**Causation**

**Diastolic blood pressure and weight gain predicted future risk of hypertension**


**QUESTION:** Does diastolic blood pressure (BP) or other cardiovascular risk factors predict the future onset of hypertension in people who are not undergoing hypertension treatment at baseline?

**Design**
Prospective cohort study of men and women in the Nijmegen Cohort Study with 18 years of follow up.

**Setting**
6 general practices in Nijmegen, the Netherlands.

**Participants**
2238 men and women between 20 and 50 years of age (mean age 35.5, 52% men, 100% white). Participants who were undergoing hypertension treatment in 1977 were excluded.

**Assessment of risk factors**
Age, familial cardiovascular risk factors, smoking status, BP, physical activity, body mass index (BMI), serum cholesterol concentrations, socioeconomic class, and history of diabetes were measured at baseline (1977) and after 18 years of follow up (1995). Outcome assessors in 1995 were blinded to the 1977 data.

**Main outcome measures**
Hypertension was defined as either under current hypertension treatment or a diastolic BP ≥95 mm Hg.

Relative risks (RRs) of developing hypertension by baseline diastolic blood pressure (DBP) and weight gain in men and women at 18 years of follow up

<table>
<thead>
<tr>
<th>Group</th>
<th>Men RR</th>
<th>Women RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBP &lt;75 mm Hg and weight gain &lt;5 kg</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>DBP &gt;75 mm Hg and weight gain 5–10 kg</td>
<td>1.6 (0.6 to 4.8)*</td>
<td>8.2 (1.5 to 45)</td>
</tr>
<tr>
<td>DBP &gt;75 mm Hg and weight gain &gt;10 kg</td>
<td>1.1 (0.1 to 3.8)*</td>
<td>12 (2.6 to 57)</td>
</tr>
<tr>
<td>DBP 75 to 85 mm Hg and weight gain &lt;5 kg</td>
<td>2.3 (0.9 to 5.7)*</td>
<td>9.2 (1.8 to 47)</td>
</tr>
<tr>
<td>DBP 75 to 85 mm Hg and weight gain 5–10 kg</td>
<td>3.0 (1.2 to 7.2)</td>
<td>14 (3.2 to 63)</td>
</tr>
<tr>
<td>DBP 75 to 85 mm Hg and weight gain &gt;10 kg</td>
<td>3.8 (1.6 to 8.9)</td>
<td>28 (8.4 to 96)</td>
</tr>
<tr>
<td>DBP &gt;85 mm Hg and weight gain &lt;5 kg</td>
<td>6.9 (3.6 to 13)</td>
<td>40 (14 to 111)</td>
</tr>
<tr>
<td>DBP &gt;85 mm Hg and weight gain 5–10 kg</td>
<td>7.7 (3.9 to 15)</td>
<td>50 (19 to 132)</td>
</tr>
<tr>
<td>DBP &gt;85 mm Hg and weight gain &gt;10 kg</td>
<td>9.1 (4.5 to 17)</td>
<td>52 (20 to 137)</td>
</tr>
</tbody>
</table>

*: Not significant.

**Main results**
Regression analysis in women showed that the risk of being under current treatment for hypertension or having a diastolic BP ≥95 mm Hg was associated with baseline diastolic BP (p < 0.005), weight gain (p < 0.005), and baseline BMI (p < 0.05). In men, the risk of being under treatment for hypertension or having a diastolic BP ≥95 mm Hg was associated with baseline diastolic BP (p < 0.005) and weight gain (p < 0.005), and inversely associated with socioeconomic class (p < 0.05). The table shows the risk of developing hypertension by baseline diastolic BP and weight gain. Compared with men, women had greater increases in hypertension risk with increasing baseline diastolic BP and weight gain.

**Conclusion**
Diastolic blood pressure and weight gain predicted the 18 year risk of hypertension in men and women who were not undergoing hypertension treatment at baseline.

**COMMENTARY**

The study by Bakx et al highlights the causative and gender specific relations between several risk factors and the development of hypertension. The findings compare favourably with other studies.1, 2 Also, these results support the possible role of menopausal events in the development of high BP.3

The study’s methodological strengths are the design, blinding of assessors, large sample size, and noting of bias related to the use of different BP cuff sizes. Minor problems with this study are those common to convenience sampling and the biases associated with a survey design. Also, hypertension is currently defined as a diastolic BP ≥90 mm Hg rather than ≥95 mm Hg,4 and the study will have missed those people with a diastolic BP between 90 and 95 mm Hg.

The authors argue quite convincingly that BP should be measured regularly in those who gain weight and have a diastolic BP ≥80 mm Hg because they are at high risk of hypertension. Prevention of weight gain is also important. Conversely, the data suggest that there is no need to check BP in middle aged people with low diastolic BP and no weight gain.

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