**Predicted cardiovascular risk and blood pressure for Americans with diabetes, chronic kidney disease, and ≥65 years of age**

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**Main idea:**

Secondary analyses of randomized controlled trials have found that the absolute CVD risk reduction with antihypertensive medication is greater for adults with higher CVD risk (see Section 8.1.1, first paragraph). Based on these data, the 2017 ACC/AHA BP guideline recommends using CVD risk and BP levels to guide the decision to initiate antihypertensive medication. The guideline states that the vast majority of adults with diabetes, chronic kidney disease, or ≥65 years of age have a 10-year CVD risk ≥10%, placing them in the high risk category and are recommended the initiation of antihypertensive drug therapy with SBP ≥ 130 mm Hg or DBP ≥ 80 mm Hg\* (see Section 9.3, 9.6, and 10.3.1 of ACC/AHA guidelines: treatment recommendations paragraph). However, data from NHANES show that a substantial proportion of US adults with stage 1 hypertension and diabetes or chronic kidney disease do not have a 10-year predicted CVD risk ≥10%. Therefore, when considering whether to initiate or intensify treatment to lower BP for an adult patient with stage 1 hypertension, physicians who aim to direct these treatments to those at higher risk for CVD should calculate CVD risk for patients with diabetes or chronic kidney disease rather than assuming it is high, particularly for adults aged 40 to 55 years. For adults with diabetes or chronic kidney disease whose 10-year predicted CVD risk is < 10%, treatment to lower BP may still provide substantial reduction in lifetime risk for CVD and prevention of complications associated with diabetes or chronic kidney disease.

\* For adults aged ≥65 years DBP is not used.

**METHODS**

NHANES was designed to assess the health and nutritional status of the non-institutionalized US population and is conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention (1). Since 1999-2000, NHANES has been conducted in two-year cycles using a multistage probability sampling design to select participants. Each cycle is independent with different participants recruited. For the current analysis, three cycles conducted in 2013-2014, 2015-2016 and 2017-2018 were pooled for analysis (2). The protocols for each NHANES cycle were approved by the National Center for Health Statistics of the Centers for Disease Control and Prevention Institutional Review Board. Written informed consent was obtained from each participant. The University of Alabama at Birmingham Institutional Review Board considered the analysis of NHANES data to be exempt research.

The current analysis was restricted to adults aged 40 to 79 years of age who complete the NHANES interview and examination (n = 9,937). Participants with age <40 or >79 were not included because the ASCVD risk prediction equation recommended by the ACC/AHA BP guideline is not recommended in these age ranges. Participants who did not have three SBP and DBP measurements (n = 565) and those who were missing information on age, race, sex, total and high-density lipoprotein cholesterol, smoking status, or diabetes (n = 575) were excluded. After these exclusions, over the three NHANES cycles, a total of 8,797 survey participants were included in the analysis (Online Figure 1).

***Data collection***

Data were collected during an in-home interview and a study visit completed at a mobile examination center. Standardized questionnaires were used to assess survey participants’ age, sex, race/ethnicity, smoking habits, medical history and use of antihypertensive medication, oral glucose lowering medication and insulin. Medical history included questions about whether the participant had been told by a doctor or other health professional that they had a heart attack, coronary heart disease stroke, or heart failure. Blood and urine samples were collected during the medical examination. Of relevance to the current analysis, serum creatinine, serum glucose and glycated hemoglobin (HbA1c) were measured. Diabetes was defined by fasting serum glucose ≥ 126 mg/dL, non-fasting glucose ≥ 200 mg/dL, HbA1c ≥ 6.5%, or self-reported use of insulin or oral glucose lowering medication. Estimated glomerular filtration rate was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation.(3) Urinary albumin and creatinine levels were measured and used to calculate the albumin-to-creatinine ratio (ACR). CKD was defined by an estimated glomerular filtration rate < 60 ml/min/1.73m² or an ACR ≥ 30 mg/dL. Ten-year predicted risk for ASCVD was calculated using the pooled cohort risk equations for participants without a history of CVD.(4) Participants with a history of CVD were presumed to have 10-year risk for ASCVD ≥10%.

***Blood pressure measurement***

Physicians conducting study examinations followed the same protocol to measure SBP and DBP in each NHANES cycle. After survey participants had rested 5 minutes, their BP was measured by a trained physician using a mercury sphygmomanometer and an appropriately sized cuff. Three BP measurements were obtained at 30 second intervals. The mean of all available measurements was used to define SBP and DBP. Quality control included re-certification of physicians every quarter with retraining if needed. All physicians participated in annual retraining.

***Definitions of hypertension***

Participants not taking antihypertensive medication were grouped into four non-overlapping categories based on the 2017 ACC/AHA BP guideline: Normal BP (SBP < 120 mm Hg and DBP < 80 mm Hg), elevated BP (SBP between 120 and 129 mm Hg and DBP < 80 mm Hg), stage 1 hypertension (SBP between 130 and 139 mm Hg and/or DBP between 80 and 89 mm Hg with SBP < 140 mm Hg and DBP < 90 mm Hg), stage 2 hypertension (SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg). Participants taking antihypertensive medication were placed in a fifth group.

***Statistical analysis***

Analyses were conducted for the overall population and among participants with diabetes, CKD, ≥65 years of age, and for those with any of these three conditions, separately. Participant characteristics were summarized as mean (standard error) and percentage for continuous and categorical variables, respectively. The percentage of US adults in each of the five BP/antihypertensive medication use categories was computed. The median 10-year predicted risk for ASCVD and the proportion with a predicted risk ≥ 10% was computed for participants in each of the BP/antihypertensive medication use categories. To assess the extent to which participants with a 10-year predicted ASCVD risk < 10% were ‘borderline’ cases (i.e., predicted ASCVD risk of 5% to <10% or 7.5% to <10%), the distribution of predicted risk among participants with predicted risk <10% was estimated and the percentage with predicted risk of 0% to <2.5%, 2.5% to <5.0%, 5.0% to <7.5%, and 7.5% to <10% was computed. The age-adjusted probability of having a 10-year predicted ASCVD risk ≥ 10% was estimated using logistic regression. The above analyses were repeated among participants with stage 1 hypertension.

NHANES sampling weights, which were calculated as the inverse probability of being selected for the survey, were used in all calculations to obtain US nationally representative estimates. The survey design of NHANES was also taken into account. Data analysis was conducted using R version 4.0.1 or higher (Vienna, Austria). P-values were two-sided.

**RESULTS**

Among US adults who were 40 to 79 years of age in 2013-2018, the estimated prevalence (95% confidence interval [CI]) of diabetes and CKD was 17.2% (16.0, 18.5) and 14.1% (13.0, 15.2), respectively, and the estimated proportion (95% CI) of adults aged >=65 years was 25.4% (23.7, 27.1) (Table 1). Overall, an estimated 14.6% (95% CI: 13.3, 16.1) of US adults who were 40 to 79 years of age had stage 1 hypertension (Table 2). Among those with diabetes, CKD, and age >=65 years, the estimated prevalence (95% CI) of stage 1 hypertension was 10.5% (8.5, 12.9), 9.5% (7.6, 11.7), and 9.1% (7.6, 10.9), respectively. Characteristics of US adults with stage 1 hypertension, overall, and with diabetes, CKD and age >=65 years are presented in Table S1

***Predicted 10-year risk for atherosclerotic cardiovascular disease***

Among US adults without a history of CVD, the estimated median (25th, 75th percentiles) 10-year predicted risk for ASCVD was 5.1% (1.9, 11.4) overall and 14.4% (7.0, 27.3), 12.1% (4.8, 22.8), and 17.9% (11.2, 27.3) among those with diabetes, CKD, and age >=65 years, respectively (Table 3; top panel). Among US adults with stage 1 hypertension and no history of CVD, the estimated median (25th, 75th percentiles) 10-year predicted risk for ASCVD was 4.2% (1.9, 8.5). Within this subgroup of adults with stage 1 hypertension, those with diabetes and CKD had median (25th, 75th percentiles) predicted risks of of 8.9% (4.5, 19.3) and 6.8% (2.6, 12.3), respectively (each <10%) while adults aged >=65 years had a median (25th, 75th percentiles) predicted risk of 13.8% (8.6, 22.3). Among all US adults with stage 1 hypertension, an estimated 55.0% (95% CI: 43.2, 66.3) of those with diabetes, 38.5% (95% CI: 27.8, 50.4) of those with CKD and 72.6% (95% CI: 62.0, 81.1) who were >=65 years of age had a 10-year predicted risk for ASCVD >=10% or a history of CVD (Table 3; bottom panel).

Among US adults with predicted 10-year predicted ASCVD risk <10% and no history of CVD, an estimated 69.4% (95% CI: 67.5, 71.3) had a 10-year predicted ASCVD risk <5% (Figure 1). Also, among this subgroup of adults, 47.7%, 95% CI 41.0, 54.5, 55.9%, 95% CI 49.6, 62.0 and 13.2%, 95% CI 8.4, 20.1 of those with diabetes, CKD and age >=65 years had a 10-year predicted ASCVD risk <5% . The distributions of 10-year predicted ASCVD risk among this subgroup of US adults are presented in Figure S2. For these US adults, 53.6%, 95% CI 35.6, 70.6 of those with diabetes and 55.8%, 95% CI 40.5, 70.0 of those with CKD had a 10-year predicted ASCVD risk <5%, compared with 7.4%, 95% CI 1.1, 35.8 of those aged >=65 years of age.

The probability of having a 10-year predicted ACVD risk >=10% or a history of CVD increased with older age and was 50% at age 65 years of age (Figure 2). The estimated age at which the probability of having a 10-year predicted ASCVD risk >=10% or a history of CVD was 50% at 54 years of age among those with diabetes and 58 years of age among those with CKD. For US adults with stage 1 hypertension, the estimated age where the probability of having a 10-year predicted ASCVD risk >=10% or a history of CVD exceeded 50% was 65, 55, and 64 years for US adults without diabetes or CKD, with diabetes, and with CKD, respectively (Figure S3).

**DISCUSSION**

In the current study, the distribution of 10-year predicted risk for ASCVD was investigated among US adults aged 40 to 79 years from 2013 to 2018. The 2017 ACC/AHA BP guideline states that the vast majority of adults with diabetes, CKD, or >=65 years of age have a 10-year predicted risk for ASCVD >=10% and are recommended the initiation of antihypertensive drug therapy for stage 1 hypertension. However, data from the current analysis indicate that while 72.5% (95% CI: 69.1, 75.6) of US adults with diabetes have 10-year predicted risk for ASCVD >=10% or prevalent CVD, only 55.0% (95% CI: 43.2, 66.3) of adults with stage 1 hypertension and diabetes have 10-year predicted risk for ASCVD >=10% or prevalent CVD. Similarly, 65.4% (95% CI: 61.6, 69.0) of US adults with CKD but only 38.5% (95% CI: 27.8, 50.4) of US adults with CKD and stage 1 hypertension have 10-year predicted risk for ASCVD >=10% or prevalent CVD. These results are not consistent the guideline's claim that a vast majority of adults with stage 1 hypertension and diabetes or CKD have 10-year predicted risk for ASCVD >=10%. However, the current analysis does validate the guideline's claim regarding 10-year predicted ASCVD risk among adults with >=65 years of age, finding that 83.8% (95% CI: 81.4, 85.9) of US adults aged >=65 years and 72.6% (95% CI: 62.0, 81.1) of US adults aged >=65 years with stage 1 hypertension have 10-year predicted risk for ASCVD >=10% or prevalent CVD.

The 2017 ACC/AHA BP guideline recommends initiation of antihypertensive medication based on BP level, predicted 10-year risk for ASCVD, and other conditions including diabetes, CKD, and age >=65 years. A previous analysis of pooled data from the REasons for Geographic and Racial Differences in Stroke study and the Jackson Heart Study showed that adults with stage 1 hypertension recommended versus not recommended to initiate antihypertensive medication by the 2017 ACC/AHA BP guideline were roughly 5 times more likely to experience stroke or coronary heart disease over 12.2 years of follow-up. Among adults recommended to initiate treatment by the ACC/AHA BP guideline, the authors found that 87.7% had a 10-year predicted risk for ASCVD >=10%. However, the mean age of adults in this group was 70.2 years, with a standard deviation of 6.9, whereas the current study found the estimated mean (95% CI) age of US adults aged 40 to 79 from 2013 to 2018 was 56.7 (56.3, 57.2). Given that age is one of the most influential predictors in the pooled cohort risk equation, the younger age of adults with stage 1 hypertension recommended to initiate antihypertensive medication by the ACC/AHA BP guidelines in the current versus previous analysis likely explains differences in 10-year predicted risk for ASCVD.

A prior analysis of NHANES data found that the proportion of adults in the US with SBP > 130 mm Hg or DBP > 80 mmHg who are aware of their BP level declined from 2013 to 2018, and multiple prior analyses have found that adults with stage 1 hypertension (i.e., SBP 130-139 mm Hg and DBP <90 mm Hg or DBP 80-89 mm Hg and SBP <140 mm Hg) recommended to initiate antihypertensive treatment by the ACC/AHA guideline are at high risk for incident ASCVD events. These recent findings suggest that the pooled cohort risk equations should be used in clinical practice to obtain critical healthcare goals such as improving awareness of hypertension and ASCVD risk. Computation of predicted risk for ASCVD may sometimes be inconvenient or time consuming if a patient's medical record does not contain recent cholesterol measurements. The current study suggests that it is probably safe to assume adults with stage 1 hypertension and >=65 years of age have 10-year predicted risk for ASCVD >= 10%. However, this assumption is not supported for patients with diabetes or CKD, particularly for those aged <55 years. Although adults in earlier life stages with diabetes or CKD may have 10-year predicted risk for ASCVD <10%, results from the current are consistent with previous work showing that adults with these conditions and advanced age have greater risk for ASCVD. For younger adults with diabetes or CKD and predicted 10-year risk for ASCVD <10%, antihypertensive treatment may still provide substantial reduction in lifetime risk for ASCVD and prevention of complications associated with diabetes or CKD.

**REFERENCES**

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Table 1: Characteristics of US adults overall and with diabetes, chronic kidney disease, and ≥ 65 years of age.

|  | | **Sub-groups** | | | |
| --- | --- | --- | --- | --- | --- |
| **Characteristic\*** | **Overall  N = 8,797** | **Diabetes  N = 1,998†** | **CKD  N = 1,566‡** | **Age 65+ years  N = 2,501** | **Diabetes, CKD, or age 65+ years  N = 4,183** |
| Age, years | 56.7 (0.2) | 60.3 (0.4) | 61.8 (0.4) | 70.6 (0.1) | 64.2 (0.3) |
| Male | 48.2 | 55.8 | 44.8 | 46.7 | 48.0 |
| Race / ethnicity | | | | | |
| Non-Hispanic White | 68.6 | 60.0 | 63.4 | 76.7 | 68.8 |
| Non-Hispanic Black | 10.1 | 13.6 | 15.0 | 7.8 | 10.9 |
| Hispanic | 12.6 | 15.9 | 13.1 | 8.3 | 11.7 |
| Non-Hispanic Asian | 5.2 | 7.0 | 4.9 | 4.5 | 5.2 |
| Other Race/ethnicity - Including Multi-Racial | 3.5 | 3.5 | 3.7 | 2.7 | 3.3 |
| Total cholesterol, mg/dl | 197.0 (0.9) | 183.2 (1.8) | 194.6 (1.8) | 188.9 (1.3) | 191.1 (1.2) |
| HDL-cholesterol, mg/dl | 54.9 (0.4) | 46.6 (0.5) | 53.0 (0.9) | 56.6 (0.7) | 53.7 (0.5) |
| Systolic blood pressure, mm Hg | 126.0 (0.3) | 130.5 (0.6) | 134.2 (0.7) | 131.8 (0.6) | 131.0 (0.5) |
| Diastolic blood pressure, mm Hg | 72.8 (0.3) | 71.6 (0.4) | 72.4 (0.4) | 68.3 (0.4) | 70.9 (0.3) |
| Antihypertensive medication use | 33.5 | 60.0 | 55.9 | 53.2 | 52.1 |
| Diabetes | 17.2 | 100.0 | 38.3 | 24.7 | 41.9 |
| Chronic kidney disease | 14.1 | 31.3 | 100.0 | 25.3 | 34.3 |
| Aged 65+ years | 25.4 | 36.4 | 45.6 | 100.0 | 61.9 |
| Current smoker | 17.3 | 14.6 | 19.1 | 10.0 | 14.4 |
| Prevalent CVD§ | 10.5 | 22.6 | 23.3 | 21.4 | 19.3 |
| \*Table values are mean (standard error) or proportion. | | | | | |
| †Diabetes was defined by fasting serum glucose ≥ 126 mg/dL, non-fasting glucose ≥ 200 mg/dL, HbA1c ≥ 6.5%, or self-reported use of insulin or oral glucose lowering medication. | | | | | |
| ‡Chronic kidney disease is defined by an albumin-to-creatinine ratio ≥ 30 mg/dl or an estimated glomerular filtration rate <60 ml/min/1.73m² | | | | | |
| §Prevalent cardiovascular disease was defined by self-report of previous heart failure, coronary heart disease, stroke, or myocardial infarction | | | | | |
| CKD = chronic kidney disease; CVD = cardiovascular disease; HDL = High density lipoprotein | | | | | |

Table 2: Estimated distribution of blood pressure categories among US adults, overall and for subgroups with diabetes, chronic kidney disease, and ≥ 65 years of age.

|  | | **Sub-groups** | | | |
| --- | --- | --- | --- | --- | --- |
| **Blood pressure category\*** | **Overall  N = 8,797** | **Diabetes  N = 1,998†** | **CKD  N = 1,566‡** | **Age 65+ years  N = 2,501** | **Diabetes, CKD, or age 65+ years  N = 4,183** |
| Normal blood pressure | 28.8 | 12.1 | 13.5 | 15.0 | 15.5 |
| Elevated blood pressure | 12.0 | 7.9 | 6.7 | 11.2 | 10.4 |
| Stage 1 hypertension | 14.6 | 10.5 | 9.5 | 9.1 | 10.4 |
| Stage 2 hypertension | 11.1 | 9.5 | 14.5 | 11.6 | 11.7 |
| Taking antihypertensive medication | 33.5 | 60.0 | 55.9 | 53.2 | 52.1 |
| \*Normal blood pressure: systolic/diastolic blood pressure < 120/80 mm Hg; Elevated blood pressure: systolic/diastolic blood pressure 120-129/<80 mm Hg; Stage 1 hypertension: systolic/diastolic blood pressure 130-139/80-89 mm Hg; Stage 2 hypertension: systolic/diastolic blood pressure ≥ 140/90 mm Hg. | | | | | |
| †Diabetes was defined by fasting serum glucose ≥ 126 mg/dL, non-fasting glucose ≥ 200 mg/dL, HbA1c ≥ 6.5%, or self-reported use of insulin or oral glucose lowering medication. | | | | | |
| ‡Chronic kidney disease is defined by an albumin-to-creatinine ratio ≥ 30 mg/dl or an estimated glomerular filtration rate <60 ml/min/1.73m² | | | | | |
| CKD = chronic kidney disease | | | | | |

Table 3: Median predicted risk for cardiovascular disease and proportion of US adults with predicted risk ≥ 10% overall and among those with diabetes, chronic kidney disease, and ≥ 65 years of age, stratified by categorization of blood pressure according to the 2017 American College of Cardiology / American Heart Association blood pressure guidelines.

|  | | **Sub-groups** | | | |
| --- | --- | --- | --- | --- | --- |
| **Blood pressure category\*** | **Overall  N = 8,797** | **Diabetes  N = 1,998†** | **CKD  N = 1,566‡** | **Age 65+ years  N = 2,501** | **Diabetes, CKD, or age 65+ years  N = 4,183** |
| *Median (25th - 75th percentile) predicted risk¶* | | | | | |
| Overall | 5.1 (1.9, 11.4) | 14.4 (7.0, 27.3) | 12.1 (4.8, 22.8) | 17.9 (11.2, 27.3) | 13.6 (7.0, 22.3) |
| Normal blood pressure | 2.0 (0.8, 4.8) | 6.8 (2.9, 15.8) | 3.0 (1.0, 8.1) | 10.6 (6.7, 16.0) | 7.0 (3.3, 12.9) |
| Elevated blood pressure | 4.3 (1.9, 9.3) | 11.4 (4.2, 17.3) | 6.2 (1.5, 13.8) | 14.6 (7.5, 19.9) | 11.8 (5.8, 17.4) |
| Stage 1 hypertension | 4.2 (1.9, 8.5) | 8.9 (4.5, 19.3) | 6.8 (2.6, 12.3) | 13.8 (8.6, 22.3) | 9.8 (5.3, 16.6) |
| Stage 2 hypertension | 8.1 (4.2, 16.0) | 18.8 (10.1, 30.2) | 13.9 (5.7, 21.3) | 20.4 (16.0, 29.6) | 17.3 (9.2, 25.4) |
| Taking antihypertensive medication | 10.5 (5.2, 19.8) | 17.2 (9.8, 31.6) | 17.0 (9.0, 29.0) | 21.2 (14.0, 31.6) | 17.2 (10.1, 27.3) |
| *Proportion (95% confidence interval) with 10-year predicted risk for ASCVD ≥10% or prevalent cardiovascular disease§‖* | | | | | |
| Overall | 36.6 (34.7, 38.6) | 72.5 (69.3, 75.6) | 65.4 (61.7, 69.0) | 83.8 (81.6, 86.0) | 70.3 (68.0, 72.7) |
| Normal blood pressure | 13.7 (11.4, 16.0) | 46.8 (39.0, 54.6) | 32.3 (21.6, 43.0) | 64.4 (57.7, 71.2) | 46.3 (40.5, 52.1) |
| Elevated blood pressure | 27.4 (23.3, 31.5) | 57.7 (49.6, 65.8) | 47.9 (36.9, 59.0) | 69.8 (59.6, 79.9) | 57.9 (50.5, 65.3) |
| Stage 1 hypertension | 24.3 (20.7, 27.9) | 55.0 (43.7, 66.4) | 38.5 (27.4, 49.6) | 72.6 (63.2, 81.9) | 55.2 (47.0, 63.3) |
| Stage 2 hypertension | 45.7 (40.4, 51.0) | 79.0 (69.3, 88.7) | 65.6 (54.7, 76.4) | 90.2 (83.8, 96.6) | 75.6 (69.5, 81.7) |
| Taking antihypertensive medication | 61.9 (59.4, 64.5) | 81.6 (78.0, 85.2) | 79.9 (75.9, 84.0) | 92.8 (91.0, 94.5) | 81.8 (79.4, 84.2) |
| \*Normal blood pressure: systolic/diastolic blood pressure < 120/80 mm Hg; Elevated blood pressure: systolic/diastolic blood pressure 120-129/<80 mm Hg; Stage 1 hypertension: systolic/diastolic blood pressure 130-139/80-89 mm Hg; Stage 2 hypertension: systolic/diastolic blood pressure ≥ 140/90 mm Hg. | | | | | |
| †Diabetes was defined by fasting serum glucose ≥ 126 mg/dL, non-fasting glucose ≥ 200 mg/dL, HbA1c ≥ 6.5%, or self-reported use of insulin or oral glucose lowering medication. | | | | | |
| ‡Chronic kidney disease is defined by an albumin-to-creatinine ratio ≥ 30 mg/dl or an estimated glomerular filtration rate <60 ml/min/1.73m² | | | | | |
| §Prevalent cardiovascular disease was defined by self-report of previous heart failure, coronary heart disease, stroke, or myocardial infarction | | | | | |
| ‖Predicted risk for cardiovascular disease was computed using the Pooled Cohort Risk equations, based on the guideline by American College of Cardiology / American Heart Association, 2013 | | | | | |
| ¶Data from survey participants with prevalent cardiovascular disease were not included for these statistics | | | | | |
| ASCVD = atherosclerotic cardiovascular disease; CKD = chronic kidney disease | | | | | |

Figure 1: Estimated distribution of 10-year predicted atherosclerotic cardiovascular disease risk among US adults with predicted risk < 10% overall and for those with diabetes, chronic kidney disease, ≥ 65 years of age, or any of the preceding conditions.



Results do not include data from survey participants with prevalent cardiovascular disease or 10-year predicted risk for atherosclerotic cardiovascular disease ≥ 10%.

Figure 2: Estimated Probability of ten-year predicted risk for atherosclerotic cardiovascular disease ≥ 10% by age for US adults with diabetes, with chronic kidney disease, and without diabetes or chronic kidney disease.



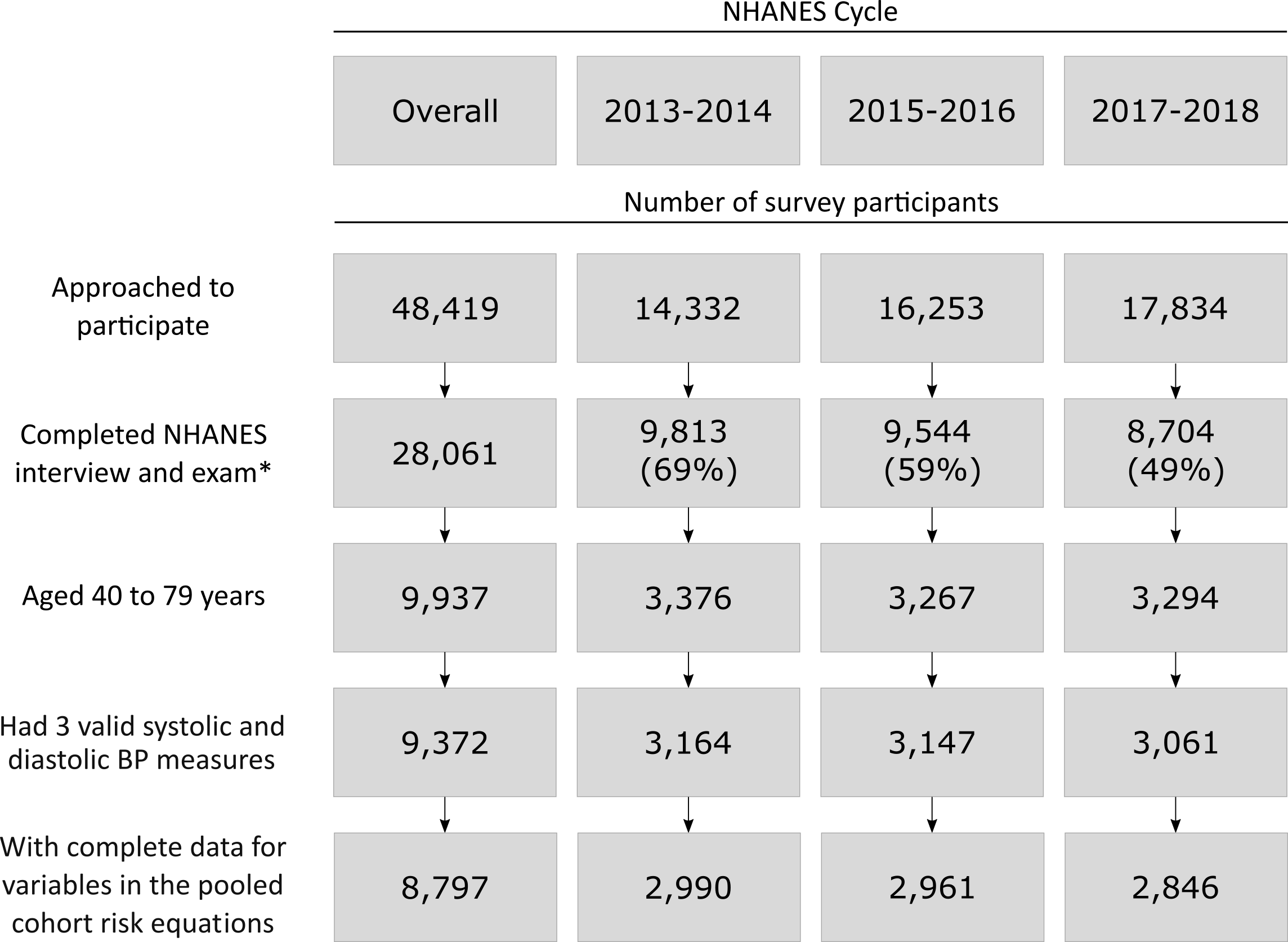
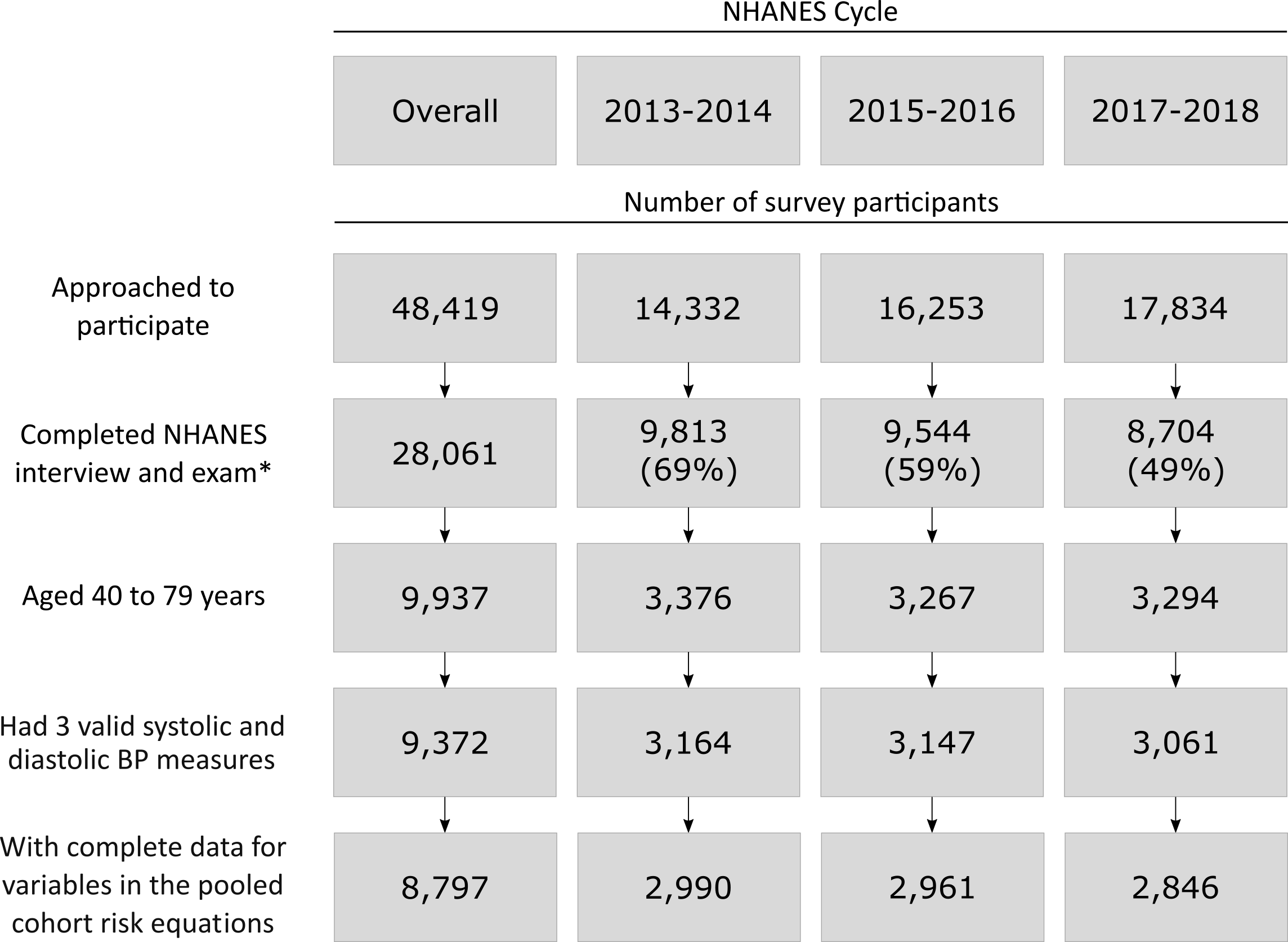
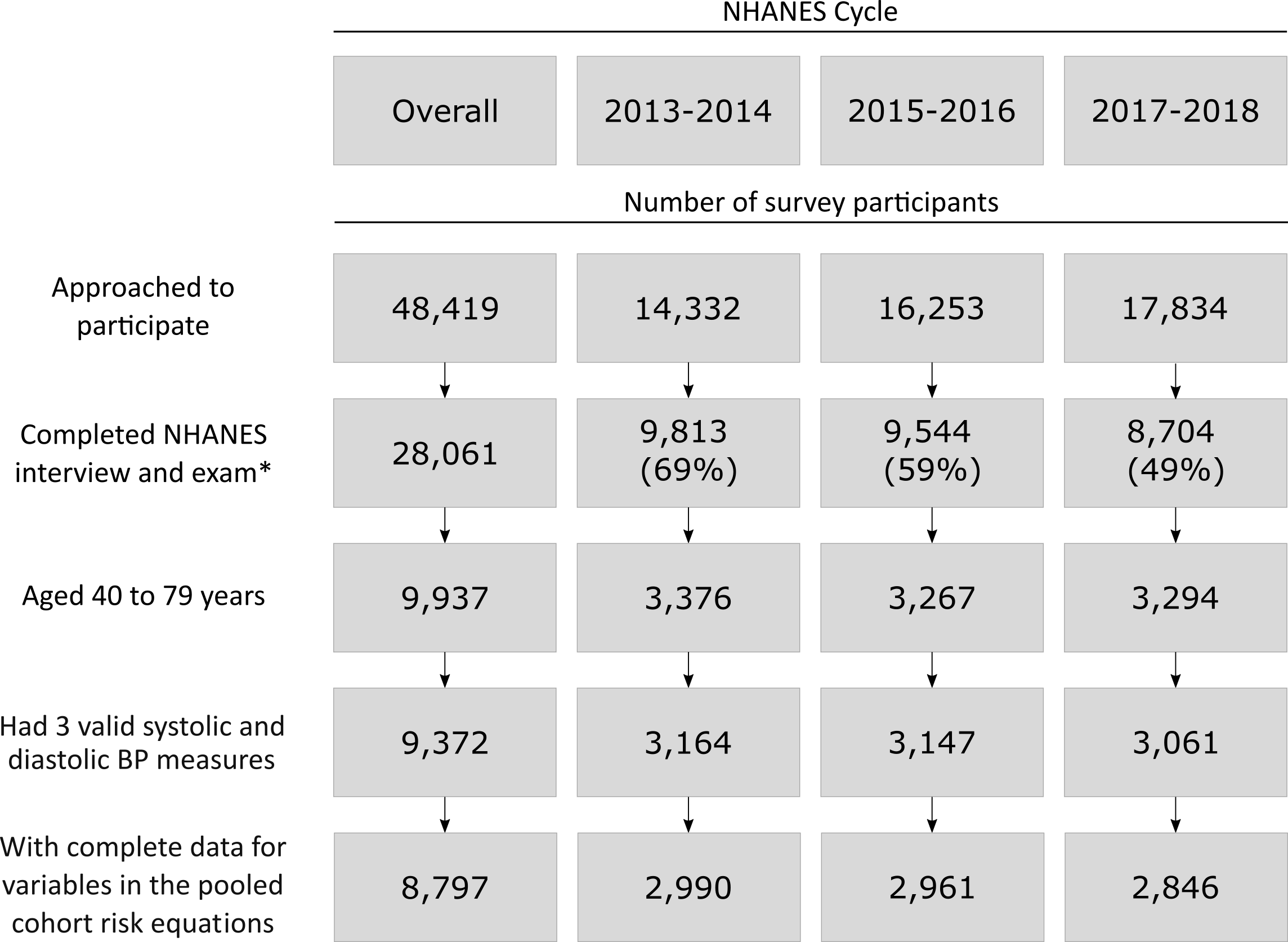
\* Age at which 50% of the population is expected to have a predicted 10-year risk for atherosclerotic cardiovascular disease ≥ 10%.

SUPPLEMENT

Table S1: Characteristics of US adults with stage 1 hypertension, overall and with diabetes, chronic kidney disease, ≥ 65 years of age, or any of the three preceding conditions

|  | | **Sub-groups** | | | |
| --- | --- | --- | --- | --- | --- |
| **Characteristic\*** | **Overall  N = 1,271** | **Diabetes  N = 204†** | **CKD‡** | **Age 65+ years  N = 236** | **Diabetes, CKD, or age 65+ years** |
| Age, years | 54.0 (0.4) | 56.8 (1.2) | 57.0 (1.2) | 69.7 (0.4) | 61.5 (0.8) |
| Male | 52.3 | 58.5 | 48.8 | 51.5 | 51.9 |
| Race / ethnicity | | | | | |
| Non-Hispanic White | 66.3 | 60.0 | 59.1 | 73.8 | 65.5 |
| Non-Hispanic Black | 9.8 | 11.4 | 12.7 | 7.4 | 10.3 |
| Hispanic | 14.2 | 19.9 | 19.2 | 10.3 | 15.1 |
| Non-Hispanic Asian | 6.0 | 7.6 | 7.0 | 4.2 | 6.0 |
| Other Race/ethnicity - Including Multi-Racial | 3.7 | 1.2 | 1.9 | 4.4 | 3.1 |
| Total cholesterol, mg/dl | 205.0 (2.4) | 188.8 (4.6) | 198.4 (5.0) | 195.4 (3.5) | 195.8 (2.9) |
| HDL-cholesterol, mg/dl | 54.0 (0.7) | 47.1 (1.5) | 53.2 (2.3) | 57.9 (1.4) | 53.8 (1.0) |
| Systolic blood pressure, mm Hg | 129.6 (0.3) | 131.1 (0.7) | 131.2 (0.7) | 132.5 (0.6) | 131.3 (0.4) |
| Diastolic blood pressure, mm Hg | 78.6 (0.4) | 76.7 (1.0) | 76.5 (0.8) | 72.2 (1.0) | 75.3 (0.6) |
| Antihypertensive medication use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Diabetes | 12.3 | 100.0 | 30.7 | 21.0 | 42.4 |
| Chronic kidney disease | 9.1 | 22.6 | 100.0 | 16.1 | 31.3 |
| Aged 65+ years | 15.7 | 26.9 | 27.8 | 100.0 | 54.2 |
| Current smoker | 19.3 | 18.8 | 23.3 | 10.7 | 16.4 |
| Prevalent CVD§ | 5.8 | 15.2 | 12.8 | 13.2 | 11.4 |
| \*Table values are mean (standard error) or proportion. | | | | | |
| †Diabetes was defined by fasting serum glucose ≥ 126 mg/dL, non-fasting glucose ≥ 200 mg/dL, HbA1c ≥ 6.5%, or self-reported use of insulin or oral glucose lowering medication. | | | | | |
| ‡Chronic kidney disease is defined by an albumin-to-creatinine ratio ≥ 30 mg/dl or an estimated glomerular filtration rate <60 ml/min/1.73m² | | | | | |
| §Prevalent cardiovascular disease was defined by self-report of previous heart failure, coronary heart disease, stroke, or myocardial infarction | | | | | |
| CKD = chronic kidney disease; CVD = cardiovascular disease; HDL = High density lipoprotein | | | | | |

Figure S1: Flowchart showing the number of NHANES participants included in the current analyses.



BP: blood pressure; NHANES: National Health and Nutrition Examination Survey.
\* The Completed NHANES interview and exam cells include number with the response rate in parentheses.

Figure S2: Estimated distribution of 10-year predicted cardiovascular risk among US adults with stage 1 hypertension and predicted risk < 10% overall and for those with diabetes, chronic kidney disease, ≥ 65 years of age, or any of the preceding conditions.



Results do not include data from survey participants with prevalent cardiovascular disease or 10-year predicted risk for cardiovascular disease ≥ 10%.

Figure S3: Estimated Probability of ten-year predicted risk for atherosclerotic cardiovascular disease ≥ 10% by age among US adults with stage 1 hypertension and diabetes, chronic kidney disease, and with without diabetes or chronic kidney disease.



\* Age at which 50% of the population is expected to have a predicted 10-year risk for atherosclerotic cardiovascular disease ≥ 10%.