Association between 30-year predicted cardiovascular disease risk and incident hypertension

Byron C Jaeger, PhD1

1Biostatistics and Data Science, Wake Forest University School of Medicine, Winston-Salem, NC.

Table 1: Participant characteristics.

| **Characteristic1** | **Overall, N = 1230 (100%)** | **Normal blood pressure, N = 613 (50%)** | **Elevated blood pressure, N = 225 (18%)** | **Stage 1 hypertension, N = 392 (32%)** |
| --- | --- | --- | --- | --- |
| Age, years | 46 (7) | 45 (7) | 47 (7) | 47 (7) |
| Sex |  |  |  |  |
| Women | 60 | 67 | 62 | 49 |
| Men | 40 | 33 | 38 | 51 |
| Body mass index, kg/m2 | 31.0 (7.0) | 30.3 (7.0) | 31.2 (6.7) | 31.8 (7.0) |
| Currently smoking | 14 | 12 | 17 | 15 |
| Statin use | 3.3 | 3.1 | 3.6 | 3.6 |
| Systolic blood pressure, mm Hg | 118 (10) | 110 (6) | 124 (3) | 128 (7) |
| Diastolic blood pressure, mm Hg | 75 (7) | 71 (6) | 74 (4) | 82 (5) |
| Diabetes | 5.9 | 3.9 | 8.4 | 7.4 |
| Total cholesterol, mg/dL | 196 (35) | 194 (32) | 195 (37) | 201 (36) |
| High density lipoprotein cholesterol, mg/dL | 51 (13) | 51 (13) | 51 (13) | 50 (13) |
| Low density lipoprotein cholesterol, mg/dL | 127 (33) | 126 (32) | 125 (34) | 131 (34) |
| PREVENT 10-year CVD risk, % | 2.4 (2.1) | 1.8 (1.6) | 2.8 (2.2) | 3.2 (2.4) |
| PREVENT 30-year CVD risk, % | 14.0 (8.1) | 11.3 (6.9) | 15.7 (7.9) | 17.4 (8.5) |
| Hypertension at visit 3 | 46 | 29 | 54 | 67 |
| Left ventricular mass at visit 3, g/m2.72 | 31 (7) | 30 (7) | 31 (6) | 32 (7) |
| Left ventricular hypertrophy at visit 32 | 5.9 | 6.1 | 4.3 | 6.5 |
| Abbreviations: CVD = cardiovascular disease; and PREVENT = predicting risk of cardiovascular disease events | | | | |
| 1Table values are mean (standard deviation) or percent | | | | |
| 2Left ventricular mass was indexed to height, and left ventricular hypertrophy was indicated by mass > 45.1 g/m2.7 for men and mass > 38 g/m2.7 for women | | | | |

Table 2: Distribution of PREVENT 10- and 30-year predicted risk for cardiovascular disease.

| **PREVENT CVD risk** | | **Blood pressure category** | | | |
| --- | --- | --- | --- | --- | --- |
| **10-year** | **30-year** | **Overall** | **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| N (%) of participants | | | | | |
| < 10% | <10% | 457 (38) | 316 (52) | 58 (26) | 83 (22) |
| 10% to <20% | 495 (41) | 213 (35) | 110 (50) | 172 (45) |
| 20% to <30% | 224 (18) | 74 (12) | 44 (20) | 106 (28) |
| ≥30% | 39 (3.2) | 8 (1.3) | 9 (4.1) | 22 (5.7) |
| ≥ 10% | ≥30% | 15 (100) | 2 (100) | 4 (100) | 9 (100) |
| % with hypertension at visit 2 or visit 3 | | | | | |
| < 10% | <10% | 43 | 32 | 54 | 73 |
| 10% to <20% | 56 | 37 | 60 | 77 |
| 20% to <30% | 61 | 38 | 72 | 74 |
| ≥30% | 89 | 71 | 89 | 95 |
| ≥ 10% | ≥30% | 87 | 50 | 100 | 89 |
| LV mass mean (% with LV hypertrophy) at visit 3 | | | | | |
| < 10% | <10% | 30 (6.5) | 30 (6.8) | 31 (0.00) | 32 (9.4) |
| 10% to <20% | 31 (5.0) | 30 (3.4) | 29 (2.0) | 33 (8.5) |
| 20% to <30% | 32 (7.2) | 31 (7.9) | 35 (16) | 32 (2.5) |
| ≥30% | 34 (6.7) | 38 (25) | 26 (0.00) | 34 (0.00) |
| ≥ 10% | ≥30% | 33 (0.00) | 33 (0.00) | -- (--) | 32 (0.00) |
| Abbreviations: CVD = cardiovascular disease; LV = left ventricular; and PREVENT = predicting risk of cardiovascular disease events | | | | | |

Table 3: Hazard ratios (95% confidence intervals) for incident hypertension at visit 2 or 3 based on predicted 30-year cardiovascular risk at visit 1.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| Per 10% predicted risk | 1.46 (1.37, 1.56) | 1.38 (1.10, 1.67) | 1.34 (1.03, 1.65) | 1.08 (0.91, 1.24) |
| Risk categories | | | | |
| <10% | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| 10% to <20% | 1.64 (1.42, 1.85) | 1.29 (0.89, 1.69) | 0.83 (0.22, 1.44) | 1.48 (1.08, 1.88) |
| 20% to <30% | 1.89 (1.64, 2.15) | 1.49 (0.98, 2.00) | 1.08 (0.31, 1.85) | 1.31 (0.85, 1.76) |
| ≥30% | 3.00 (2.61, 3.39) | 4.57 (-0.48, 9.61) | 1.86 (0.59, 3.12) | 1.50 (0.91, 2.10) |

Table 4: Expected left ventricular mass (95% confidence interval) at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| per 10% predicted risk | 1.33 (0.61, 2.06) | 1.05 (-0.07, 2.16) | 1.74 (-0.12, 3.60) | 0.53 (-0.77, 1.82) |
| Differences by risk categories | | | | |
| <10% | 0 (ref) | 0 (ref) | 0 (ref) | 0 (ref) |
| 10% to <20% | 0.67 (-0.59, 1.93) | 0.22 (-1.52, 1.96) | -2.48 (-5.39, 0.43) | 1.30 (-1.44, 4.03) |
| 20% to <30% | 2.08 (0.48, 3.69) | 1.22 (-1.15, 3.60) | 4.03 (0.47, 7.58) | 0.29 (-2.82, 3.40) |
| ≥30% | 4.26 (0.80, 7.72) | 8.64 (2.10, 15.19) | -5.26 (-13.64, 3.13) | 2.85 (-2.10, 7.80) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3 and had predicted 30-year cardiovascular disease risk <10% at visit 1. | | | | |

Table 5: Prevalence ratios (95% confidence interval) for left ventricular hypertrophy at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| Per 10% predicted risk | 1.08 (0.71, 1.65) | 1.30 (0.68, 2.50) | 3.03 (1.21, 7.58) | 0.58 (0.28, 1.20) |
| By risk categories | | | | |
| <10% | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| 10% to <20% | 0.77 (0.35, 1.68) | 0.49 (0.14, 1.74) |  | 0.91 (0.25, 3.31) |
| 20% to <30% | 1.12 (0.46, 2.72) | 1.18 (0.34, 4.09) |  | 0.27 (0.03, 2.44) |
| ≥30% | 1.03 (0.14, 7.32) | 3.65 (0.60, 22.07) |  |  |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3 and had predicted 30-year cardiovascular disease risk <10% at visit 1. | | | | |

Table S1: Exclusions

| **Inclusion criteria** | **No. of participants** |
| --- | --- |
| JHS participants | 5,306 |
| Age 30 to < 60 years at visit 1 | 3,067 |
| Consented to CVD follow-up at visit 1 | 2,953 |
| No history of CVD at visit 1 | 2,943 |
| Have information on self-reported antihypertensive medication use and blood pressure at visit 1 | 2,882 |
| Have information on other variables in the PCEs and PREVENT equations at visit 1 | 2,608 |
| All variables in range for PREVENT equations at visit 1 | 2,489 |
| Without hypertension at visit 1 | 1,388 |
| With hypertension status known at visit 2 or visit 3 | 1,230 |

Table S2: Expected left ventricular mass (95% confidence interval) at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| per 10% predicted risk | 1.41 (0.98, 1.84) | 1.06 (0.31, 1.81) | 1.08 (0.01, 2.15) | 0.67 (-0.05, 1.38) |
| Differences by risk categories | | | | |
| <10% | 0 (ref) | 0 (ref) | 0 (ref) | 0 (ref) |
| 10% to <20% | 0.69 (-0.07, 1.46) | 0.00 (-1.09, 1.08) | -1.28 (-3.13, 0.56) | 1.07 (-0.46, 2.61) |
| 20% to <30% | 2.04 (1.09, 2.98) | 1.10 (-0.44, 2.64) | 2.20 (-0.02, 4.43) | 0.79 (-0.81, 2.38) |
| ≥30% | 4.10 (2.15, 6.05) | 7.59 (2.98, 12.21) | -0.57 (-4.90, 3.77) | 2.72 (0.04, 5.39) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3 and had predicted 30-year cardiovascular disease risk <10% at visit 1. | | | | |
| Results are based on multiple imputation using chained equations to account for missing values of left ventricular mass index | | | | |

Table S3: Prevalence ratios (95% confidence interval) for left ventricular hypertrophy at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| Per 10% predicted risk | 1.09 (0.76, 1.58) | 1.16 (0.57, 2.34) | 1.18 (0.43, 3.20) | 0.90 (0.47, 1.73) |
| By risk categories | | | | |
| <10% | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| 10% to <20% | 0.77 (0.37, 1.59) | 0.53 (0.14, 2.01) | 0.65 (0.04, 10.65) | 1.01 (0.27, 3.83) |
| 20% to <30% | 0.91 (0.39, 2.11) | 0.97 (0.27, 3.40) | 2.12 (0.24, 18.75) | 0.48 (0.10, 2.39) |
| ≥30% | 1.91 (0.60, 6.10) | 3.54 (0.43, 28.74) |  | 1.29 (0.15, 11.40) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3 and had predicted 30-year cardiovascular disease risk <10% at visit 1. | | | | |
| Results are based on multiple imputation using chained equations to account for missing values of left ventricular mass index | | | | |