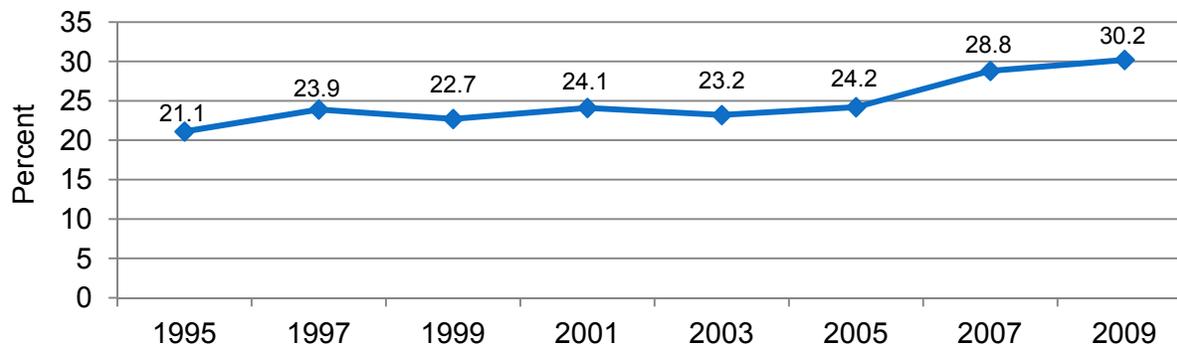




The Burden of High Blood Pressure

High blood pressure, often referred to as a “silent killer,” affects approximately 68 million (31%) U.S. adults.¹ In Hawaii, 30.2% of adults, or 304,000 people, reported in 2009 that they were told by a health care professional that they had high blood pressure.² Nationally, approximately 8% of the adult population has undiagnosed hypertension, so the actual prevalence in Hawaii may be higher.³ Nationally, the prevalence of high blood pressure, a major risk factor for cardiovascular disease, has remained unchanged at approximately 30% for the ten year period 1999-2008.⁴ Meanwhile, in Hawaii, self-reported high blood pressure among adults increased 43% from 21.1% in 1995 to 30.2% in 2009 (Figure 1).² The prevalence of U.S. adults with both high blood pressure and high blood cholesterol, both associated with cardiovascular disease, was 9% in 1999-2006.³ During the same time period 3% of U.S. adults had high blood pressure, high blood cholesterol, and diabetes.³ In 2009, 15.7% of Hawaii adults had comorbid high blood pressure and high blood cholesterol² and 3.7% had comorbid high blood pressure, high blood cholesterol, and diabetes.⁵

Figure 1: Prevalence of Adult High Blood Pressure, Hawaii 1995-2009



Source: Hawaii Behavioral Risk Factor Surveillance System

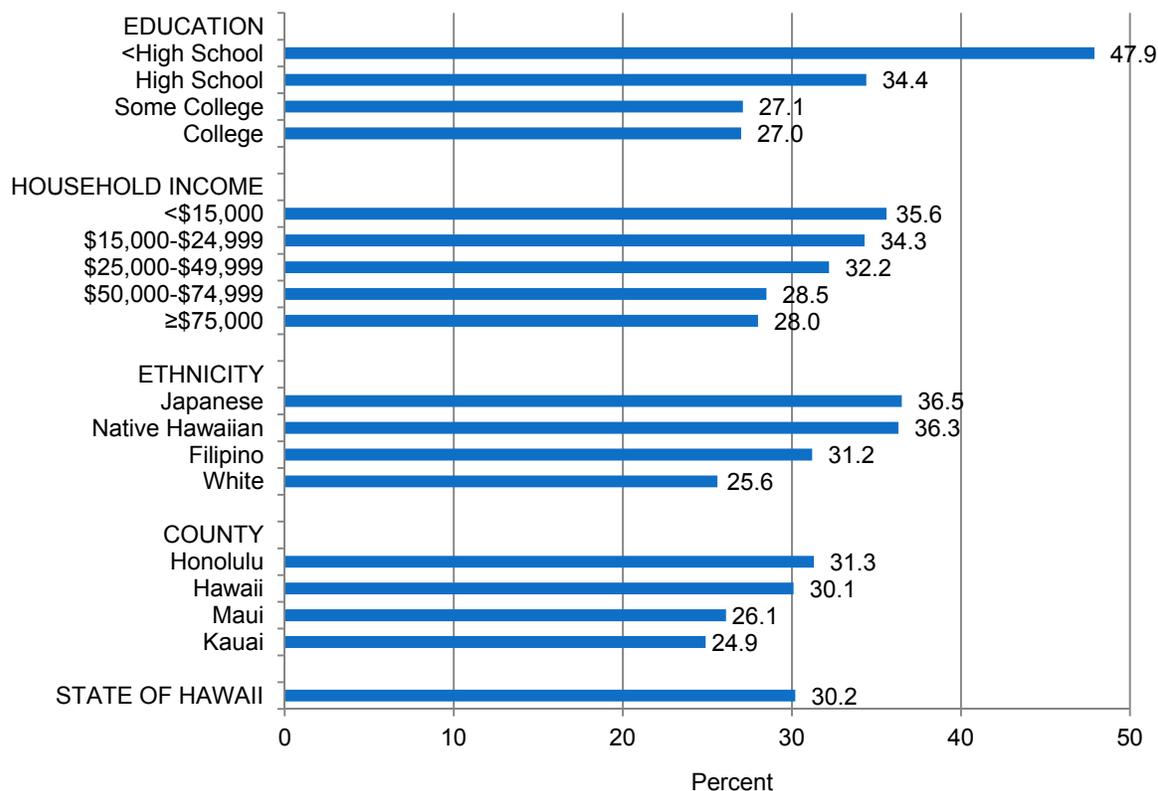
Although approximately 1 in 3 Hawaii adults has high blood pressure, some disparities exist in subgroups of the population.² The prevalence of high blood pressure is disproportionately higher in Hawaii residents with less than a high school degree and low household income (Figure 2).² Hawaii residents of Japanese or Native Hawaiian ancestry also have a high blood pressure prevalence above the state average (Figure 2).²

Risk Factors for High Blood Pressure

Non-modifiable risk factors for high blood pressure include age, ethnicity, and family history of high blood pressure.⁶ Modifiable risk factors for high blood pressure include overweight and obesity, physical inactivity, tobacco use, stress, poor diet, and excessive alcohol intake.⁶ In

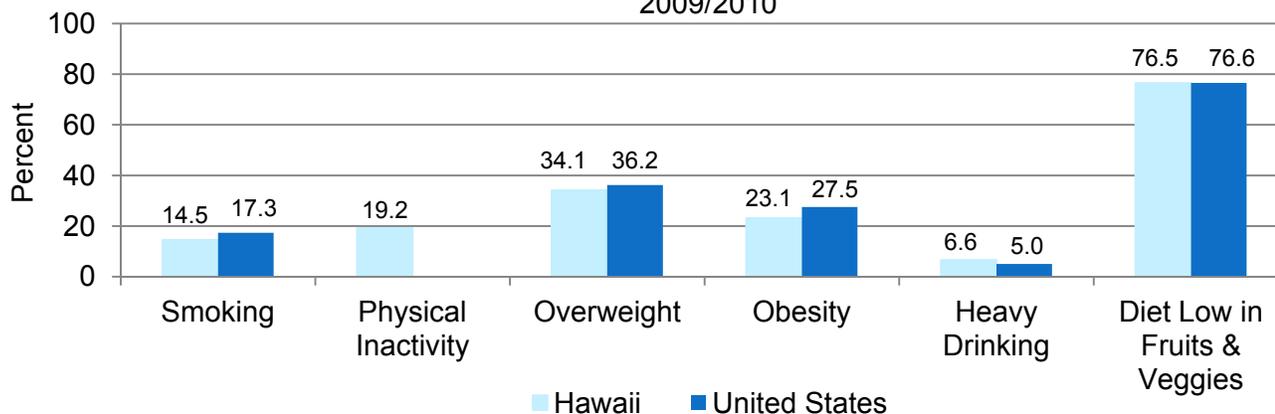
Hawaii, the prevalence of modifiable risk factors among adults is similar to the median prevalence among the 50 United States and the District of Columbia (Figure 3).^{2,7}

Figure 2: Adult High Blood Pressure Prevalence by Demographics, Hawaii 2009



Source: Hawaii Behavioral Risk Factor Surveillance System

Figure 3: Adult Prevalence of High Blood Pressure Risk Factors, U.S. and Hawaii 2009/2010



Source: Hawaii Behavioral Risk Factor Surveillance System, U.S. Behavioral Risk Factor Surveillance System, 2009/2010
 Note: U.S. includes the median prevalence of the 50 states and the District of Columbia; data on diet low in fruits and veggies (eating fruits and veggies < 5 times per day) comes from 2009 BRFSS; data on smoking, physical inactivity (no leisure time physical activity in past 30 days), overweight, obesity, and heavy drinking (> 2 drinks per day for men and > 1 drink per day for women) comes from 2010 BRFSS.

The Importance of Sodium Reduction

Diets high in sodium increase the risk of high blood pressure and death.^{8,9} The average American eats 3,330 mg sodium per day¹⁰ which surpasses the *Dietary Guidelines for Americans 2010* recommendation of no more than 2,300 mg sodium per day (or 1,500 mg sodium/day among individuals who are 51 or older, African American, or have hypertension, diabetes, or chronic kidney disease).¹¹ With 77% of daily sodium coming from processed and restaurant food, it is increasingly difficult to meet the guidelines for sodium consumption.¹² Financial analysis shows that reducing the average consumption of sodium to a maximum of 2,300 mg of sodium per day may reduce the number of Americans with high blood pressure by 11 million and save \$18 billion in healthcare dollars.¹³ Similarly, reducing the average sodium consumption by 1,200 mg per day has the potential to reduce the U.S. annual number of new cases of coronary heart disease by 60,000 to 120,000, stroke by 32,000 to 66,000, myocardial infarction by 54,000 to 99,000, and the number of deaths from any cause by 44,000 to 92,000.¹⁴

Awareness, Treatment, and Control of High Blood Pressure

According to an analysis of NHANES*, the number of American adults with high blood pressure who were aware of their condition increased from 69.6% in 1999-2000 to 80.6% in 2007-2008.⁴ This increase in awareness also paralleled an increase in the number of U.S. adults taking medication to control their high blood pressure which increased from 59.4% to 71.6% during the same time period.⁴ Men and women, all age groups, and all ethnic groups analyzed showed a significant increase in control of blood pressure (<140/90 mmHg) between 1999-2000 and 2007-2008.⁴ Overall, control of high blood pressure increased from 31.6% to 48.4% of U.S. adults with high blood pressure.⁴ While improvements have been made in the awareness, treatment, and control of high blood pressure, half of all adults with high blood pressure still don't have it under control.^{1,4,15}

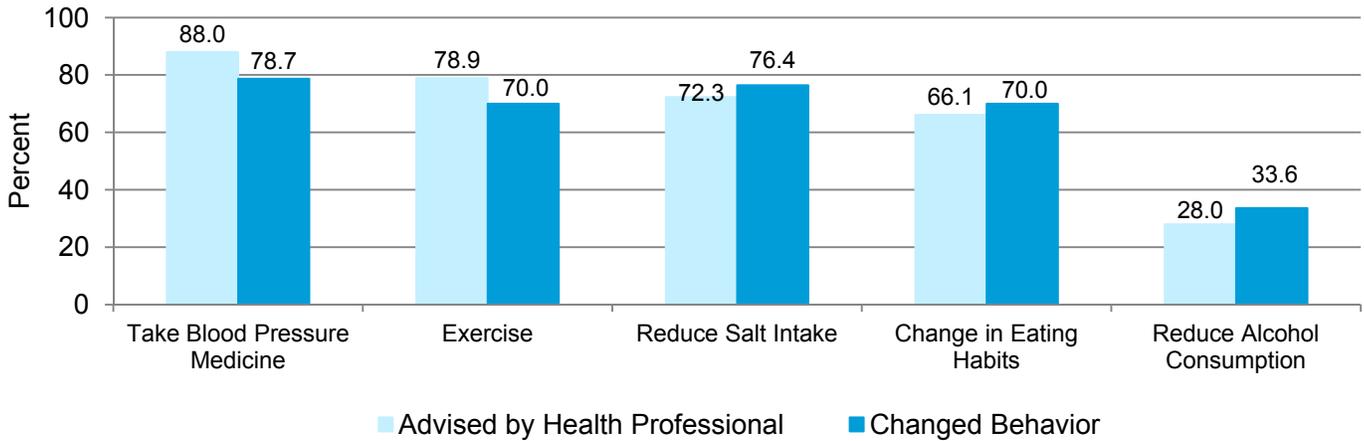
In Hawaii, 88% of Hawaii adults with high blood pressure were advised by a health professional to take medication and 78.7% reported taking medication to reduce their blood pressure in 2009 (Figure 4).² Hawaii adults with high blood pressure report receiving advice from their health professional to exercise (78.9%), reduce salt intake (72.3%), change their eating habits (66.1%) and reduce alcohol consumption (28.0%) (Figure 4).² The percent of hypertensive adults who made these behavior changes was 70.0%, 76.4%, 70.0%, and 33.6%, respectively (Figure 4).²

The prevalence of medically confirmed high blood pressure control is known for a small subgroup of Hawaii's population. Among QUEST and QExA enrollees[†] (Medicaid) aged 18-85, 45.8% who were diagnosed with hypertension had their blood pressure under control (<140/90) in 2010.¹⁶

* National Health and Nutrition Examination Survey

[†] QUEST is Hawaii's Medicaid plan for patients less than 65 years of age and not certified blind or disabled; Quest Expanded Access (QExA) is an option for Medicaid patients over 65 years or those certified blind or disabled.

Figure 4: Prevalence of Hawaii Adults with High Blood Pressure Who Were Advised by a Health Professional to Take Action to Control Their High Blood Pressure, Hawaii 2009



Source: Hawaii Behavioral Risk Factor Surveillance System

The Impact of High Blood Pressure

Approximately, 395,000 deaths in the U.S. are attributed to high blood pressure every year.¹⁷ High blood pressure is second only to tobacco use in the number of U.S. deaths it causes annually among dietary, lifestyle, and metabolic risk factors.¹⁷

As noted in the *Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)*, “The relationship between blood pressure and risk of CVD events is continuous, consistent, and independent of other risk factors. The higher the blood pressure, the greater the chance of heart attack, heart failure, stroke, and kidney disease.”¹⁸ Hypertension is present in 69% of people who have a first heart attack, 77% of those who have a first stroke, and 74% of those who have congestive heart failure.⁶ Elevated blood pressure is also associated with a decrease in life expectancy and a decrease in life expectancy free of CVD.¹⁹ A man or woman with hypertension at age 50 is expected to live 5.1 and 4.9 years less, respectively, than someone with normal blood pressure.¹⁹ Even adults with prehypertension (120-139/80-89 mmHg) have 1.5 to 2 times the risk of cardiovascular events compared to adults with normal blood pressure.²⁰

The Cost of High Blood Pressure

In 2007, the direct and indirect costs associated with high blood pressure were \$43.5 billion in the U.S.⁶ However, the American Heart Association has projected that the total costs associated with high blood pressure are expected to increase to \$240.1 billion by 2030.²¹

In Hawaii, the direct cost of high blood pressure is estimated to increase from \$110 million in 2003 to \$250 million in 2023.²² Similarly, indirect costs (such as individual and caregiver loss of

productivity) associated with high blood pressure are expected to increase from \$970 million to \$2.7 billion between 2003 and 2023.²² This equates to a projected 127% increase in direct costs and a 178% increase in indirect costs over this 20 year period.

Every year, high blood pressure contributes to an estimated medical cost of \$1,000 per person per year nationally.²³ In Hawaii, Medicaid incurs an estimated cost of \$2,120[†] per beneficiary per year due to hypertension and related complications.²⁴

Benefits of Reducing High Blood Pressure

Research has shown that an average reduction of 12 to 13 mm Hg in systolic blood pressure over 4 years can reduce the risk of coronary heart disease by 21%, stroke (37%), cardiovascular mortality (25%), and all-cause mortality (13%).²⁵

When comparing the use of clinical preventive services such as hypertension treatment, hyperlipidemia treatment, aspirin prophylaxis, smoking cessation, cancer screenings, and influenza and pneumococcal vaccination, research has shown that increased utilization of hypertension treatment has the greatest potential to save lives.²⁶ For every 10% increase in hypertension treatment, 14,000 deaths could be prevented.²⁶ This effect is explained in part because high blood pressure is a common risk factor, hypertension treatment is known to have an effect on cause-specific and all-cause mortality in hypertensive patients, and current utilization is below achievable levels. Farley and colleagues state that “the greatest population benefit through these specific clinical preventive services now lies not in improving screening but in improving treatment and adherence.”²⁶

Health Care Utilization due to High Blood Pressure

Access to medical care is necessary but not sufficient for control of high blood pressure at the population level. In fact, NHANES III found that 75% of adults who were unaware that they had hypertension had had their blood pressure measured by a health professional in the preceding year.²⁷ While hypertension is the most frequent primary medical diagnosis for office visits, accounting for 23.7% of all office visits in 2007,²⁸ 92% of all patients with uncontrolled hypertension had insurance, 86% reported having a usual source of care, and the mean number of visits to physicians in this group was 4.28 per year.²⁷

In an attempt to determine the quality of healthcare provided in the U.S., researchers found that patients with high blood pressure received 64.7% of the recommended care for hypertension based on patient interviews and medical record reviews.²⁹ Analysis of physician adherence to hypertension guidelines in six family medicine community-based residency training offices found moderate physician adherence.³⁰ While adherence to hypertension guidelines was greater for patients with comorbid conditions, adherence for different guideline areas varied. Among patients with uncontrolled hypertension, 4.4% had a documented recommended blood pressure

[†] Cost estimates from the 2001-2005 Medical Expenditure Panel Survey (MEPS) inflated to 2007 dollars.

goal, 21.5% had a documented discussion of lifestyle recommendations, and 55.9% had their medication increased or changed when their blood pressure was uncontrolled.³⁰

Benefits of Guidelines to Measure, Classify, and Treat High Blood Pressure

Following JNC 7 blood pressure guidelines to measure blood pressure is important for accurate blood pressure measurements. Errors as low as plus or minus 5 mmHg in the 90-95 mmHg range can falsely diagnose an additional 27 million patients with high blood pressure and result in unnecessary treatment costs or could miss 21 million patients who would go untreated for high blood pressure which can result in CVD morbidity and premature death in the U.S.²³ A discrepancy of 5 mmHg can be due to observer or equipment errors such as terminal digit bias (the tendency to round blood pressure measurements to the nearest zero) and failure to properly calibrate equipment.^{23,31,32} Additional deviations in blood pressure could be the result of an improperly fitted cuff, a cuff used over clothing, patients with unsupported arm/feet/back, not resting three to five minutes before measurement is taken, smoking or consuming alcohol or caffeine within 30 minutes of measurement, and a full bladder which can contribute to fluctuations in blood pressure between 5 and 40 mmHg.^{32,33}

Table 1: JNC 7 Classification of Blood Pressure

BP Classification	Systolic BP mmHg	Diastolic BP mmHg
Normal	< 120	and < 80
Prehypertension	120-139	or 80-89
Hypertension, Stage 1	140-159	or 90-99
Hypertension, Stage 2	≥ 160	or ≥ 100

In addition to more accurate blood pressure measurements, research has shown significant improvements in control of high blood pressure in diabetics and non-diabetics following the release of the JNC 7 guidelines in 2003.³⁴ After controlling for certain high blood pressure risk factors, medication use, and geographic region, patients in the cohort before the release of JNC 7 were 45% less likely to achieve blood pressure control compared to the cohort post-JNC 7.³⁴ Additionally, Fischer and Avorn have shown that a large proportion of prescriptions for hypertension do not follow JNC 7 guidelines and if evidence-based pharmacologic recommendations were followed, \$1.2 billion per year may be saved on hypertensive drug spending among elderly Americans.³⁵

Clinical Interventions to Improve Blood Pressure Control

Since many patients with high blood pressure have access to medical care, interventions at the clinic level can be explored to improve high blood pressure control, including interventions to improve physician adherence to blood pressure guidelines. However, physicians cite the presence of comorbidities, patient noncompliance, time constraints, satisfaction with patient's blood pressure level (even when blood pressure is high or prehypertensive), and clinical inertia as common factors influencing adherence to blood pressure guidelines.^{30,36} Clinical tools to help physicians follow blood pressure guidelines include electronic health records (EHR) and clinical decision support (CDS). Samal and colleagues have found clinics with both EHR and CDS have patients with lower mean systolic blood pressures and higher rates of controlled hypertension than clinics with neither.³⁷

Another study conducted in a cardiology clinic compared patients with electronic medical records to patients with traditional medical records and found the former group to have a higher rate of documented hypertension, a higher rate of antihypertensive drug therapy, and a higher percent with controlled blood pressure ($\leq 140/90$ mmHg).³⁸

Conclusion

With safe and effective treatments for hypertension readily available, improvements in blood pressure treatment and control have great potential to further the health and wellness of patients. The JNC 7 guidelines include recommendations on blood pressure measurement, classification, risk factors, lifestyle modification, and treatment algorithms to help physicians accurately assess high blood pressure in their patients and help those who have hypertension control their blood pressure which will save lives, improve quality of life, and reduce costs. Several tools are available, such as EHR and CDS, to help physicians keep their patients healthy and decrease the burden of high blood pressure on the nation and Hawaii.

Resources

JNC 7 guidelines	http://www.nhlbi.nih.gov/guidelines/hypertension/#support
JNC 7 physician reference card	http://www.nhlbi.nih.gov/guidelines/hypertension/jnc7card.htm
Centers for Disease Control and Prevention Division for Heart Disease and Stroke Prevention	http://www.cdc.gov/dhdsp/
Dietary Guidelines for Americans, 2010	http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/PolicyDoc.pdf
Hawaii State Department of Health Heart Disease and Stroke Prevention Program State Plan	http://hawaii.gov/health/family-child-health/chronic-disease/cvd/HDSP_Plan.pdf
Hawaii Health Data Warehouse	http://www.hhdw.org/

Hawaii State Department of Health
Chronic Disease Management and Control Branch - Heart Disease and Stroke Prevention Program
1250 Punchbowl Street - Honolulu, HI 96813
<http://hawaii.gov/health>

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