

# Central obesity measures in early pregnancy and the risk of hypertensive disorders of pregnancy and postpartum chronic hypertension

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## Background

Elevated body mass index (BMI) is a risk factor for hypertension, but BMI cannot account for body fat distribution. Little is known about the role of central (abdominal) obesity in hypertensive disorders of pregnancy (HDP) and postpartum chronic hypertension (CH).

## Objective

To examine whether central obesity is associated with HDPs and new-onset postpartum CH.

## Methods

**Study design.** Prospective cohort of 3,055 pregnant individuals in the Kaiser Permanente PETALS cohort, with up to 9.9 years (mean 4.8; SD 2.7) follow-up after delivery via electronic health records. Individuals with multiple gestation and pre-pregnancy chronic hypertension or hypertension diagnosed before 20 weeks gestation excluded from analysis (n=138).

**Exposure.** Central obesity at 10-13 weeks gestation:

- Waist circumference (WC) ≥80 cm
- Waist-to-hip ratio (WHR) ≥0.85
- Waist-to-height ratio (WHtR) ≥0.5
- Body roundness index (BRI) ≥3.35, the 25<sup>th</sup> percentile

$$BRI = 364.2 - 365.5 \times \sqrt{1 - \frac{\left(\frac{WC}{2\pi}\right)^2}{(0.5 \times height)^2}}$$

**Body roundness index**

**Outcomes.** Outcomes ascertained via electronic health records using blood pressure measurements, physician diagnosis, and antihypertensive medications:

- HDP (n=210 cases), includes gestational hypertension, pre-eclampsia, eclampsia
- New-onset postpartum CH (n=289 cases)

## Covariates.

- For HDP: age at delivery, race and ethnicity, parity, family history of hypertension, pre-pregnancy BMI (in race- and ethnicity-specific categories following WHO guidelines), smoking in pregnancy, and gestational age at central obesity measurement
- For new-onset postpartum CH: HDP covariates plus gestational weight gain (below, meeting, or above IOM guidelines based on pre-pregnancy BMI).

**Statistical analysis.** Modified Poisson regression for HDP (adjusted relative risk, aRR) and Cox proportional hazards models (adjusted hazard ratio, aHR) for postpartum CH.

**Table 1. Participant characteristics in the PETALS cohort (n=3,055), n (%)**

<b>Age at delivery, years (mean ± SD)</b>	30.3±5.3
<b>Race and ethnicity</b>	
Asian/Pacific Islander	708 (23.2%)
Black	315 (10.3%)
Hispanic	1,268 (41.5%)
White	670 (21.9%)
Other or unknown	94 (3.1%)
<b>Family history of hypertension</b>	
<b>Nulliparous, n (%)</b>	1,466 (48.0%)
<b>Smoker, n (%)</b>	13 (0.4%)
<b>Pre-pregnancy BMI</b>	
Underweight	68 (2.2%)
Healthy weight	1,108 (36.3%)
Overweight	956 (31.3%)
Obesity	923 (30.2%)
<b>Gestational weight gain</b>	
Below IOM guidelines	449 (14.7%)
Met IOM guidelines	745 (24.4%)
Above IOM guidelines	1,861 (60.9%)

Abbreviations: BMI, body mass index; IOM, Institute of Medicine; SD, standard deviation

## Results

- Central obesity is a risk factor for HDP and postpartum CH independent of BMI.
- HDP risk was elevated at the highest level of central obesity and postpartum CH risk was elevated across all levels and measures of central obesity (Figure 1).
- Individuals with elevated (above-median) central obesity and healthy weight pre-pregnancy BMI had a 2.04- to 2.36-fold increased risk of postpartum CH (Figure 2).
- Across all levels of pre-pregnancy BMI, elevated central obesity increased the risk of postpartum CH 2.04- to 6.09-fold (Figure 2).

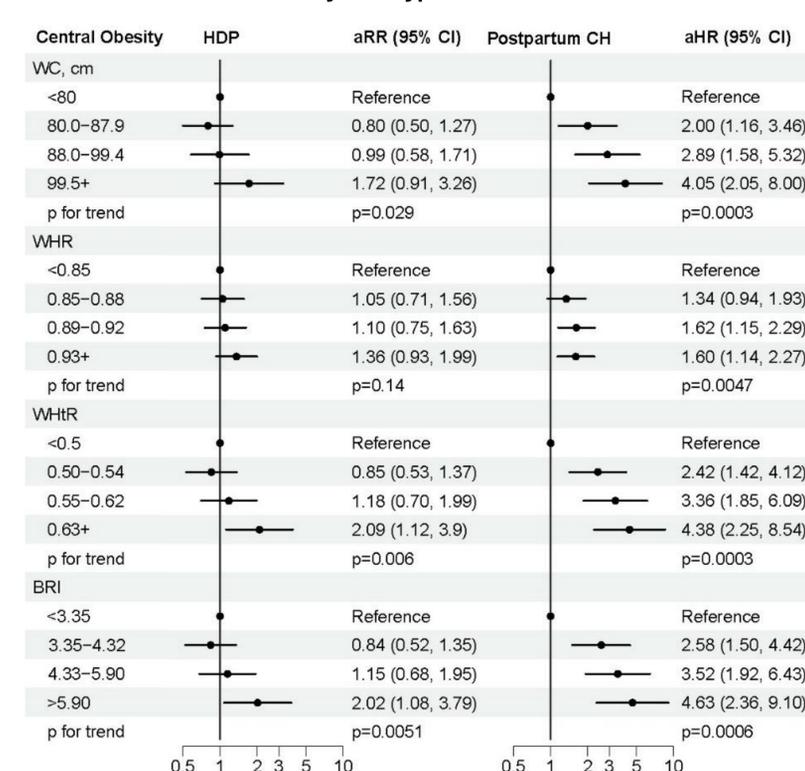
## Implications

Central obesity measurements could be a valuable addition to clinical practice, informing screening and prevention and helping identify at-risk individuals who might otherwise be missed.

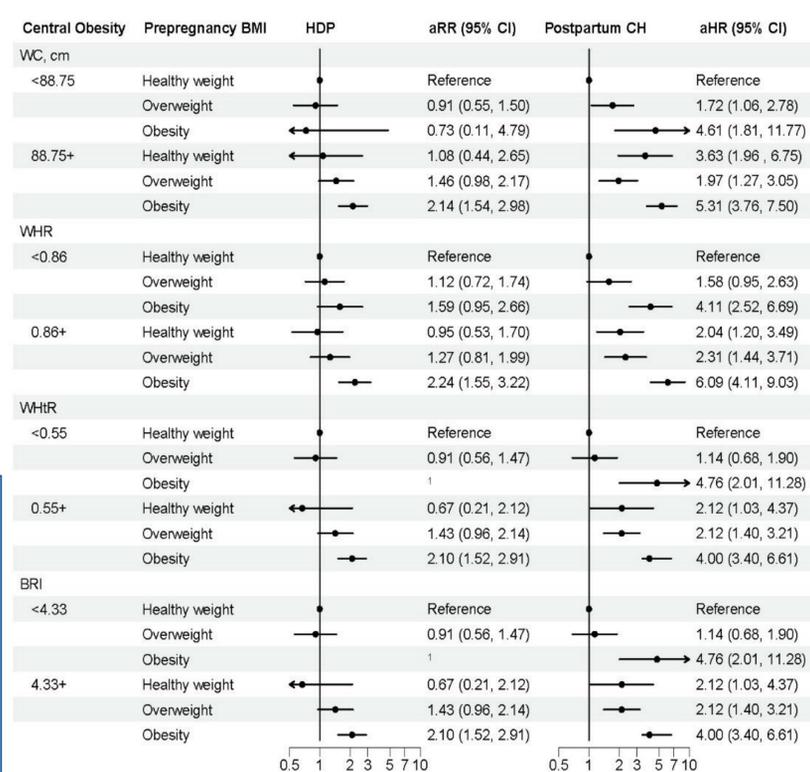
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**Figure 1. Associations between early pregnancy central obesity and hypertensive outcomes**



**Figure 2. Joint associations of early pregnancy central obesity and pre-pregnancy BMI with risk of hypertensive outcomes**



**Figures 1 and 2 notes:** In Figure 1, the reference category (no central obesity) of WC, WHR, and WHtR is based on clinical guidelines. BRI is categorized in quartiles as there are no established clinical cutoffs for the index. In Figure 2, central obesity measures were dichotomized at the median, and healthy weight BMI includes underweight BMI (n=68).  
<sup>1</sup>In Figure 2, no HDP cases occurred in these strata (obesity and WHtR or BRI <median, n=25) so the category was omitted from analysis.