

4

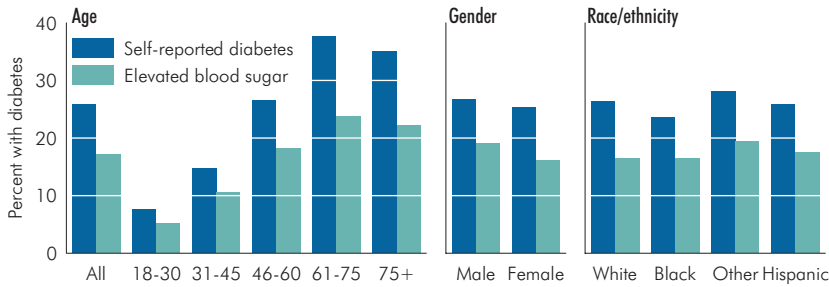
Diabetes & hypertension

“I was not aware of how high blood pressure can affect the kidneys. I was talking with other people who had attended (the screening) and the comments were very positive. Several told me they did not know they had sugar diabetes. When I go to my doctor now I make sure he checks my urine. Thank you!”

K&E&P participant: Screening date, August, 2005

diabetes
glycemic control
hypertension
blood pressure
control &
risk factors for
hypertension

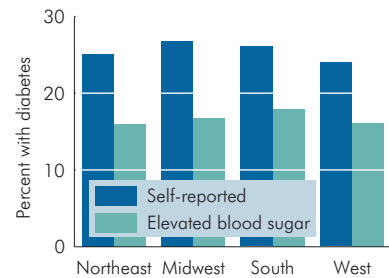
DIABETES



4.1

KEEP participants with diabetes, by age, gender, & race/ethnicity

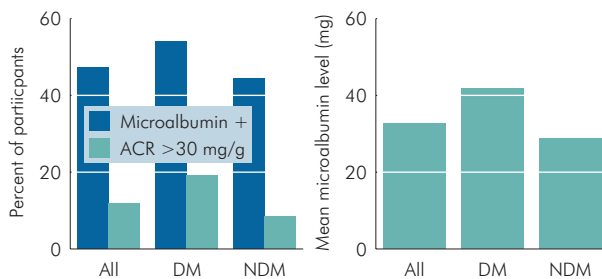
KEEP N= 53,217, age; 53,152, gender; 52,095, race.



4.3

KEEP participants with diabetes, by U.S. Census Region

KEEP N= 53,197.



4.5

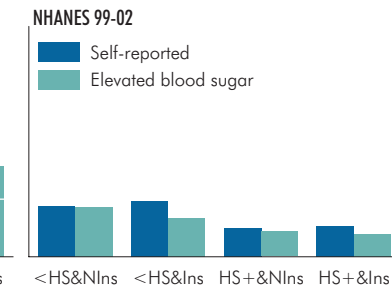
Microalbuminuria & ACR in KEEP participants, by diabetic status

KEEP N= 48,397; 44,068, ACR. Positive microalbumin, >20mg/L.

4.2

KEEP participants with diabetes, by cohort year

KEEP N= 53,217.



4.4

KEEP & NHANES participants with diabetes, by education & insurance status

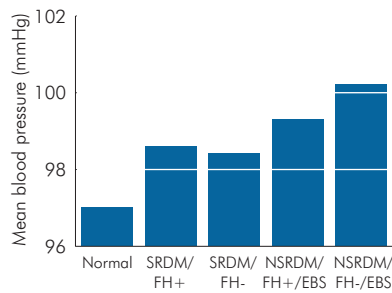
KEEP N= 50,615, NHANES N= 11,165, self-reported diabetes; 9,683, elevated blood sugar.

Diabetes and hypertension are two central health issues facing the U.S. population, and are major targets of the KEEP program.

Twenty-six percent of KEEP participants report having diabetes, while 17.1% have an elevated blood sugar. In participants age 61–75, 38% report having diabetes, and diabetes is present in 27% and 25% of men and women, respectively.

By, race/ethnicity, diabetes is most prominent in individuals of other races, at 28.1%, followed by 26.4% in whites,

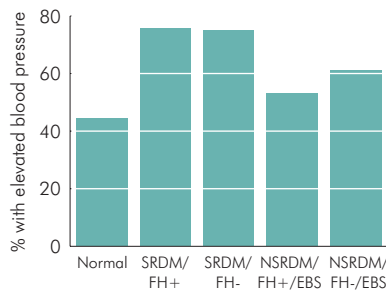
KEEP PARTICIPANTS, BY DIABETIC STATUS AND FAMILY HISTORY



4.6

Mean blood pressure

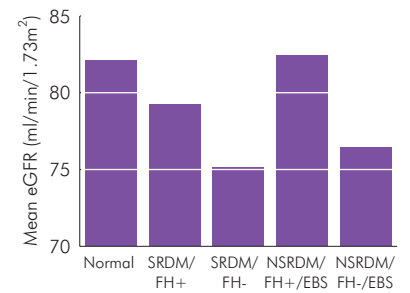
KEEP N= 54,317.



4.7

Elevated blood pressure

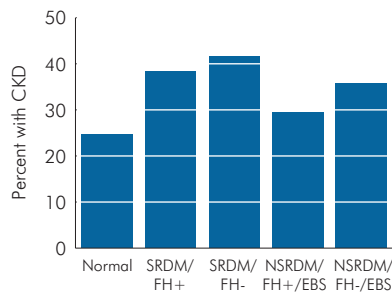
KEEP N= 54,317.



4.8

Mean eGFR

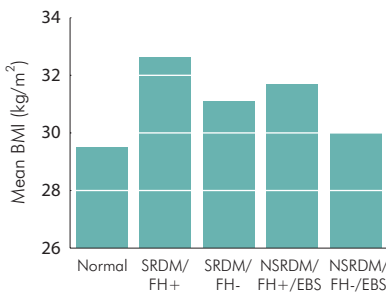
KEEP N= 52,892.



4.9

Presence of CKD

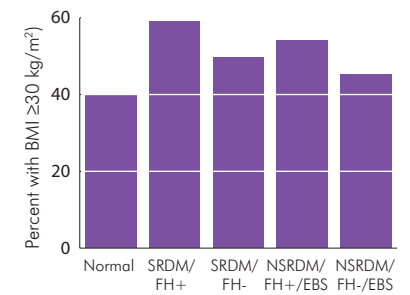
KEEP N= 45,311.



4.10

Mean BMI

KEEP N= 54,463.



4.11

BMI ≥ 30 kg/m²

KEEP N= 54,463.

25.9% in Hispanics, and 23.6% in blacks. Individuals residing in the West have the lowest rates of diabetes, at 24%.

Diabetes is most common in KEEP and NHANES participants who are insured and have less than a high school education, at 38.1 and 9.7%, while in those with less than a high school education and no insurance rates of diabetes stand at 27.3 and 8.8%.

Fifty-four percent of KEEP participants with diabetes have a positive urinary albumin test, in comparison to 44% in those without diabetes.

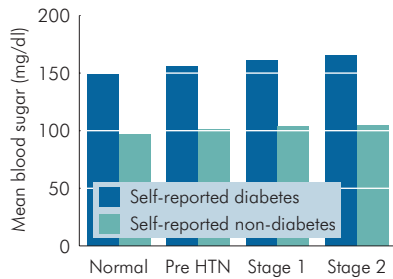
Mean blood pressure is highest in KEEP participants who report no diabetes or family history of the disease but who do have an elevated blood sugar.

Among KEEP participants, the lowest estimated glomerular filtration levels (eGFRs) occur in those who report having diabetes but do not have a family history of the disease, and rates of CKD are highest in these individuals, at 41.7%.

Mean BMI is highest, at 32.6%, in KEEP participants who report having diabetes and a family history of the disease—59% of these individuals have a BMI equal to or exceeding 30 kg/m².

GLYCEMIC CONTROL

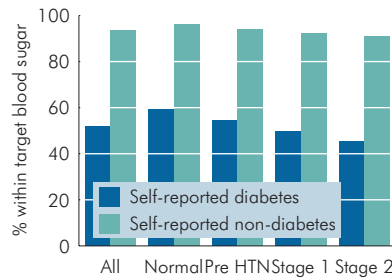
KEEP PARTICIPANTS WITH OR WITHOUT SELF-REPORTED DIABETES



4.12

Mean blood sugar, by hypertensive stage (JNC 7)

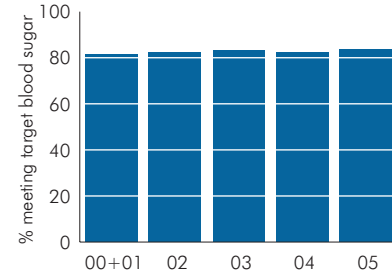
KEEP N = 52,530.



4.13

Participants who meet the target blood sugar level, by HTN stage (JNC 7)

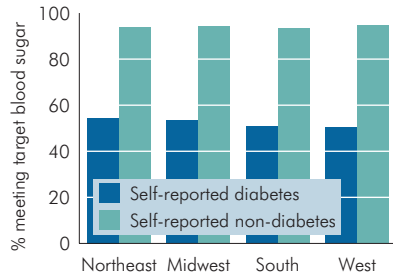
KEEP N = 52,530.



4.14

Participants who meet the target blood sugar level, by cohort year

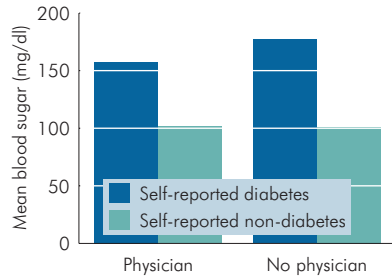
KEEP N = 53,749.



4.15

Participants meeting the target blood sugar level, by U.S. Census region

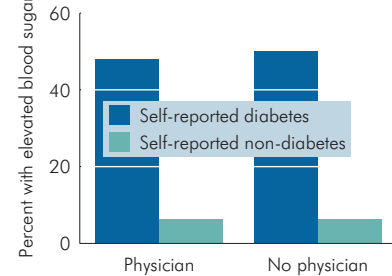
KEEP N = 53,197.



4.16

Mean blood sugar, by physician interaction

KEEP N = 51,778.



4.17

Elevated blood sugar, by physician interaction

KEEP N = 51,778.

Eighty-four percent of KEEP participants met the target blood sugar level (fasting <126 mg/dl, non-fasting <139 mg/dl) in 2005, compared to 81.6% in 2000–2001. In KEEP participants with self-reported diabetes, mean blood sugar levels increase with the severity of hypertension, ranging from 149.4 mg/dl in those classified as having a normal blood pressure (JNC 7) to 165.7 mg/dl in those identified as having Stage 2 hypertension. Participants with normal or prehypertensive classifications are the most likely to meet the target blood sugar level. Across U.S. Census Regions, 50–55% of KEEP participants with self-reported diabetes, and over 90% of those reporting no diabetes, meet the target blood sugar level. Of KEEP participants with self-reported diabetes, 47.8% who reported having a physician had an elevated blood

sugar compared to 50.1% of those without a physician. Physician interaction plays an important role in blood sugar level; levels in participants reporting they have a physician are 20 mg/dl lower than those in participants without a physician.

In self-reported non-diabetic KEEP participants, the odds of an elevated blood sugar are 36% higher for those age 61–75 than for those age 46–60, 24.5% higher for men than for women, 58% higher for those with a BMI equal to or exceeding 30 kg/m², and 22.4% higher in those with CKD. In KEEP participants with diabetes, the odds of having a blood sugar level in the target range are 37% higher in participants age 18–30 than in those age 46–60, 26% lower in males, 19% lower in individuals with a BMI equal to or exceeding 30 kg/m², and 24% lower in those with CKD.

	RR	lower	upper	p-value
18-30	0.402	0.314	0.515	<.0001
31-45	0.662	0.576	0.761	<.0001
61-75	1.363	1.205	1.543	<.0001
> 75	1.424	1.182	1.716	0.0002
male	1.245	1.12	1.384	<.0001
black	1.252	1.117	1.404	0.0001
other	1.565	1.365	1.795	<.0001
Smoking & used to smoke	1.067	0.965	1.179	0.2037
Self-reported HTN	1.206	1.082	1.345	0.0007
Family history of diabetes	1.264	1.138	1.404	<.0001
Family history of hypertension	0.871	0.771	0.983	0.0258
BMI ≥ 30	1.583	1.431	1.75	<.0001
CKD	1.224	1.093	1.372	0.0005
Northeast	0.883	0.78	0.999	0.0482
Midwest	0.878	0.763	1.011	0.0709
West	0.806	0.676	0.96	0.0159

4.a

Odds of self-reported non-diabetic KEEP participants having an elevated blood sugar

KEEP N= 28,200.

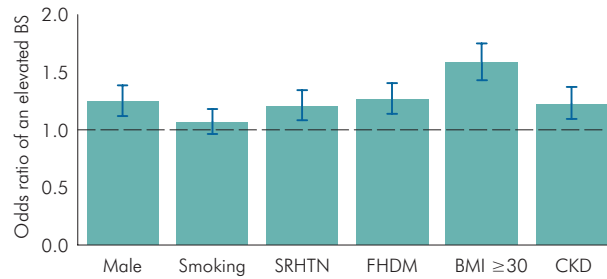
	RR	lower	upper	p-value
18-30	1.372	1.044	1.803	0.0231
31-45	1.167	1.023	1.33	0.0212
61-75	1.02	0.926	1.123	0.6872
> 75	1.118	0.967	1.294	0.1324
male	0.738	0.675	0.807	<.0001
black	0.955	0.868	1.052	0.3521
other	0.794	0.709	0.888	<.0001
Smoking & used to smoke	0.997	0.918	1.084	0.9507
Self-reported HTN	0.935	0.849	1.029	0.1687
Family history of diabetes	0.832	0.753	0.919	0.0003
Family history of hypertension	1.187	1.074	1.312	0.0008
BMI ≥ 30	0.811	0.745	0.883	<.0001
CKD	0.759	0.696	0.828	<.0001
Northeast	1.147	1.035	1.271	0.009
Midwest	1.126	1.006	1.261	0.0388
West	1.008	0.871	1.167	0.9122

4.b

Odds of meeting the target blood sugar level in known KEEP diabetic participants

KEEP N= 28,200.

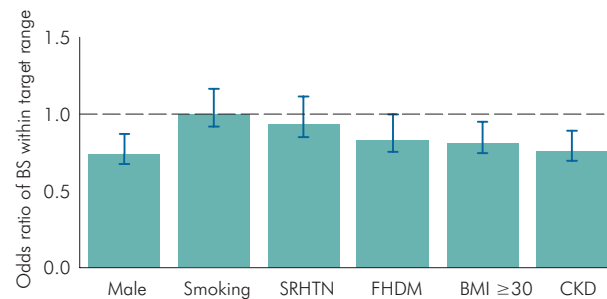
Reference groups: age 46–60, female, white, never smoked, no self-reported hypertension, no family history of diabetes, no family history of hypertension, BMI <30 kg/m², no CKD, and South.



4.18

Odds of self-reported non-diabetic KEEP participants having an elevated blood sugar, by risk factor

KEEP N= 9,785.

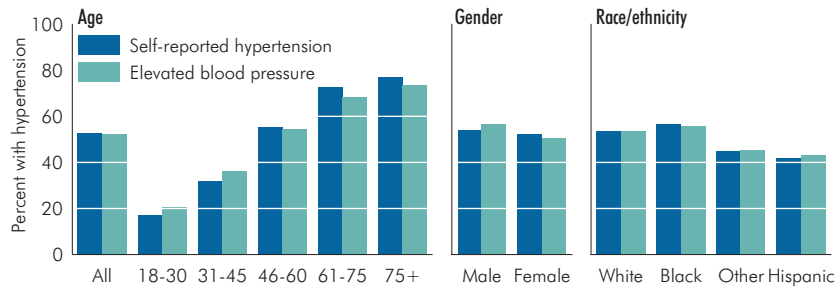


4.19

Odds of being within the target blood sugar level in known KEEP participants with diabetes, by risk factor

KEEP N= 9,785.

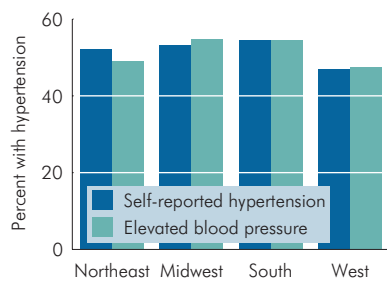
HYPERTENSION



4.20

KEEP participants with hypertension, by age, gender, & race/ethnicity

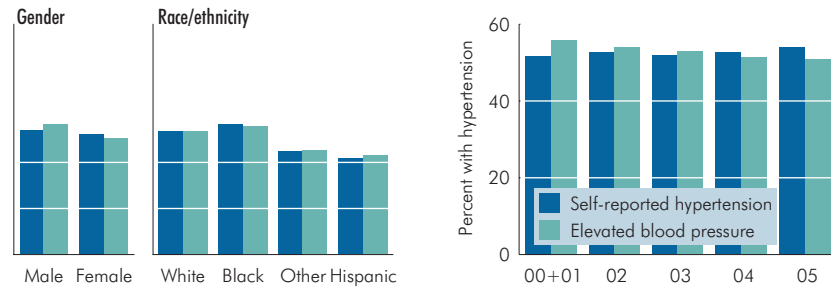
KEEP N= 53,681, age; 53,612 gender, 52,541 race.



4.22

KEEP participants, by U.S. Census Region

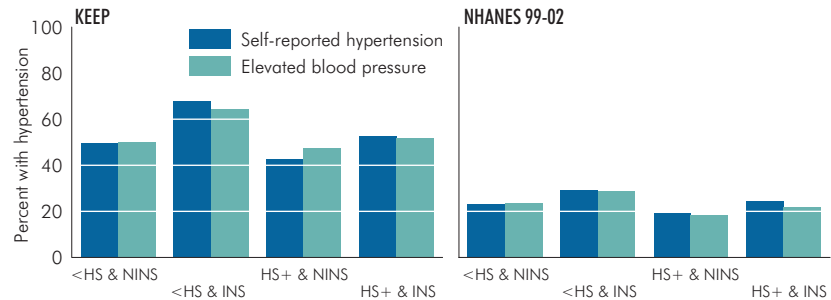
KEEP N= 53,662.



4.21

KEEP participants with hypertension, by cohort year

KEEP N= 53,681.



4.23

KEEP & NHANES participants with hypertension, by education & insurance status

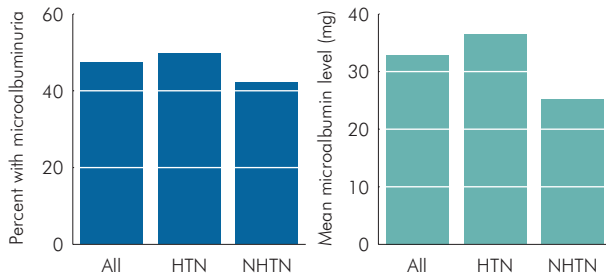
KEEP N= 51,033. NHANES N= 11,014, self-reported hypertension; 9,275, elevated blood pressure.

The percent of KEEP participants with hypertension has remained stable, by year, at 50–56%. Overall, more than half of eligible KEEP participants report having hypertension or have an elevated blood pressure. Black participants are most likely to report having hypertension or to have an elevated blood pressure, at 56.6 and 55.5% respectively, followed by whites at 53.8 and 56.6%.

A greater percentage of KEEP participants living in the Midwest or the South have hypertension compared to those living in the Northeast or West. Microalbuminuria is present in 49.7% of KEEP participants with hypertension compared to 42.2% in those without the diagnosis, while mean microalbumin levels are 37 and 25 mg, respectively. Mean blood

pressure in KEEP participants has fallen by only 2% since the beginning of the study, and is highest in those who report no hypertension but have an elevated blood pressure and a family history of the condition. Nearly 70% of KEEP participants with self-reported hypertension have a measured elevated blood pressure.

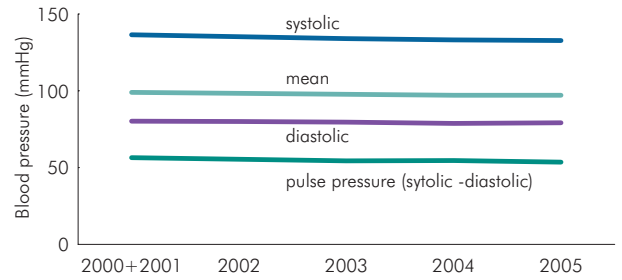
Mean eGFR is lowest in KEEP participants who report being hypertensive but do not have a family history of the condition. CKD is most common in these individuals. Mean BMI is highest in KEEP participants who report being hypertensive and have a family history of the condition. Of KEEP participants with self-reported hypertension and a family history of the condition, 54% have a BMI equal to or greater than 30 kg/m².



4.24

Microalbuminuria in KEEP participants, by hypertensive status

KEEP N= 49,814. Positive microalbumin, >20mg/L

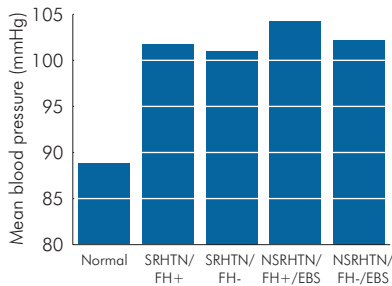


4.25

Blood pressure parameters in KEEP participants, by cohort year

KEEP N= 54,320.

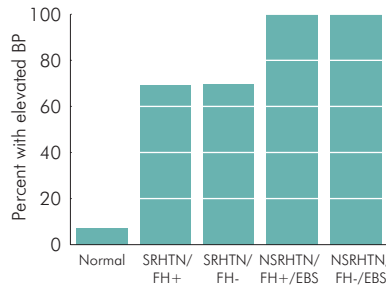
KEEP PARTICIPANTS, BY HYPERTENSIVE STATUS AND FAMILY HISTORY



4.26

Mean blood pressure

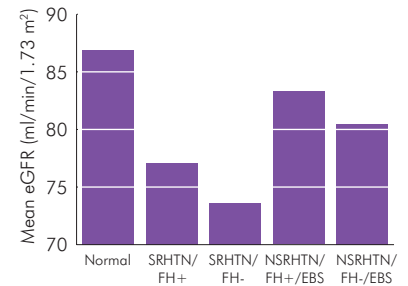
KEEP N= 54,320.



4.27

Elevated blood pressure

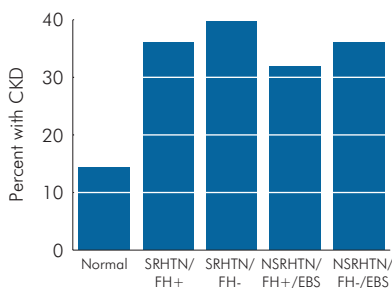
KEEP N= 54,320.



4.28

Mean eGFR

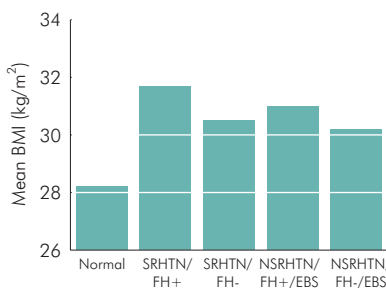
KEEP N= 52,887.



4.29

Presence of CKD

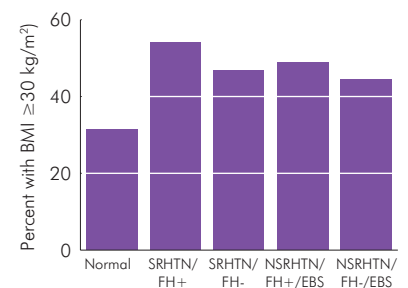
KEEP N= 45,308.



4.30

Mean BMI

KEEP N= 54,463.



4.31

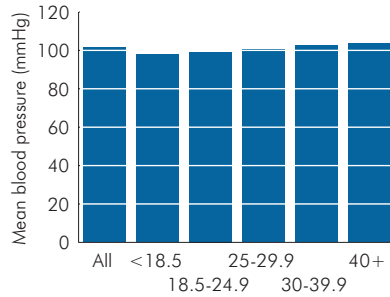
BMI ≥ 30 kg/m²

KEEP N= 54,463.

BLOOD PRESSURE CONTROL & RISK FACTORS FOR HYPERTENSION

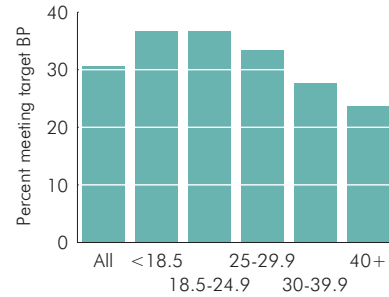
In KEEP participants, mean blood pressure increases with BMI, and is nearly 3 mmHg lower in those with a physician. Of KEEP participants who see a physician, 54% had an elevated blood pressure. In self-reported non-hypertensive KEEP participants with a blood relative who has had a heart attack or stroke, or who has PVD, a family history of cardiovascular disease does not appear to significantly influence the chances of having a risk factor for hypertension.

The odds of an elevated blood pressure in KEEP participants without self-reported hypertension and age 75 and older are more than double those found in participants age 46–60, and are twice as high in participants with a BMI equal to or exceeding 30 kg/m² compared to those with a normal BMI. The odds of an elevated blood pressure are three times higher in those with diabetes compared to those without the disease.



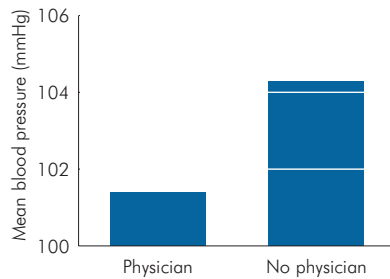
4-32 Mean blood pressure in KEEP participants with self-reported hypertension, by BMI

KEEP N = 27,968.



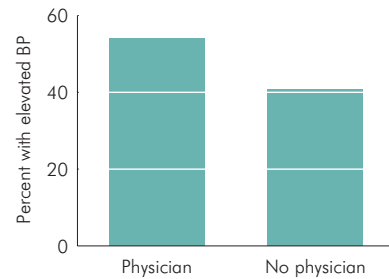
4-33 Target blood pressure (JNC 7) in KEEP participants with self-reported hypertension, by BMI

KEEP N = 28,376.



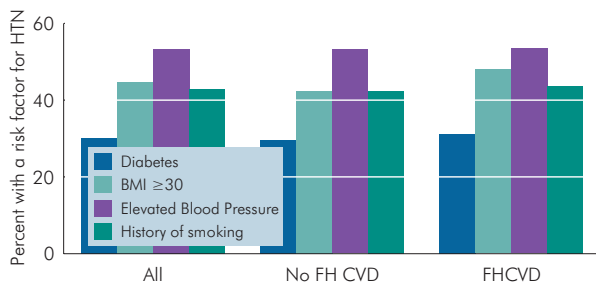
4-34 Mean blood pressure in KEEP participants with self-reported hypertension, by physician interaction

KEEP N = 27,595.



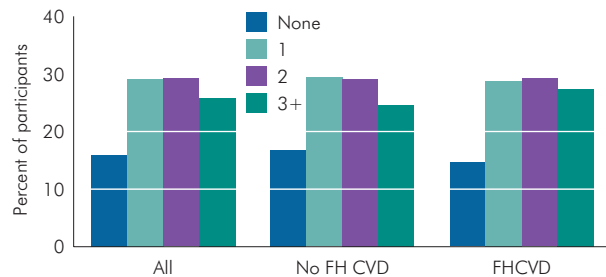
4-35 KEEP participants outside the target blood pressure range (JNC 7), by physician interaction

KEEP N = 27,595.



4-36 Risk factors for HTN in KEEP participants, by family history of PVD

KEEP N = 50,572.



4-37 Number of risk factors for hypertension in KEEP participants, by family history of PVD

KEEP N = 50,572.

	RR	Low	Upper	P-value
18-30	0.398	0.352	0.45	<.0001
31-45	0.613	0.563	0.668	<.0001
61-75	1.712	1.545	1.897	<.0001
>75	2.177	1.828	2.592	<.0001
Male	1.84	1.706	1.985	<.0001
Black	1.105	1.017	1.201	0.0188
Other race	0.88	0.8	0.969	0.0093
Smoking & used to smoke	0.888	0.826	0.954	0.0011
Self-reported diabetes	3.08	2.811	3.375	<.0001
Family history of diabetes	1.014	0.938	1.095	0.73
Family history of hypertension	1.273	1.166	1.391	<.0001
BMI ≥ 30	2.373	2.206	2.552	<.0001
CKD	3.185	2.915	3.481	<.0001
Northeast	0.791	0.725	0.864	<.0001
Midwest	1.003	0.909	1.107	0.9509
West	0.806	0.716	0.907	0.0004

4.c

Odds ratios of self-reported non-hypertensive KEEP participants having elevated blood pressure (JNC 7)

KEEP N= 17,869.

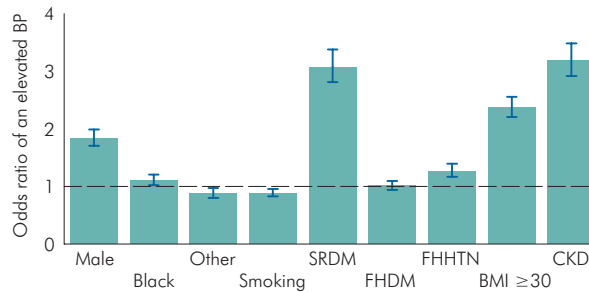
	RR	Low	Upper	P-value
18-30	1.966	1.636	2.362	<.0001
31-45	1.344	1.223	1.477	<.0001
61-75	0.827	0.765	0.893	<.0001
>75	0.734	0.653	0.825	<.0001
Male	0.784	0.73	0.841	<.0001
Black	0.844	0.785	0.908	<.0001
Other race	1.096	0.998	1.203	0.0552
Smoking & used to smoke	1.137	1.065	1.213	0.0001
Self-reported diabetes	0.469	0.435	0.505	<.0001
Family history of diabetes	1.07	0.999	1.146	0.0537
Family history of hypertension	0.942	0.865	1.025	0.1656
BMI ≥ 30	0.692	0.648	0.739	<.0001
CKD	0.419	0.389	0.451	<.0001
Northeast	1.219	1.126	1.319	<.0001
Midwest	0.928	0.847	1.017	0.1082
West	0.98	0.872	1.1	0.7303

4.d

Odds ratios of meeting target blood pressure (JNC 7) in KEEP participants with known hypertension

KEEP N= 20,135.

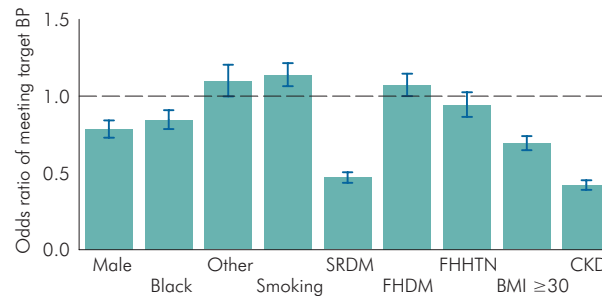
Reference groups: age 46-60, female, white, never smoked, no self-reported hypertension, no family history of diabetes, no family history of hypertension, BMI <30 kg/m², no CKD, and South



4.38

Odds of self-reported non-hypertensive KEEP participants having an elevated blood pressure, by risk factor

KEEP N= 17,869.



4.39

Odds of meeting target blood pressure (JNC 7) in KEEP participants with known hypertension, by risk factor

KEEP N= 20,135.

CHAPTER HIGHLIGHTS

Figure 4.1

Twenty-six percent of KEEP participants report having diabetes, while 17.1% have an elevated blood sugar. In participants age 61–75, 38% report having diabetes, and diabetes is present in 27% and 25% of men and women, respectively.

Table 4.b

In KEEP participants with diabetes, the odds of having a blood sugar level in the target range are 37% higher in participants age 18–30 than in those age 46–60, 26% lower in males, 19% lower in individuals with a BMI equal to or exceeding 30 kg/m², and 24% lower in those with CKD.

Figure 4.20

Overall, more than half of eligible KEEP participants report having hypertension or have an elevated blood pressure. Black participants are most likely to report having hypertension or to have an elevated blood pressure, at 56.6 and 55.5% respectively, followed by whites at 53.8 and 56.6%.

Figure 4.21

The percent of KEEP participants with hypertension has remained stable, by year, at 50–56%.

Figure 4.32

In KEEP participants, mean blood pressure increases with BMI.

Table 4.c

The odds of an elevated blood pressure in KEEP participants without self-reported hypertension and age 75 and older are more than double those found in participants age 46–60, and are twice as high in participants with a BMI equal to or exceeding 30 kg/m² compared to those with a normal BMI. The odds of an elevated blood pressure are three times higher in those with diabetes compared to those without the disease.

DIABETES

Self-reported diabetes
Elevated blood sugar

DIABETIC GROUPS

- 1: Self-reported DM, (+) family history
- 2: Self-reported DM, (-) family history
- 3: Self-reported NDM, (+) family history & elevated blood sugar
- 4: Self-reported NDM, (-) family history & elevated blood sugar

GLUCOSE GREATER THAN THE NORMAL LIMIT

Fasting: >126 mg/dl
Non-fasting: >139 mg/dl

ELEVATED BLOOD SUGAR (EBS)

glucose >normal limit: fasting, >126 mg/dl; non-fasting, >139 mg/dl

ELEVATED ALBUMIN/CREATININE RATIO

ACR ≥30 mg/g

POSITIVE MICROALBUMIN

>20 mg/L

HYPERTENSION GROUPS

- 1: Self-reported HTN, (+) family history
- 2: Self-reported HTN, (-) family history
- 3: Self-reported NHTN, (+) family history & elevated blood pressure
- 4: Self-reported NHTN, (-) family history & elevated blood pressure

MEAN BLOOD PRESSURE

(Systolic-Diastolic)/3 + Diastolic

ELEVATED BLOOD PRESSURE (EBP) (JNC 7)

DM or CKD:
systolic: ≥130 mmHg or diastolic: ≥80 mmHg
No DM or CKD:
systolic: ≥140 mmHg or
diastolic: ≥90 mmHg

RISK FACTORS FOR HYPERTENSION

Diabetes
Elevated blood pressure
BMI ≥30
Smoking history

HYPERTENSION TOTAL

Self-reported hypertension
Elevated blood pressure

CKD DEFINITION

If eGFR by K/DOQI MDRD <60 ml/min/1.73 m² or eGFR ≥60 ml/min/1.73 m² and abnormal albumin/creatinine ratio (ACR ≥30mg/g)

BODY MASS INDEX CATEGORIES

UW: underweight, BMI <18.5
N: normal, BMI 18.5–24.9
OW: overweight, BMI 25–29.9
OB: obese, BMI 30–39.9
EOB: extremely obese, BMI ≥40

EDUCATION & INSURANCE

<HS&NIns: Less than a high school education, & no insurance
<HS&Ins: Less than a high school education, & insurance
HS+&NIns: High school education or greater, & no insurance
HS+&Ins: High school education or greater, & insurance