### Table: The Bogalusa Heart Study

<table>
<thead>
<tr>
<th>Study Groups</th>
<th>Follow-up</th>
<th>Age (yrs)</th>
<th>Gender</th>
<th>BMI (kg/m²)</th>
<th>SBP (mm Hg)</th>
<th>DBP (mm Hg)</th>
<th>Fasting Glucose (mg/dl)</th>
<th>Triceps SF (cm²)</th>
<th>Subscapular SF (cm²)</th>
<th>WC (cm)</th>
<th>Waist to Hip Ratio</th>
<th>Waist to Height Ratio</th>
<th>Ponderal Index</th>
<th>Quetelet Index</th>
<th>MAP (mm Hg)</th>
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<tbody>
<tr>
<td>Young adults</td>
<td>1981-1996</td>
<td>13-27</td>
<td>51% M; 48% F</td>
<td>27.7 ± 3.6</td>
<td>116 ± 15</td>
<td>73 ± 11</td>
<td>90 ± 45</td>
<td>11.1 ± 1.5</td>
<td>13.3 ± 3.2</td>
<td>87 ± 5</td>
<td>0.51 ± 0.09</td>
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<td>10.8 ± 2.7</td>
<td>1.03 ± 0.12</td>
<td>118 ± 16</td>
</tr>
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<td>Adolescents</td>
<td>1981-1996</td>
<td>11-17</td>
<td>52% M; 48% F</td>
<td>27.8 ± 3.5</td>
<td>116 ± 14</td>
<td>73 ± 10</td>
<td>90 ± 44</td>
<td>11.0 ± 1.6</td>
<td>13.3 ± 3.4</td>
<td>87 ± 5</td>
<td>0.51 ± 0.09</td>
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<td>10.7 ± 2.3</td>
<td>1.03 ± 0.11</td>
<td>118 ± 17</td>
</tr>
<tr>
<td>Children</td>
<td>1981-1996</td>
<td>5-11</td>
<td>52% M; 48% F</td>
<td>27.6 ± 3.1</td>
<td>116 ± 11</td>
<td>73 ± 9</td>
<td>90 ± 43</td>
<td>11.0 ± 1.7</td>
<td>13.3 ± 3.5</td>
<td>87 ± 5</td>
<td>0.51 ± 0.09</td>
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<td>10.6 ± 2.2</td>
<td>1.03 ± 0.11</td>
<td>118 ± 18</td>
</tr>
</tbody>
</table>

### Results

- **Map = DBP + (SBP-DBP/3)**
- **Mean BP = DBP + 1/3(SBP-DBP) = MBP**
- **Rohrer Index (Wt (kgs)/ Ht (meters) cubed)**
- **Quetelet Index (Wt (kgs)/ Ht (meters squared)**
- **Ponderal Index (Wt (kgs)/ Ht (meters cubed)**
- **BMI**
- **BMI ≥ 85th%ile = overweight, 95th%ile = obese**
- **Overweight defined as QI > 95th%ile for age/sex.**
- **BMI > 75th%ile at F/U increased significantly across baseline quintiles of insulin only**
- **BMI > 75th%ile at F/U increased significantly across baseline quintiles of insulin only**

### Analysis

- Logistic regression analysis indicated that the proportion of subjects who developed hypertension through hyperinsulinemia was increased in older age groups and those with higher baseline BMI.
- In MVA, the best predictor of F/U insulin level was baseline BMI in children & adults.
- Baseline BMI was the best predictor of F/U BMI in all age groups.
- By MVA, adverse parental (mother,father, either or both) levels of BMI and BMI increase were found to significantly increase the risk of developing hypertension.

### Discussion

- The findings suggest that overweight and obesity in children and adolescents are associated with an increased risk of developing hypertension.
- The results support the hypothesis that overweight and obesity in children and adolescents are associated with an increased risk of developing hypertension.
- Parental dyslipidemia and HBP were not associated with offspring Met S RFs.
- When subjects were ranked by tertiles for fasting insulin & wt/ adiposity, increasing tertiles were found to be associated with increased risk of developing hypertension.

### Conclusion

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<th>Study Groups</th>
<th>Type</th>
<th>Design</th>
<th>Duration</th>
<th>Outcomes Measured</th>
<th>Results</th>
<th>Main Reported Findings by Critical Question</th>
</tr>
</thead>
</table>
| White: 646  
Mexican American: 846  
Female: 1,280  
At or above poverty level: 1,394 | Retrospect. Study CVD RF by CQ Country Setting Main Study Objective N at Baseline (N at follow-up) | 12-19 yr: 1,462  
Age 15-19 yr: 1,439  
5 CrS surveys in the Bogalusa Heart Study | Study cohort selected from among 1,930 young subjects aged 8-17 yrs. and one at age>/= 19yrs and have no missing data among the variables of interest. | 126 mg/dl = DM; HDL-C (< 40 mg/dl in M,< 50 mg/dl in F = low); TC/HDL or TG/HDL.  Clustering = All 4 variables were present at adverse levels of the 4 RFs by race & age group. RRs were significantly different in all CrS groups when compared to CrS negative group.  As BMI increases, number of cluster variables present increases. | To maximize F/U when subject participated in the study, subjects were seen at follow-up every 2-3 yrs. and were stratified as upper 25% and lower 75% of the BMI distribution - 54.5% male(M),19.5% B. | 5 CrS surveys of school children & young adults - originally offered participation in a euglemic clamp study after adjustment for BMI, fasting insulin, SBP or mean BP, and clustering components of the MetS. |
| | 174 subjects were from the top 25% of the BP distribution - 43.7% female(F), 21.3% B. | Follow-up examinations were performed between 1978 & 1996. | Mean levels of RFs for preadolescence(4-11 yrs), adolescence (12-18 y) & adulthood (>= 19yrs) were performed. 5 CrS surveys of school children & young adults - originally offered participation in a euglemic clamp study after adjustment for BMI, fasting insulin, SBP or mean BP, and clustering components of the MetS. | There is no correlation between SBP & Mlbm for the entire cohort. SBP was significantly correlated with all measures of body size except Subscapular skin fold (SSF) increased as activity level increased. | For subjects with multiple exams, the data from each exam were analyzed separately. To maximize F/U when subject participated in the study, subjects were seen at follow-up every 2-3 yrs. and were stratified as upper 25% and lower 75% of the BMI distribution - 54.5% male(M),19.5% B. | There is no correlation between SBP & Mlbm for the entire cohort. SBP was significantly correlated with all measures of body size except Subscapular skin fold (SSF) increased as activity level increased. |
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The Bogalusa Heart Study

**Purpose and Methodology**

The Bogalusa Heart Study is a community-based cohort of black (B) and white (W) adolescents aged 9-10 years, examined at 5-17 years; 52% female (F), 48% male (M); 44% B. A total of 1,491 girls were enrolled in 3 geographic locations at age 9-10 years, and follow-up data was available for 2/3's of the sample. The cohort had a mean age of 15.2 +/- 1.6 years at baseline.

**Population Eligibility Criteria**

- Community-based cohort of black (B) & white (W) females, mean age 10 years.
- All 500 teens from the national expanded follow-up of the Bogalusa Heart Study.

**Study Groups**

- Target population: 1,474 subjects with evaluation at baseline and yr-10.
- LM = 1042 women; n at Baseline (n at Study End) = 450.
- B Fs - n=500; 65% W, 35% B.
- Sample size: 1,474 subjects; n=1,491 girls enrolled.

**Baseline Characteristics**

- Menarche: the Bogalusa Heart Study
- Adiposity and related risk variables of young adults

**Study Groups by Race and Sex**

- B Fs - n=500
- W Fs - n=500
- Mixed sex: n=674

**Outcome Measures**

- BMI
- HDL-C (≥ 40 mg/dl = high)
- Fasting glucose (FG) (≥ 110 mg/dl = high)
- Fasting insulin (INS) (>18 uU/ml = high)
- HDL-C (< 50 mg/dl = low)
- TG (>200 mg/dl = high)
- Carotid IMT (cIMT)
- WC
- Hippocratic

**Results**

- Using ATPIII definition of MetS, overall prevalence of MetS in adulthood for the cohort was 12.1%, higher in Ws than Bs (14.5% vs 8.2%, p=0.001).
- Overall prevalence of MetS in adulthood was 13.6%, higher in Ws than Bs (15.2% vs 11.5%, p=0.001).
- Using ATPIII definition of MetS, low risk MetS group had significantly lower prevalence of MetS (4.6 vs 12.9%, p=0.001).
- In B girls, INS and HOMA-IR were significantly higher in the prepubertal period, ranging from 67 - 75%.
- Across all participants, 10 yr changes in BMI correlated with changes in INS (r= -0.48 & 0.55, both, p=0.001).
- BMI-INS correlations were (+) in both B & W girls at yr 1 (both, r=0.44 & p=0.001) & yr 10 (r=0.48 & 0.55, both, p=0.001).
- One-third of ATPIII defined MetS subjects did not have hyperinsulinemia.
- In childhood, 9% of the cohort had 3 or 4 MetS RFs in the bottom quartile of BMI/FG; across all participants, 10 yr changes in BMI correlated with changes in INS (r= -0.48 & 0.55, both, p=0.001).
- Study 2: girls with a family history of diabetes were more likely to develop MetS (OR=1.88, 95% CI 1.08, 1.88).
- Agreement between the MetS definitions was poor with k statistic of 0.41.
- Prevalence of known C-V RFs was high in the group as a whole, with low HDL by WHO criteria.
- In this biracial adolescent cohort, the prevalence of MetS was significantly higher in women than men (13.0% vs 6.5%, p=0.001).
- The prevalence of MetS was significantly higher in black females than white females (17.4% vs 7.6%, p=0.001).
- Mid-childhood (4-9 yrs) for the black females was associated with early menarche.
- Early menarche was associated with higher BMI & triceps SFs from childhood through adulthood.
- In childhood, 9% of the cohort had 3 or 4 MetS RFs in the bottom quartile of BMI/FG; across all participants, 10 yr changes in BMI correlated with changes in INS (r= -0.48 & 0.55, both, p=0.001).
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<th>Population</th>
<th>Eligibility Criteria</th>
<th>Patient Characteristics</th>
<th>Study Groups</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2001-2002</td>
<td>Q6 (RF4,5,8,14)</td>
<td>None</td>
<td>Cohort Prospective Bogalusa None</td>
<td>Q6 (RF4,5,8,14)</td>
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<td>2</td>
<td>2007</td>
<td>Q7 (RF14)</td>
<td>None</td>
<td>Cohort Prospective Princeton None</td>
<td>Q7 (RF 4,5,8,14)</td>
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<tr>
<td>3</td>
<td>2006</td>
<td>Q7 (RF4,5,8,14)</td>
<td>None</td>
<td>Cohort Prospective</td>
<td>Q8 (RF 4,5,8,14)</td>
</tr>
</tbody>
</table>

**Main Study Objective:** Evaluate serial changes in C-V components: the Coronary Artery Risk Evaluation (CARE) study.

**Population-Based, prospective observational study:** Follow-up to evaluate serial C-V components.

**Study Groups:**
- Children evaluated at baseline for longitudinal cohort examination and usable fasting morning blood samples at baseline and follow-up (F/U).
- Those with other variables at baseline and F/U and those subjects constitute this study group.

**Total Follow-up Duration:** 10 yrs.

**Outcomes Measured:**
- Waist circumference (WC) (≥100 cm = obese)
- BMI (Obesity ≥ 30)
- SBP (HTN: ≥ 130/85; FG: 100 mg/dl)
- TC (≥ 220 mg/dl)
- TG (≥ 150 mg/dl)
- HDL-C (< 40 mg/dl)

**Results:**
- Cumulative incidence rates for MetS were as follows: pediatric AHA=3.8% (95% CI, 2.3% to 5.9%), AHA=49% (95% CI, 32% to 66%), and non-AHA=56% (95% CI, 41% to 71%).
- These rates are higher in the adult study at 3 sites and followed X 10 yrs. In 2001-2002, Subjects had a baseline physical examination and usable fasting morning blood samples at baseline and follow-up (F/U).

**Main Reported Findings by Critical Question:**
- Increased BP and higher BMI in childhood and accelerated adverse metabolic syndrome components, regardless of baseline BMI, whereas those with increased BMI at follow-up.
- Higher BMI, adiposity, SBP, DBP & FG worsening levels.
- Blacks and lower SES youth had higher BMI z score and increased insulin resistance index, LDL-C, HDL-C, and TGs with HTN.
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**Conclusions:**
- Longitudinal changes with aging suggest a worsening of insulin resistance over time (F = 18.86, p=S**).
- Blacks and lower SES youth had higher BMI z score and increased insulin resistance index, LDL-C, HDL-C, and TGs with HTN.
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**Further Reading:**
<table>
<thead>
<tr>
<th>PMID</th>
<th>Title</th>
<th>Study Groups</th>
<th>Study Population</th>
<th>Main Study Objective</th>
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<th>Main Reported Findings</th>
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<tbody>
<tr>
<td>17573336</td>
<td>Clustering of long-term trends in metabolic syndrome variables from childhood to adulthood in Blacks and Whites: the Bogalusa Heart Study</td>
<td></td>
<td>Community-based cohort of black (B) &amp; white (W) children and young adults - originally examined at 5-17 yrs; 52% female (F), 48% male (M); 44% B in 1982; serial cross-sectional studies performed from 1970 to present.</td>
<td>Evaluate long-term rates of change in metabolic syndrome variables from childhood to adulthood.</td>
<td>Total Follow-up Duration: Average of 16 yr BMI HOMA-IR TG/HDL-C ratio Mean BP</td>
<td>Intraclass correlations, a measure of the degree of clustering among the variables were significant for childhood, adulthood, and incremental area values and were higher in adulthood than in childhood, more in Ms than Fs (p &lt; 0.05 for all 4 variables). Blacks showed a higher degree of clustering of long-term rates of change in metabolic syndrome risk variables than did Whites. Adjustment for body mass index reduced the degree of clustering by approximately 50%. Results show that metabolic syndrome variables coexist in terms not only of their levels in childhood and adulthood but also the long-term rates of change. Q5: Blacks showed a higher degree of clustering of long-term rates of change in metabolic syndrome risk variables than did Whites. Q6: Intraclass correlations, a measure of the degree of clustering, among variables, were significant for childhood, adulthood, and incremental area values and were higher in adulthood than in childhood.</td>
<td></td>
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<tr>
<td>17986354</td>
<td>Diagnostic criteria patterns of U.S. children with Metabolic Syndrome: NHANES 1999-2002</td>
<td></td>
<td></td>
<td></td>
<td>Disease prevalence estimates were 2% in the group of 2-18 yr olds with data for ≥ 3 diagnostic criteria but no fasting glucose levels; 0.7% in the group of 12-18 yr olds with data for ≥ 3 diagnostic criteria and provided fasting blood glucose data but were not overweight or obese; and 23% in the group of 12-18 yr olds with data for ≥ 3 diagnostic criteria and provided fasting blood glucose data but were overweight or obese. More than 10% of the children providing fasting blood levels had hyperglycemia. Among overweight children meeting criteria for MS, 2% had all 5 diagnostic criteria. In all groups, elevated total triglycerides and low HDL level affected a large proportion of the population.</td>
<td></td>
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