Life Course Indicator: Hypertension

The Life Course Metrics Project

As MCH programs begin to develop new programming guided by a life course framework, measures are needed to determine the success of their approaches. In response to the need for standardized metrics for the life course approach, AMCHP launched a project designed to identify and promote a set of indicators that can be used to measure progress using the life course approach to improve maternal and child health. This project was funded with support from the W.K. Kellogg Foundation.

Using an RFA process, AMCHP selected seven state teams, Florida, Iowa, Louisiana, Massachusetts, Michigan, Nebraska and North Carolina, to propose, screen, select and develop potential life course indicators across four domains: Capacity, Outcomes, Services, and Risk. The first round of indicators, proposed both by the teams and members of the public included 413 indicators for consideration. The teams distilled the 413 proposed indicators down to 104 indicators that were written up according to three data and five life course criteria for final selection.

In June of 2013, state teams selected 59 indicators for the final set. The indicators were put out for public comment in July 2013, and the final set was released in the Fall of 2013.

Basic Indicator Information

Name of indicator: Hypertension (LC-29)

Brief description: Percent of adults with diagnosed hypertension

Indicator category: Family Well-Being

Indicator domain: Risk/Outcome

Numerator: Total number of adults aged 18 and over who indicated a health professional told them they had high blood pressure

Denominator: Total adult population 18 and over

Potential modifiers: Age, Race/Ethnicity, Gender, Education, and Income

Data source: Behavioral Risk Factor Surveillance System (BRFSS)

Notes on calculation: Numerator: Yes to the question “Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?” (Excludes female told only during pregnancy). Currently, the hypertension question is only asked every other year on BRFSS. Analysts who use the raw datasets should apply the appropriate survey weights to generate the final estimates.

Similar measures in other indicator sets: Preconception Health Indicator I3; HP 2020 Focus area HDS-5; Chronic Disease Indicator

Life Course Criteria

Introduction

Hypertension, or high blood pressure, increases the risk for heart disease and stroke, which are leading causes of death in the United States [2]. Currently, nearly one in three adults (approximately 67 million) have high blood pressure and more than half do not have their blood pressure under control [2, 4]. Uncontrolled hypertension increases risk for heart attacks and strokes, heart failure, and chronic kidney disease [2,7,9-11]. According to the Centers for Disease Control and Prevention (CDC), high blood pressure (>140/90 mm Hg) increases one's risk of having a stroke by four and the risk of heart disease by three [12]. In the United States, hypertension prevalence has risen steadily since the 1990s. In 1995, 22.2 percent (BRFSS) of adults reported having been told they have high blood pressure. Since then, prevalence has risen to 25.6 percent in 2001, and is currently estimated at 30.9 percent (BRFSS 2011). Hypertension is significant to the life course as it accumulates with age and can have an adverse impact on everyone from adolescents to the elderly. Medical expenditures associated with hypertension and hypertension-related morbidity have been estimated as being $131 billion [12]. The economic burden of hypertension is just one dimension of the need for improved prevention and intervention of high blood pressure. Improvements in hypertension prevalence and control would ease the financial burden of this disease and lead to improved quality of life and productivity among adults living in the United States.

Implications for equity

Generally, the risk for hypertension increases with age [2, 5-7]. In 2011, rates of hypertension were only 7.2 percent among young adults (ages 18-24). Rates increase steadily with age until peaking among adults 65 years and older at 61.4 percent (BRFSS 2011). Racial/ethnic and socioeconomic disparities in hypertension prevalence in the United States have been documented for decades [2,4], with hypertension being consistently higher among blacks than among non-Hispanic whites and Hispanics. In 2011, prevalence among blacks was 39.2 percent, compared to 31.7 percent among non-Hispanic whites and only 22.4 percent among Hispanics (BRFSS 2011). Hypertension rates tend to decrease as income and educational attainment increase. In 2011, prevalence of hypertension was approximately 38 percent for the least educated and least wealthy, while it was approximately 25 percent for the most educated and most wealthy (BRFSS 2011). Research suggests that inequities in hypertension also exist by nativity, health insurance status and health status including being diabetic, obese, and/or disability status [2]. Evidence supporting inequities by gender are inconsistent [2, BRFSS 2011].

One's social context plays an important role in their risk for hypertension. Studies have generally shown that lower neighborhood socioeconomic status is associated with hypertension after adjusting for individual socioeconomic status [52-58]. Characteristics of lower socio-economic neighborhoods such as increased air and noise pollution [59-62], lack of healthy food options and green space for exercise [63-65], low social cohesion and social capital, and elevated crime and perceived insecurity all contribute to elevations in blood pressure [66-67]. Furthermore, research has shown work environments that create job strain (the combination of high psychological job demands and low job control) put employees at increased risk for high hypertension, after adjusting for potential risk factors, such as age, body mass index, race, work physical activity, and alcohol use [68].

The ability to control hypertension is also important. Estimates from 2008 indicate that only 50 percent of individuals diagnosed with hypertension were taking appropriate measures to control their blood pressure [7]. Age-adjusted rates of hypertension control from the 2009-2010 NHANES indicate a significant difference in control between non-Hispanic whites and blacks and Hispanics. Compared to the 56.3 percent of non-Hispanic whites with hypertension control, only 40.7 percent of Hispanics and 47.9 percent of blacks had control. The same study found that men were significantly less likely than women to control their hypertension (50.4 percent compared to 57.5 percent) and that adults ages 18-39 years of age were significantly less likely than persons 40-59 years or 60 or more years of age to control their hypertension (32.8 percent, 55.7 percent, and 54.9 percent respectively) [8]. It is likely that factors contributing to increased risk for hypertension are also associated with ability to control hypertension. Social factors, neighborhood, work environment, job stress, and income all have influence over an individual's ability to access health care or pharmacy needs, their opportunities to reduce continued exposure to risk factors (e.g. stressful environments), and ultimately the power to make healthy lifestyle choices.

Public health impact

Medical expenditures associated with hypertension and hypertension-related morbidity have been estimated at? $131 billion annually [12]. The economic burden of hypertension, which includes an added $25 billion in costs from loss of productivity due to morbidity and premature mortality, is compelling evidence of the need for improved prevention and intervention of high blood pressure. Improvements in hypertension prevalence and control would ease the financial burden of this disease and lead to improved quality of life and productivity among adults living in the United States.

The Healthy People 2020 objective for hypertension is to decrease rates among U.S. adults to 26.9 percent [13]. In an analysis based on the Framingham Heart Study experience, Cook et al. concluded that a two mmHg reduction in the population average of diastolic blood pressure for white U.S. residents 35 to 64 years of age would result in a 17 percent decrease in the prevalence of hypertension, a 14 percent reduction in the risk of stroke and transient ischemic attacks, and a six percent reduction in the risk of cardiovascular heart disease [69]. Documented effective interventions of hypertension include weight loss, dietary sodium reduction, increased physical activity, moderation of alcohol consumption, potassium supplementation, and maintaining a diet that is rich in fruits and vegetables and in low fat dairy products. Interventions with uncertain, or less proven, efficacy include calcium, fish oil, and herbal (e.g. Gingko biloba extract and St. John's wort) supplementation.

The U.S. Food and Drug Administration has proposed requirements that certain establishments whose primary objective is to sell food (e.g. restaurants, fast food chains, and vending machines) display calorie counts for their menu items [24]. Some research suggests that displaying calorie information in fast-food restaurants could be beneficial for public health, especially among young women. In several studies, women who received calorie information chose significantly lower calorie meals than did women who did not receive calorie information [48-51]. Efforts to reduce obesity, smoking, and inactivity will require continued public health attention in order to reduce hypertension. Even small reductions in these rates could make a long term impact on the prevalence of hypertension and incidence of other chronic conditions.

Leverage or realign resources

The hypertension indicator has the potential to leverage and realign resources across public and private employers, in clinical settings, and within municipal and county governments. An average reduction of just 12 to 13 mmHg in systolic blood pressure over four years of follow-up is associated with a 21 percent reduction in coronary heart disease, a 37 percent reduction in stroke, a 25 percent reduction in total cardiovascular disease deaths and a 13 percent reduction in overall death rates. U.S. adults substantially lowered their blood pressure, high cholesterol levels and other heart disease risk factors during the 1980s. As a result, U.S. costs associated with coronary heart disease declined by an estimated 9 percent – from about $240 billion in 1981 to about $220 billion in 1990 [71].

If effectively planned, implemented, evaluated, and documented, worksite wellness programs also can reduce the burden. Workplace Wellness programs can yield a $3.27 drop in medical expenses for every $1 spent on wellness programs. Taking presenteeism and absenteeism into account, the return on investment can yield up to $6 for each dollar invested [72].

Health care providers can ensure they are following clinical guidelines related to blood pressure, counsel patients on healthier eating and exercise, and refer patients to wellness programs. Municipal and county governments can act to develop and enlarge parks and green spaces, and also repair or create walking trails, all to ensure that safe places to walk are easily accessible.

The Million Hearts Initiative is one example of a comprehensive effort to leverage best practices and apply what works to a very large problem. Million Hearts has as its goal to prevent one million heart attacks and strokes by 2017 by improving access to effective care, improving the quality of care for the ABCS (Aspirin, Blood Pressure Control, Cholesterol Management, and Smoking Cessation), focusing clinical attention on the prevention of heart attack and stroke, activating the public to lead a heart-healthy lifestyle, and improving the prescription and adherence to appropriate medications for the ABCS [73]. Million Hearts includes a challenge to use electronic health records and other health IT as tools to identify patients who need support in achieving safe and swift control of the blood pressure; the challenge will help patients and care teams use health IT tools to improve their cardiovascular health [74].

Predict an individual's health and wellness and/or that of their offspring

Contributing to nearly 1,000 deaths per day, hypertension is a major cause of mortality and morbidity in the United States [12]. Currently, nearly one in three adults (approximately 67 million) have high blood pressure and more than half do not have their blood pressure under control [2, 4]. Uncontrolled hypertension increases risk for heart attacks and strokes, heart failure, and chronic kidney disease [2,7,9-11]. According to the CDC, high blood pressure (>140/90 mm Hg) increases one's risk of having a stroke four-fold and the risk of heart disease three-fold [12].

As we age, our risk for hypertension generally increases, making it a disease that we typically face later in the life course. Although hypertension is not common among children [27-28], only about one to five percent, it is on the rise [29]. It is clear that hypertension has the potential to begin in childhood and adolescence and that it contributes to early development of cardiovascular disease and chronic kidney disease [29-30]. Childhood risk factors for high adult blood pressure include obesity and metabolic syndrome. Researchers speculate that the propensity toward developing hypertension may begin during gestation. According to the Barker hypothesis, intrauterine growth restriction is the failure of a fetus to reach his/her biological growth potential because of a pathological slow-down in the fetal growth pace [28-29, 31-39]. Infants who have experienced compromised growth during gestation are at higher risk for neonatal mortality and morbidity, particularly when they are preterm [31,40-41]. Subsequently, infants born prematurely or small-for-gestational-age, were shown to be at elevated risk for chronic diseases in adulthood. These diseases include hypertension, coronary heart disease, stroke, diabetes and metabolic diseases. [31, 42].

Maternal determinants of premature or low birth weight are many of the same determinants for hypertension and pregnancy-induced hypertension. Infants at risk are generally born to mothers who are obese [43], gain excessive [43] or inadequate weight during pregnancy [33, 44], consume alcohol during pregnancy [34], smoke [35], experience maternal stress [45], endure gestational hypertension [46], and experience preeclampsia [47].

Data Criteria

Data availability

The Behavioral Risk Factor Surveillance System (BRFSS) is the world's largest, ongoing telephone health survey system, tracking health conditions and risk behaviors in the United States yearly since 1984. Currently, data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam for adults 18 years of age and older. CDC provides state and national level prevalence data on their website.

The CDC develops approximately 80 questions each year. Some of these are core questions asked each year, and some are rotating core questions asked every other year. There are also CDC supported modules that address specific topics that states can use. States also may develop additional questions to supplement the core questions. Modules used by states are noted on the CDC websites.

Local level estimates for BRFSS data can be obtained using the Selected Metropolitan/Micropolitan Area Risk Trends (SMART) data. Local areas are metropolitan or micropolitan statistical areas (MMSAs) as defined by the Office of Management and Budget. SMART data is currently available for data going back to 2002 for MMSAs with 500 or more respondents.

Currently, the BRFSS has one hypertension indicator in the core module: "Adults who have been told they have hypertension." Prevalence and trend reports are available biannually from 1995 through 2011. These reports allow users to quickly analyze prevalence of adult hypertension by state and by sociodemographic predictors including: gender, age, race, income or education. One limitation of the reports provided by the BRFSS is that they do not allow researchers to cross tabulate prevalence and trends (e.g. gender by race or gender by age) [1].

Data quality

Numerous studies have compared estimates of chronic conditions and behaviors obtained from BRFSS to other national surveys including the National Health Interview Survey and the National Health and Nutrition Examination Survey; while there are some differences, findings on overall health status and certain chronic conditions tended to be similar despite declining response rates for BRFSS.

Since some questions on the BRFSS address sensitive health conditions and behaviors, there is intermittent missing data throughout the dataset. However, refusal to answer generally accounts for a small proportion of responses for most data elements. The notable exception is income, where refusals accounted for more than 23 percent of the data in one state in 2010; the median percent missing across BRFSS for income in 2010 was 14 percent.

Quality control computer programs are used to check the raw data for values out of range. CDC performs quality checks for core questions, and each state has its own protocol for checking state-specific questions. Interviewers are monitored during the annual questionnaire pilot period and intermittently during the data collection period to determine whether any interviewer bias exists and to correct any bias that might be found. On an ongoing basis, 10 percent of interview calls are verified.

Prior to 2011, the sampling for BRFSS represented only adults living in a private residence with a landline telephone, but starting in 2011, the sample also included data from respondents living in cell phone-only households. Weighted response rates are presented by state. For 2011, the median weighted response rate for the combined cell phone and landline was 49.72 percent.

The survey adjusts for non-response to reduce the known differences between respondents and non-respondents. Although participants interviewed may not represent a state in terms of age, sex and race distribution, it is believed that weighting the data corrects for this potential bias. As with other health surveys, estimates are based on self-report data and they may over- or underestimate the actual prevalence of a particular risk factor in the population. Despite some oversampling in states by geography, the annual sample size is too small to compute precise estimates at the county level.

A study testing the reliability of BRFSS chronic disease measures found the Cohen Kappa reliability statistic for hypertension to be 0.82 [48]. Kappa statistics greater than 0.75 represent excellent agreement, suggesting that BRFSS indicators for chronic conditions are generally reliable.

Simplicity of indicator

The level of complexity in calculating this indicator is very low. The BRFSS provides pre-calculated rates for every state, as well as several counties and cities, by gender, age, race, income, and education. Data weighting and adjustments are calculated by state health departments and the CDC prior to their release on the CDC website. Additionally, many states conduct county-level surveys every two or three years. These data contribute richer detail on county health status and facilitate county health assessment and tracking. The indicator is simple to explain and conceptually easy to understand.

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