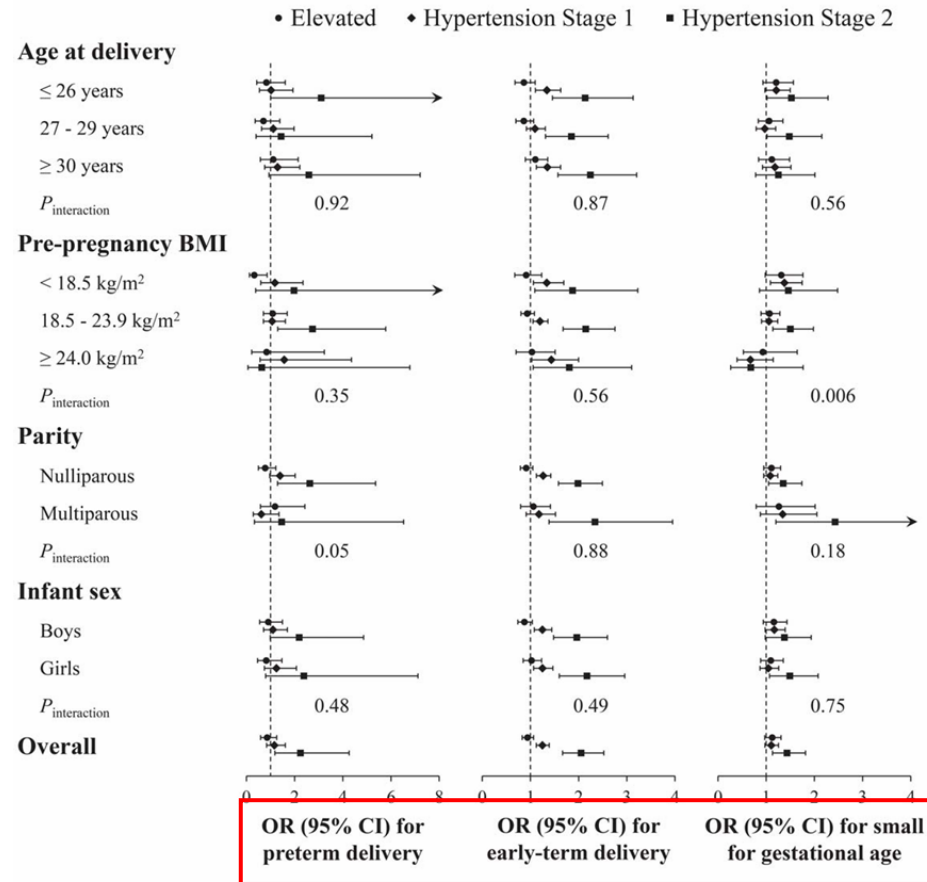
J Am Coll Cardiol. 2018

✓ It is crucial to investigate whether the adoption of the 2017 ACC/AHA guideline applies to gestational hypertension and its impact on maternal and neonatal risk.



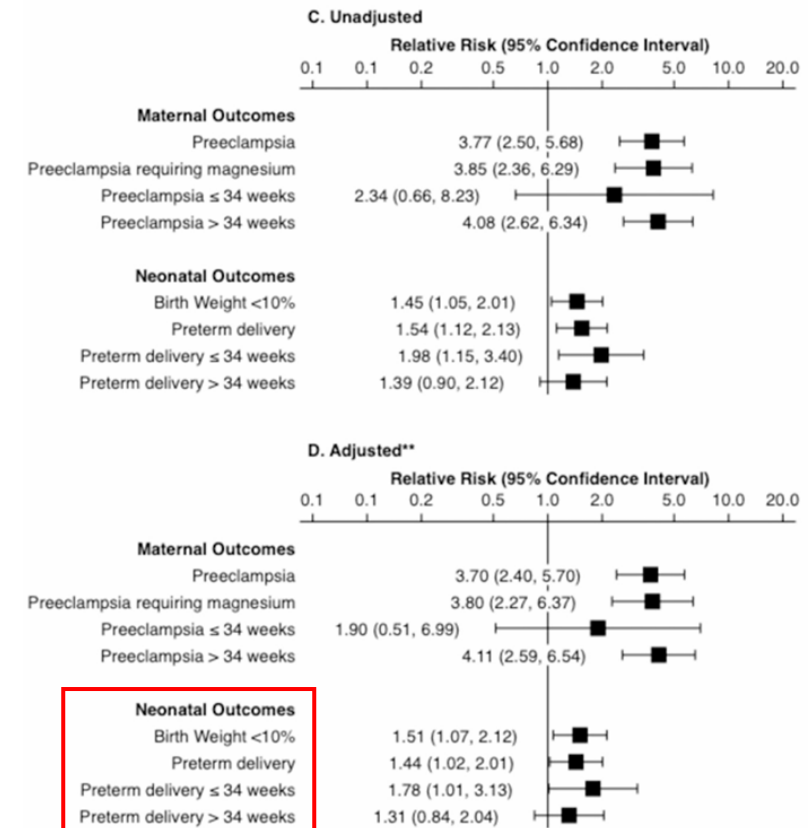
Background

- Maternal stage 1 hypertension increases risk of adverse perinatal outcomes



Circ Res. 2019

Stage I ACC-AHA Criteria vs. Normotensive

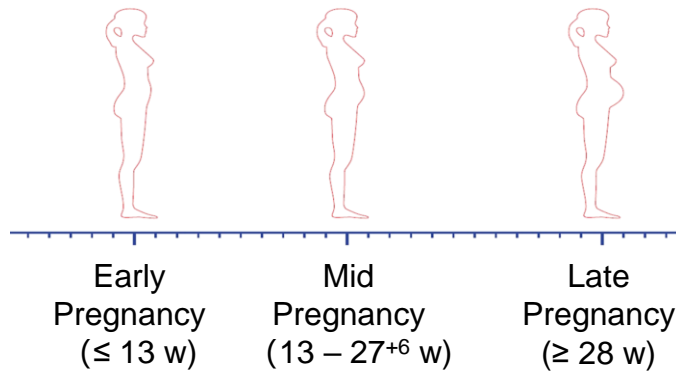


Am J Perinatol. 2021

Study Design

Jiangsu Birth Cohort, China

Blood Pressure Measurement



Bayley-III Screening Test



1 year of age

Whole pregnancy

- **Normotensive:**
SBP<130 and DBP<80
- **Stage 1 hypertension**
SBP: 130-139 and/or
DBP: 80-89
- **Hypertension**
SBP≥140 and/or DBP≥90

- **1. The control group:**
with normal BP values throughout all three trimesters;
- **2. Stage 1 hypertension occurring in the 2nd or 3rd trimester;**
- **3. Stage 1 hypertension occurring only in the 1st trimester;**
- **4. Stage 1 hypertension initiating in the 1st trimester and lasting to the 2nd or 3rd trimester;**
- **5. Hypertension at any time during pregnancy;**



Development delay

Five domain:

- Cognition
- Receptive Communication
- Expressive Communication
- Fine motor
- Gross motor



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Results

- **Basic characteristics of study population**

| Basic characteristics | Total |
|--|-------------|
| Maternal characteristics (n) | 3470 |
| Maternal age at delivery, years | 30.98 ±3.84 |
| Pre-pregnancy BMI, kg/m² | |
| <18.5 | 375 (10.8) |
| 18.5–23.9 | 2345 (67.6) |
| 24.0-27.9 | 569 (16.4) |
| ≥28.0 | 180 (5.2) |
| Center | |
| Changzhou | 725 (20.9) |
| Nanjing | 1548 (44.6) |
| Suzhou | 1197 (34.5) |
| Area of residence | |
| Rural | 169 (4.9) |
| Urban/sub-urban | 3301 (95.1) |
| Household income, CNY | |
| <50,000 | 114 (3.3) |
| 50,000–100,000 | 721 (20.9) |
| 100,000–200,000 | 1483 (42.9) |
| ≥100,000 | 1140 (33.0) |
| Mode of conception | |
| Spontaneous | 1940 (55.9) |
| Assisted reproductive technology | 1530 (44.1) |

| Basic characteristics | Total |
|---|--------------|
| Infant characteristics (n) | 3764 |
| Plurality | |
| Singleton | 3158 (83.9) |
| Twins | 606 (16.1) |
| Sex | |
| Boys | 2000 (53.1) |
| Girls | 1764 (46.9) |
| Gestational age at delivery, weeks | 38.91 ±1.77 |
| Premature birth | 448 (11.9) |
| Birth defects | |
| No | 3516 (93.4) |
| Yes | 248 (6.6) |
| Child age at assessment, days | 365.41 ±7.49 |

Results

- Associations between maternal **stage 1 hypertension** and the risk of development delay in offspring in different trimesters.

| Characters | First trimester (N=3451) | | Second trimester (N=3240) | | Third trimester (N=3094) | |
|--|--------------------------|---------|---------------------------|---------|--------------------------|---------|
| | β (95% CI)* | P Value | β (95% CI)* | P Value | β (95% CI)* | P Value |
| Cognitive domain | | | | | | |
| Normal BP | ref | | ref | | ref | |
| Stage 1 hypertension | 1.17(0.90,1.53) | 0.244 | 1.00(0.70,1.45) | 0.983 | 1.23(0.84,1.78) | 0.290 |
| Hypertension | 1.38(1.03,1.84) | 0.029 | 1.36(1.00,1.85) | 0.051 | 1.31(0.94,1.82) | 0.116 |
| Receptive communication domain | | | | | | |
| Normal BP | ref | | ref | | ref | |
| Stage 1 hypertension | 1.26(1.02,1.56) | 0.030 | 1.13(0.86,1.49) | 0.370 | 0.95(0.68,1.33) | 0.772 |
| Hypertension | 1.13(0.87,1.45) | 0.359 | 1.07(0.81,1.40) | 0.649 | 0.99(0.74,1.32) | 0.932 |
| Expressive communication domain | | | | | | |
| Normal BP | ref | | ref | | ref | |
| Stage 1 hypertension | 1.70(1.19,2.42) | 0.004 | 1.26(0.79,2.01) | 0.334 | 1.09(0.64,1.87) | 0.756 |
| Hypertension | 1.92(1.30,2.85) | 0.001 | 1.40(0.90,2.17) | 0.137 | 1.19(0.74,1.92) | 0.476 |
| Motor domain | | | | | | |
| Normal BP | ref | | ref | | ref | |
| Stage 1 hypertension | 0.77(0.44,1.35) | 0.359 | 0.58(0.25,1.34) | 0.201 | 0.96(0.44,2.09) | 0.909 |
| Hypertension | 0.76(0.41,1.41) | 0.385 | 0.98(0.53,1.82) | 0.948 | 0.80(0.39,1.65) | 0.549 |
| Gross motor domain | | | | | | |
| Normal BP | ref | | ref | | ref | |
| Stage 1 hypertension | 1.02(0.75,1.39) | 0.907 | 1.27(0.87,1.84) | 0.212 | 1.17(0.76,1.79) | 0.469 |
| Hypertension | 1.23(0.88,1.73) | 0.216 | 1.59(1.13,2.24) | 0.008 | 1.50(1.05,2.15) | 0.026 |

The model was adjusted for mode of conception, maternal age at delivery, pre-pregnancy BMI, parity, plurality, infant sex, examination age of infant, maternal education, and study center.

Results

- Associations between maternal **stage 1 hypertension** and the risk of development delay in offspring in total trimesters.

| Characters | Cognition | | Receptive Communication | | Expressive Communication | | Fine Motor | | Gross Motor | |
|--|-----------------|-------|-------------------------|-------|--------------------------|-------|-----------------|-------|-----------------|-------|
| | RR (95%CI) | P | RR (95%CI) | P | RR (95%CI) | P | RR (95%CI) | P | RR (95%CI) | P |
| Normal BP | ref | | ref | | ref | | ref | | ref | |
| Stage 1 hypertension: | | | | | | | | | | |
| At least once in second or third trimester | 1.12(0.74,1.72) | 0.589 | 0.83(0.57,1.21) | 0.337 | 1.00(0.54,1.85) | 0.998 | 0.82(0.35,1.92) | 0.646 | 1.03(0.64,1.64) | 0.904 |
| Only in first trimester | 1.01(0.68,1.52) | 0.954 | 1.30(0.97,1.75) | 0.075 | 1.84(1.14,2.97) | 0.013 | 1.11(0.56,2.20) | 0.765 | 0.95(0.60,1.51) | 0.826 |
| In first trimester, and at least once in second or third trimester | 1.30(0.80,2.11) | 0.289 | 1.43(0.98,2.10) | 0.064 | 2.10(1.12,3.93) | 0.021 | 0.62(0.19,2.02) | 0.424 | 1.44(0.87,2.38) | 0.157 |
| Hypertension (any trimester) | 1.50(1.08,2.08) | 0.015 | 1.18(0.89,1.57) | 0.253 | 2.06(1.33,3.21) | 0.001 | 0.91(0.47,1.76) | 0.771 | 1.21(0.82,1.79) | 0.327 |

The model was adjusted for mode of conception, maternal age at delivery, pre-pregnancy BMI, parity, plurality, infant sex, examination age of infant, maternal education, and study center.

Conclusion

- **Stage 1 hypertension may affect language development in offspring**
 - ✓ The offspring of women with stage 1 hypertension defined by the ACC/AHA diagnostic criteria detected **in first trimester** had higher risk of being non-competent in **expressive communication** domain.
- **The first trimester is a critical window**
 - ✓ This risk in **expressive communication** domain is even higher if stage 1 hypertension detected **early persists into the second or third trimester.**

Stage 1 hypertension during the first trimester requires early attention and monitoring!

Thank you for your listening!