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

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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 2 or 3 | 49 | 31 | 57 | 72 |
| 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% | 38 | 27 | 48 | 70 |
| 10% to <20% | 51 | 33 | 52 | 72 |
| 20% to <30% | 60 | 38 | 70 | 71 |
| ≥30% | 82 | 62 | 89 | 86 |
| ≥ 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 (1.33, 1.61) | 1.38 (1.04, 1.83) | 1.34 (0.98, 1.83) | 1.08 (0.91, 1.27) |
| Risk categories | | | | |
| <10% | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| 10% to <20% | 1.64 (1.32, 2.02) | 1.29 (0.87, 1.92) | 0.83 (0.45, 1.53) | 1.48 (0.99, 2.20) |
| 20% to <30% | 1.89 (1.47, 2.44) | 1.49 (0.89, 2.48) | 1.08 (0.50, 2.33) | 1.31 (0.83, 2.06) |
| ≥30% | 3.00 (2.02, 4.45) | 4.57 (0.03, 707.74) | 1.86 (0.52, 6.58) | 1.50 (0.83, 2.72) |

Table 4A: Expected left ventricular mass (95% confidence interval) at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1 for participants who *developed* hypertension between visit 1 and visit 3.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| per 10% predicted risk | 0.77 (-0.36, 1.90) | 0.22 (-2.12, 2.55) | 1.03 (-1.45, 3.51) | 0.71 (-0.90, 2.31) |
| Differences by risk categories | | | | |
| <10% | 0 (ref) | 0 (ref) | 0 (ref) | 0 (ref) |
| 10% to <20% | -0.76 (-2.86, 1.34) | -2.93 (-6.71, 0.86) | -2.06 (-6.30, 2.17) | 0.57 (-2.87, 4.02) |
| 20% to <30% | 1.47 (-1.03, 3.97) | 0.46 (-4.10, 5.03) | 4.15 (-0.53, 8.83) | 0.65 (-3.41, 4.71) |
| ≥30% | 1.70 (-2.45, 5.85) | 3.94 (-4.96, 12.84) | -5.50 (-14.58, 3.58) | 2.58 (-3.12, 8.28) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3, had incident hypertension by visit 3, and had predicted 10-year cardiovascular disease risk <10% at visit 1. | | | | |

Table 4B: Expected left ventricular mass (95% confidence interval) at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1 for participants who *did not develop* hypertension between visit 1 and visit 3.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| per 10% predicted risk | 1.11 (0.14, 2.09) | 1.07 (-0.20, 2.34) | 2.44 (-0.77, 5.65) | -0.13 (-2.28, 2.01) |
| Differences by risk categories | | | | |
| <10% | 0 (ref) | 0 (ref) | 0 (ref) | 0 (ref) |
| 10% to <20% | 1.00 (-0.55, 2.55) | 1.26 (-0.63, 3.15) | -2.77 (-7.01, 1.47) | 2.54 (-2.02, 7.09) |
| 20% to <30% | 1.23 (-0.87, 3.33) | 0.74 (-2.03, 3.52) | 3.30 (-2.94, 9.54) | -0.11 (-4.79, 4.56) |
| ≥30% | 8.18 (-0.25, 16.61) | 15.43 (3.47, 27.40) |  | 0.14 (-12.15, 12.44) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3, did not have incident hypertension by visit 3, and had predicted 10-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 | 0.88 (0.51, 1.50) | 1.16 (0.49, 2.72) | 2.26 (0.90, 5.65) | 0.49 (0.19, 1.30) |
| By risk categories | | | | |
| <10% | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| 10% to <20% | 0.41 (0.17, 1.04) |  |  | 0.65 (0.18, 2.36) |
| 20% to <30% | 0.88 (0.36, 2.16) | 1.00 (0.30, 3.35) |  | 0.28 (0.03, 2.50) |
| ≥30% | 0.52 (0.07, 3.74) | 1.67 (0.29, 9.42) | 5.09 (1.29, 20.00) |  |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3 and had predicted 10-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 S2A: Expected left ventricular mass (95% confidence interval) at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1 for participants who *developed* hypertension between visit 1 and visit 3.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| per 10% predicted risk | 0.95 (0.35, 1.55) | 0.12 (-1.15, 1.39) | 0.83 (-0.59, 2.25) | 1.00 (0.14, 1.86) |
| Differences by risk categories | | | | |
| <10% | 0 (ref) | 0 (ref) | 0 (ref) | 0 (ref) |
| 10% to <20% | -0.39 (-1.56, 0.79) | -2.01 (-3.95, -0.07) | -0.92 (-3.50, 1.65) | 0.63 (-1.19, 2.44) |
| 20% to <30% | 1.30 (-0.03, 2.63) | -0.22 (-2.88, 2.44) | 2.19 (-0.74, 5.11) | 1.27 (-0.71, 3.25) |
| ≥30% | 2.59 (0.30, 4.89) | 3.80 (-2.02, 9.61) | -0.21 (-5.00, 4.57) | 3.24 (0.18, 6.29) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3, had incident hypertension by visit 3, and had predicted 10-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 S2B: Expected left ventricular mass (95% confidence interval) at visit 3 based on predicted 30-year cardiovascular disease risk at visit 1 for participants who *did not develop* hypertension between visit 1 and visit 3.

| **PREVENT 30-year CVD risk** | **Overall** | **Blood pressure groups** | | |
| --- | --- | --- | --- | --- |
| **Normal blood pressure** | **Elevated blood pressure** | **Stage 1 hypertension** |
| per 10% predicted risk | 1.43 (0.77, 2.09) | 1.37 (0.49, 2.26) | 1.51 (-0.37, 3.39) | -0.32 (-1.73, 1.08) |
| Differences by risk categories | | | | |
| <10% | 0 (ref) | 0 (ref) | 0 (ref) | 0 (ref) |
| 10% to <20% | 1.13 (0.11, 2.15) | 0.69 (-0.60, 1.98) | -1.24 (-3.91, 1.43) | 2.03 (-0.68, 4.75) |
| 20% to <30% | 1.80 (0.42, 3.17) | 1.41 (-0.39, 3.21) | 2.75 (-0.96, 6.45) | -0.30 (-3.24, 2.65) |
| ≥30% | 4.72 (0.27, 9.16) | 11.17 (4.23, 18.12) | -2.61 (-13.92, 8.71) | -1.61 (-7.94, 4.73) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3, did not have incident hypertension by visit 3, and had predicted 10-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 | 1.04 (0.66, 1.62) | 1.13 (0.44, 2.88) | 1.58 (0.62, 3.99) | 0.90 (0.45, 1.80) |
| By risk categories | | | | |
| <10% | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| 10% to <20% | 0.57 (0.25, 1.33) |  | 1 (ref) | 0.95 (0.26, 3.43) |
| 20% to <30% | 0.87 (0.35, 2.17) | 1.05 (0.29, 3.77) | 1 (ref) | 0.54 (0.10, 2.81) |
| ≥30% | 1.26 (0.37, 4.29) | 2.11 (0.30, 15.00) |  | 1.15 (0.13, 10.51) |
| Results are presented for participants who did not have stroke or coronary heart disease event from visit 1 to visit 3 and had predicted 10-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 | | | | |