REPORT 1 OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH (A-08)
The Clinical Utility of Measuring Body Mass Index and Waist Circumference in the Diagnosis and Management of Adult Overweight and Obesity
(Reference Committee D)

EXECUTIVE SUMMARY

Objective: To evaluate the clinical utility of measuring body mass index (BMI) and waist circumference in the diagnosis and management of overweight and obesity in adults.

Methods: Reports, statements, and/or guidelines on the measurement of overweight and obesity were obtained from the web sites of government and health professional organizations. The Cochrane Database of Systematic Reviews and the web site of the Agency for Healthcare Research and Quality were searched for reviews related to this topic. Literature searches were conducted in PubMed for English-language review articles published between July 1997 and December 2007 using the search terms "BMI," "body mass index," "waist circumference," "waist hip ratio," "overweight," "obesity," and "guidelines." Additional articles were identified by reviewing the reference lists of pertinent publications.

Results: BMI is an indirect measure of body fatness that is widely recommended by several government and health professional organizations, including our American Medical Association, to screen for overweight and obesity in adults. Waist circumference measurement is also recommended to help identify individuals at high risk of adverse health outcomes, along with patient history and other clinical measurements. The risk of adverse health outcomes associated with BMI and waist circumference varies with age, gender, race/ethnicity, and socioeconomic status, and may reflect population-specific differences in body composition, fat distribution, causes of overweight, and genetic susceptibility. Thus, current BMI cut-points to define categories of normal weight, overweight, and obesity may misclassify the health status of some individuals. Concern also exists about inconsistent associations between BMI and certain health outcomes, particularly mortality. However, J- and U-shaped associations between BMI and mortality may be due to inadequate control of confounding and/or less aggressive preventive and treatment efforts in individuals classified as normal weight. The clinical utility of waist circumference remains uncertain, in part due to the lack of a standard approach for measurement in research studies. Despite concerns about misclassification of disease risk, BMI and waist circumference are believed to help clinicians and patients monitor changes in body size over time, and thus aid prevention and management efforts. Nevertheless, there is a lack of intervention trials on the efficacy of clinical screening programs for overweight and obesity to improve mortality, morbidity, or mental health.

Conclusions: BMI and waist circumference remain practical estimates of risk of obesity-related conditions and should be included in routine health assessments. However, physician education programs should more clearly highlight the risk differences among ethnic and age groups at varying levels of BMI. At the same time, more research is needed to determine the efficacy of screening programs, using different indicators of body fatness, in decreasing morbidity and mortality, and improving mental health and prevention of weight gain. Likewise, more research is needed on physician screening and interventions related to healthy lifestyle behaviors in all patients to improve health and minimize disease risks.

Action of the AMA House of Delegates 2008 Annual Meeting: Council on Science and Public Health Report 1 Recommendations Adopted, and Remainder of Report Filed.

REPORT OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH

CSAPH Report 1-A-08

Subject: The Clinical Utility of Measuring Body Mass Index and Waist Circumference in the Diagnosis and Management of Adult Overweight and Obesity

Presented by: Mary Anne McCaffree, MD, Chair

Referred to: Reference Committee D
(Robert T. M. Phillips, MD, PhD, Chair)

Board of Trustees Report 9-A-07 recommended, in part, that our American Medical Association (AMA) ask the Council on Science and Public Health (CSAPH) to critically evaluate the clinical utility of measuring body mass index (BMI) and/or waist circumference in the diagnosis and management of overweight and obesity, with input from leading researchers and key stakeholder organizations.

This report reviews the reports, statements, and/or guidelines of several government and health professional organizations on the measurement of overweight and obesity. It also reviews selected research that supports or challenges these guidelines and recommendations. The report focuses on the use of BMI and waist circumference in adults only, as the AMA recently convened an expert committee to address this issue in children and adolescents.

Current AMA Policy on Measurement of Overweight and Obesity

AMA policies related to measuring overweight and obesity include Policy D-440.971 (AMA Policy Database), which encourages physicians to routinely measure BMI and waist circumference in adults and BMI percentiles in children, while recognizing ethnic sensitivities and the relationship of BMI to stature, and Policy H-150.953, which urges physicians to assess their patients for overweight and obesity during routine medical examinations. See the Appendix for complete policy statements. In addition, recommendations emanating from our AMA's National Obesity Summit in 2004 encouraged routine measurement of BMI and waist circumference.

Background

BMI is an estimate of body fatness expressed as weight in kilograms divided by height in meters squared (kg/m^2). BMI has been widely recommended by several government and health professional organizations, including our AMA, as a useful tool to screen for overweight and obesity in adults. Waist circumference is an estimate of abdominal adiposity that is also recommended by many of these organizations, although it is less widely used clinically. BMI and waist circumference are intended to identify individuals at high risk of adverse health outcomes, along with patient history and other clinical measurements.[1]

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Action of the AMA House of Delegates 2008 Annual Meeting: Council on Science and Public Health Report 1 Recommendations Adopted, and Remainder of Report Filed.

Obesity and overweight are currently defined by the National Heart Lung Blood Institute (NHLBI), World Health Organization (WHO), and most health professional and governmental organizations using BMI cut-points, despite evidence that BMI may not correspond to the same degree of body fatness or disease risk in all populations. Some attempts have been made to recommend alternative cut-points or alternate measures of body fatness and/or disease risk. In general, it remains unclear whether the current BMI cut-points have helped clinicians improve patient morbidity and mortality. However, few effective interventions are available to clinicians to reduce BMI in their patients compared with comorbid conditions such as hypertension and diabetes.

Recent estimates indicate that approximately two-thirds of Americans aged 20 to 74 years are classified as overweight or obese based on BMI categories established by the National Institutes of Health.[2] This compares to less than 50% of adults who were deemed overweight or obese before 1980 using the same measures.[2] The increasing trend in overweight in the last 25 years reflects primarily an increase in the obese category (BMI $\geq$ 30 kg/m^2) and a decrease in the percentage of adults in the normal (18.5-25 kg/m^2) range.[2] Similarly, abdominal adiposity, as measured by waist circumference, has significantly increased in adults over the last 20 years.[3] The prevalence of obesity is increasing in the United States and throughout the world using either indicator of adiposity.

Categories of body size have research, policy, and clinical applications. While these categories may not be equally applicable across populations for all obesity-related conditions, any revisions to these widely used definitions of overweight and obesity must be carefully considered.

Methods

The web sites of government and health professional organizations were searched for reports, statements, and/or guidelines on the measurement of overweight and obesity. The Cochrane Database of Systematic Reviews and the web site of the Agency for Healthcare Research and Quality were searched for reviews related to this topic. PubMed was searched for English-language review articles published between July 1997 and December 2007 using the search terms "BMI," "body mass index," "waist circumference," "waist hip ratio," "overweight," "obesity," and "guidelines." Additional articles were identified by reviewing the reference lists of pertinent publications.

Current Classifications of Weight Status

In 1993, the WHO's Expert Committee on Physical Status recommended classifying overweight adults using BMI categories of 25.0 to 29.9 kg/m^2 for overweight grade 1, 30.0 to 39.9 kg/m^2 for overweight grade 2, and $\geq$ 40.0 kg/m^2 for overweight grade 3.[4] The panel acknowledged that BMI does not directly measure fat mass or fat percentages, but believed that the possibility of misclassification would have minimal impact as part of an overall health risk assessment that includes abdominal adiposity, smoking and dietary habits, physical activity, blood pressure, serum lipids and glucose, and family history.[4] In 1997, the WHO Consultation on Obesity recommended an additional cut-point at a BMI of 35 kg/m^2 as part of a three-tiered classification of obesity (Table 1).

In 1998, the NHLBI's Obesity Education Initiative Expert Panel defined overweight and obesity in adults 18 years of age and older using the same BMI cut-points as the WHO (Table 2). The

NHLBI additionally recommended measuring waist circumference in individuals with BMIs below 35 kg/m^2, noting an increased relative risk of obesity-associated factors in women with waist circumference greater than 88 cm (35 inches) and in men with waist circumference greater than 102 cm (40 in). These guidelines have been endorsed by many government and professional organizations, including the National Cholesterol Education Program, the National High Blood Pressure Education Program, the North American Association for the Study of Obesity (NAASO), the Centers for Disease Control and Prevention (CDC), the American Heart Association, the American College of Physicians (ACP), the American College of Preventive Medicine (ACPM), and the US Preventive Services Task Force (USPSTF) (Table 3).

Both the WHO and NHLBI guidelines recognize that current BMI cut-points are not ideal indicators of body size. The WHO expert committees regarded BMI as a crude population-level indicator of obesity and associated risks that does not necessarily coincide with the same degree of adiposity across populations.[5] The 1997 WHO report recommended the development of sex-specific waist circumference cut-points for different populations to further aid in the classification of overweight and obesity,[5] which the NHLBI report did define for the general American population.[1] The WHO and NHLBI recommendations further recognized that BMI may misclassify some individuals on the basis of stature, such as those who are very muscular,[1] less than 5 feet tall,[1,4] or taller than 6 feet 3 inches.[4] In addition, their recommendations to prevent further weight gain or to lose weight at a given BMI are not intended for pregnant or lactating women, individuals with serious psychiatric illness, or anyone with an illness that may be aggravated by caloric restriction.[1] Moreover, adult BMI scores are not directly applicable to children or young teenagers.[6]

In 2003, a WHO expert consultation recommended retaining the current classifications of overweight and obesity based on BMI, but with additional BMI cut-points of 23, 27.5, 32.5, and 37.5 kg/m^2 for public health action in many Asian populations.[7] However, the committee failed to establish clear BMI cut-off points for overweight or obesity for all Asians, noting an onset of increased risk varying from 22 to 25 kg/m^2 across Asian populations, and of high risk varying from 26 to 31 kg/m^2.[7] In addition, the expert consultation recommended the measurement of waist circumference, particularly in populations predisposed to central adiposity, but did not recommend specific waist circumference cut-points.[7] The WHO has not recommended specific BMI or waist circumference cut-points for other populations, such as Africans or other populations not of European descent.

Scientific Evidence for Indicators of Overweight and Obesity

Although numerous governmental and health organizations, including our AMA, endorse the use of BMI and waist circumference to assess and monitor overweight and obesity, these measures, in fact, are screening tools, and are only qualified predictors of risk. BMI is significantly correlated with more accurate measures of body fatness, such as underwater weighing and dual-energy x-ray absorptiometry (DXA), but does not measure it directly.[1] In adults, waist circumference is a measure of central adiposity, but also is not a direct measure.[1] Waist circumference is most useful in further defining risk of overweight and obesity in individuals with a BMI below 35 kg/m^2; for BMIs above this value, waist measurement adds little clinical information.[1,8]

A large body of evidence supports the use of BMI and waist circumference in adults as indicators of underweight, overweight, and obesity.[1,4] BMI has been the most frequently studied indicator,

and much of the scientific literature has found increased BMI to be associated with several diseases and conditions, including type 2 diabetes, coronary heart disease, high blood cholesterol, stroke, hypertension, gall bladder disease, osteoarthritis, sleep apnea, several cancers (notably endometrial, breast, prostate, and colon cancer), pregnancy complications, menstrual irregularities, stress incontinence, depression, and mortality.[1] The nature of the relationships between BMI and these conditions is generally similar across population groups, although the specific level of risk at a given BMI may differ by age, gender, race/ethnicity, and/or socioeconomic status.[1] These variations in specific risk are important to note, as they may reflect differences in body composition and fat distribution, as well as population-specific causes of overweight and genetic susceptibility to certain diseases.[4]

Waist circumference also has been shown to be an independent predictor of disease risk, particularly of cardiovascular disease (CVD) and CVD risk factors such as hypertension, dyslipidemia, and type 2 diabetes.[1,8-10] In fact, waist circumference is considered by some to be as good or better a predictor of CVD, type 2 diabetes, and mortality as BMI.[3,10,11] As with BMI, ethnicity, gender, and age may modify the specific level of risk associated with a given waist circumference.[1,5,12,13]

Concerns About Use of BMI and Waist Circumference

Despite the substantial literature supporting use of BMI and waist circumference in adults, some investigations have not observed direct associations between BMI and waist circumference and various health outcomes, particularly mortality. As noted above, even direct associations between BMI, waist circumference, and health outcomes may vary by ethnicity, stature, and age. These variations in absolute and relative risks have led some researchers and clinicians to question the clinical utility of using BMI, particularly the current BMI cut-points, as clear indicators of overweight and obesity. Concerns are greatest in the normal and overweight classifications; there is less disagreement about the utility of these cut-points in the moderate to severely underweight (< 17 kg/m^2)[4] and obese categories.

Population-Specific Variations in BMI and Health Risk. Ethnicity, age, and athletic training may affect the relationship between BMI and various health outcomes. For example, some studies have found that risk of complications from overweight are not apparent in African Americans until they reach a BMI greater than 30 kg/m^2,[14,15] which may be due to reduced body fatness in African Americans at a given BMI compared to Caucasians.[16] However, other studies have not observed a different relationship between body fatness and BMI in African Americans as compared with Caucasians,[17,18] and risk of mortality from CVD remains higher in African Americans than in Caucasians, due in part to higher rates of other CVD risk factors in African Americans, such as hypertension and diabetes.[19,20] Waist circumference may be particularly helpful in clarifying disease risk in older African American women with BMIs in the normal and overweight ranges.[21]

In contrast, the risk of obesity-related disorders has been reported to begin at a lower BMI in some Asian populations than in Caucasian populations.[7,22] In general, many Asians have a higher percent body fatness than Caucasians of the same age, gender, and BMI.[7,23] Likewise, the prevalence of Asians with risk factors for type 2 diabetes and CVD is higher than seen in Caucasian populations with BMIs below 25 kg/m^2.[7] However, there is considerable variation in these associations between Asian populations. For example, a range of higher percentages of body fatness has been observed at low BMIs in Hong Kong Chinese, Singaporean Chinese, Malays,

Indians, Indonesians, and Japanese, as compared with Caucasians, while Polynesians have a lower proportion of body fat compared to Caucasians. However, despite their lower proportion of body fat, Polynesians still have a higher prevalence of diabetes.[7] Similarly, the optimal BMI range for Australian Aboriginals appears to be 17 to 22 kg/m^2, with adverse metabolic consequences seen at BMI values greater than 22 kg/m^2.[5] Nevertheless, there are no clear categories for overweight and obesity for all Asians. Research suggests that optimal cut-points for overweight range from 22 to 25 kg/m^2, and for obesity from 26 to 31 kg/m^2. Lower cut-points for populations in Hong Kong, Indonesia, and Singapore are not considered appropriate for those in northern China and Japan.[7] A WHO expert consultation on the appropriate BMI categories for Asian populations noted that BMI categories serve merely as a "convenience" for public health and clinical use, and that in reality, increased health risks exist on a continuum with increasing BMI.[7]

In older adults, changes in body composition (loss of fat-free mass, and gains in fat mass) and height alter the association between BMI and body fatness.[4,24] At any given BMI, body composition changes seen with aging underestimate body fatness and height losses overestimate fatness.[4,24] Despite these changes, risk of several conditions, including osteoarthritis, type 2 diabetes, sleep apnea, urinary incontinence, cataract, and some cancers are directly associated with BMI in older adults.[4,24] Mortality risk is also related to BMI in older adults, although the relationship is more nuanced than in younger and middle-aged adults. As age increases, the relative risk of mortality associated with BMI decreases, leading some to argue that obesity is not as harmful in older adults as in younger and middle-aged adults.[4,24] However, the absolute risk of mortality associated with BMI continues to increase with age, until approximately age 75 years; the apparent lack of association after age 75 years may be due to other competing risks or unique subgroup resistance to the adverse health effects of obesity.[4,24]

Current BMI cut-points do not reflect the same level of body fatness in highly trained athletes, such as those participating in college sports[25] or even former professional athletes.[26] However, this does not apply to all athletes; for example, football linemen tend to have significantly higher BMIs than their fellow football players and other athletes, with correspondingly higher percent body fatness[25,27] and greater risk for obesity-related conditions, such as high blood pressure and sleep apnea.[28]

Such variation in risk has led to arguments that a BMI cutoff of 25 kg/m^2 to classify individuals as overweight is too conservative in certain populations and may stigmatize some individuals unnecessarily.[29] In contrast, others argue that current cut-points result in lost opportunities to prevent or treat obesity-related conditions in some individuals currently classified as "normal" weight.[7] Therefore, based on the above considerations, the current cut points for BMI probably misclassify some individuals, but the extent of such misclassification is unknown, as is the real impact of any stigmatization that may be associated with being classified as overweight or obese based on BMI alone.

Concerns About Waist Circumference. Waist circumference is not universally accepted as an optimal measure of abdominal adiposity, as some studies have found waist-to-hip ratio or waist-to-height ratio to be better predictors of cardiovascular risk.[30,31] As noted above, ethnicity, age, and gender may modify the specific level of risk associated with a given waist circumference,[1,5,12,16] although ethnicity and age-specific cut-points are still lacking. Furthermore, a consensus panel convened in 2006 by NAASO--the Obesity Society; the American Diabetes Association; and Shaping America's Health: Association for Weight Management and Obesity Prevention--

concluded that a standardized approach for measuring waist circumference in research studies does not exist, as the optimal site at which waist circumference is most strongly correlated with abdominal adipose tissue is variable and the concomitant disease risk has not been established.[10] The panel concluded that there was not sufficient evidence that waist circumference provided enough additional information beyond BMI, blood pressure, and blood glucose and lipid levels to warrant its use clinically.[10] In addition, waist circumference has not as been as well-studied with many health outcomes other than CVD and its risk factors.

Reasons for Inconsistent Associations between BMI and Mortality. Perhaps the most controversy over the use of body size classifications has revolved around the association between BMI and mortality. Some concern focuses on the usefulness of BMI categories, as a number of studies have found that BMI values in the overweight range (25.0-29.9 kg/m^2) are not strongly associated with mortality as compared with BMI values in the normal range (18.5-24.9 kg/m^2).[32-35] Of even greater concern are observed differences in the shape of the relationship between BMI and mortality. While many studies have reported direct, linear associations between BMI and mortality,[36-40] other studies observed J- or U-shaped associations* between BMI and mortality.[33,41,42] However, the causes of death at low and high BMIs differ. At low BMIs, mortality is more likely due to digestive and pulmonary disease than at higher BMIs, where mortality is often due to CVD, diabetes, and gallbladder disease.[4]

It has been argued that J- or U-shaped associations between BMI and mortality reflect inadequate control of confounding variables.[1,4,37] A significant confounder is smoking, or inadequate measurement of smoking status. Early mortality due to pre-existing clinical or subclinical illness could also increase mortality risk at low BMIs. In addition, inappropriate adjustment for risk factors in the causal pathway, such as hypertension, hyperlipidemia, and diabetes, may result in underestimation of risks associated with overweight.[4]

While these potential confounders are widely known, they continue to be inadequately controlled for in study designs or analyses. For example, a recent study analyzed smoking status only as "current" or "not current,"[34] while another study did not include smoking at all in statistical models.[43] Some studies also fail to account for interactions between BMI and smoking.[41,42] Other studies have not accounted for pre-existing disease[34] or early deaths.[42] Some argue that excluding people with early deaths may not reduce bias and may have little impact on the association between BMI and mortality.[44] However, the lack of impact may be due, in part, to a loss of statistical power that comes from sample size reductions.[37] A recent analysis systematically demonstrated how estimates of J- or U-shaped associations between BMI and mortality may be observed when potential sources of bias are not carefully and comprehensively accounted for in study design and statistical analyses.[37] Unfortunately, it can be difficult to judge the thoroughness of statistical analyses from the limited information provided in the methods sections of many published articles; in other words, merely "adjusting for smoking" may not be sufficient to adequately address potential bias and confounding due to smoking.

J- or U-shaped associations may also reflect the possibility that people in the "normal" weight range are not as aggressively screened or treated for additional cardiovascular or other risk factors.

* J- and U-shaped associations reflect increased mortality at both lower and higher ranges of BMI values. Thus, the lowest risk of mortality is observed in the normal, overweight, and/or obesity class I categories of BMI.

A comparison of relative risks of mortality associated with different levels of BMI across National Health and Nutrition Examination Surveys (NHANES) I (1971-1975), II (1976-1980), and III (1988-1994) found that the impact of obesity on mortality appeared to decrease over time, possibly due to improved medical care, particularly for CVD.[33] Indeed, other analyses have found significantly greater decreases in total cholesterol levels and blood pressure in individuals classified as overweight and obese compared to those classified as normal weight.[45] These decreases paralleled significant increases in the use of cholesterol and blood pressure medications, with the most marked increases seen among overweight and obese adults.[45]

Advantages of Using BMI and Waist Circumference

Direct measures of body fatness, such as in vivo neutron inactivation analysis (IVNAA), are expensive and uncommon. Indirect methods, such as densitometry and DXA, are more accurate than the doubly indirect methods of BMI, waist circumference, and bioelectrical impedance, but are still relatively expensive and time consuming.[7] Because they are simple, rapid, and inexpensive, BMI and waist circumference are more practical for use in clinical settings than other measures of body fatness.[1]

Both BMI and waist circumference are believed to help both clinicians and patients monitor changes in body size over time, which may aid efforts to prevent and manage obesity-related diseases.[46] In obese adults with obesity-related diseases, modest weight loss of 5% to 10% of body weight may improve health.[46] In adults who are classified as overweight or obese without obesity-related comorbid conditions, lifestyle interventions may decrease the risk of developing these conditions and prevent further weight gain.[46] BMI can also help screen for conditions related to underweight, including anorexia nervosa.

Waist circumference provides an estimate of abdominal adiposity, which can predict risk of cardiometabolic disease above and beyond BMI.[10] Waist circumference may be easier for the public to understand than BMI,[3] and may be a useful gauge of healthy lifestyle interventions in patients whose BMI is unchanging.[10]

BMI in particular is an easy tool for monitoring obesity at the population level for public health and policy decisions. Cut-points inform policymakers of the percentage of the population at high risk of an adverse health outcome.[7] Changing the cut-points would change the proportion of individuals receiving treatment, as well as the nature and extent of prevention efforts; this could in turn have both short- and long-term financial effects on government, health insurers, and individuals.[7] BMI and waist circumference are also useful to assess the effect of interventions, as well as for estimating economic costs of obesity-related conditions.

Disadvantages of Using BMI and Waist Circumference

BMI and waist circumference measures are not intended to be the sole indicators of an individual's disease risk.[1] For example, normal-weight obese syndrome has been described in which individuals have a normal weight and BMI (<25 kg/m^2), but have a fat mass > 30%.[47] These individuals do not have metabolic syndrome, but do have higher plasma levels of proinflammatory cytokines, which may raise their risk of later developing obesity, metabolic syndrome, and/or CVD. In addition, people with BMIs below 25 kg/m^2 may present with insulin resistance, hyperinsulinemia, and dyslipidemia, while some individuals with BMIs greater than 30 kg/m^2 and

excess body fat may be metabolically healthy (ie, have high insulin sensitivity and normal blood pressure and lipid levels).[48,49] Furthermore, weight gain in adulthood has been associated with increased morbidity and mortality, independent of baseline weight.[4] Thus, monitoring changes in body weight throughout life, as well as monitoring other indicators of disease risk, such as hypertension and dyslipidemia, are necessary to assess an individual's health status.

Categories of overweight and obesity using current cut-points may misclassify the health status of some individuals. As noted above, cut-points for BMI and waist circumference as indicators of overweight or obesity do not apply equally well across all populations. However, multiple cut-points for multiple populations could be confusing, particularly in locations where residents are of mixed cultural, ethnic, and racial heritage.[7]

Specific to waist circumference, trained staff are needed to properly perform this measurement, making it less widely used.[3] Like BMI, waist circumference may not be useful in very short (under 5 feet) individuals, nor does it appear to add additional risk information in those with a BMI ≥ 35.0 kg/m^2. In addition, waist circumference has been correlated with fewer health outcomes than BMI. Also, there is currently no evidence that reducing either waist circumference or BMI through procedures such as liposuction will reduce risk of adverse health outcomes.[50]

In addition, concern exists that overemphasis on BMI or body size alone, without appropriate counseling on healthy lifestyle behaviors, may contribute to unhealthy behaviors or eating disorders, although dieting has not been associated with increased risk of eating disorders in adults.[51] Moreover, overattention to body size may detract from other modifiable risk factors, such as diet and physical activity, which are often independently associated with adverse health outcomes.[16,52,53]

Furthermore, there is little evidence that obesity screening programs improve mortality or morbidity. A 2003 report by the USPSTF did not find any randomized controlled trials that tested the efficacy of obesity screening programs in improving mortality, morbidity, or mental health. Likewise, the report found only limited evidence on the effectiveness of weight loss on clinical outcomes.[54] Another review also concluded that screening for obesity is unlikely to improve morbidity and mortality, due to misclassification of many individuals and lack of effective treatments for obesity.[16]

Screening and Promotion of Healthy Diets and Physical Activity

Since BMI is not the only modifiable risk factor for most conditions, it is also important to monitor other indicators of risk, including high blood pressure and blood cholesterol levels, weight change, and physical inactivity. Healthy diets and physical activity are already recommended for the management of overweight and obesity by the ACP.[55] Similarly, the USPSTF recommends high-intensity counseling about diet and/or physical activity, combined with other behavioral interventions, to promote sustained weight loss in obese adults.[54] The USPSTF also recommends moderate to high intensity behavioral dietary counseling for adults with hyperlipidemia and/or other known risk factors for cardiovascular and other diet-related chronic diseases.[56] However, the USPSTF found insufficient evidence to support moderate or low-intensity counseling and behavioral interventions in overweight and obese adults, as there is little direct evidence that these interventions lower mortality or morbidity related to obesity. Nevertheless, some organizations recommend healthy lifestyle counseling of varying degrees to individuals regardless of their BMI.

For example, the American Academy of Family Physicians (AAFP) recommends that all patients aged 2 years and older be advised to "maintain caloric balance."[57] The AAFP also developed a program called "Americans in Motion" (AIM) to encourage physical activity, healthy nutrition, and emotional well-being in all individuals, families, and communities.[58] While healthy diets and physical activity have many health benefits beyond weight loss, and are recommended for healthy individuals of any size or body composition,[4,59,60] the efficacy of routine dietary counseling in all individuals in primary care settings has yet to be established.[56]

Summary and Conclusion

Overall, BMI and waist circumference are simple and affordable tools that help physicians identify changes in body size early, and that support efforts to maintain weight or achieve a modest weight reduction that will provide optimal health benefits to their patients. Both waist circumference and BMI are independent predictors of disease risk. Neither measure alone can predict a patient's absolute disease risk; rather, clinicians should consider these values in conjunction with other information, such as the presence of other diseases, other disease risk factors, and family history.[1] While BMI may inappropriately classify as overweight some individuals who are not at increased risk of disease, it is a useful tool that currently serves as a prompt to screen for other risk factors. However, individuals with normal BMIs should not be assumed to be risk-free, and should likewise be monitored for changes in body size and assessed for other disease risk factors.

The research, policy, and clinical effects of changing the current definitions for overweight and obesity must be carefully considered. BMI currently has wide acceptance as an indicator of overweight and obesity. The NHLBI and WHO reports are careful to point out that BMI is only one of several tools to use in assessing a patient's risk of adverse health conditions, and concern exists about stigmatizing people at relatively low disease risk as overweight or obese. The benefit of measuring waist circumference on a regular basis in clinical settings appears unclear, as it requires additional training of staff and increased office visit time. Of great concern to some physicians and researchers is the differential association between BMI and disease risk across some populations. However, disease risk is not homogeneous even within ethnic or cultural groups, such as "Europeans," "Asians," and "Africans." Multiple cut-points for multiple populations could be confusing, particularly in locations where people are of mixed cultural, ethnic, and racial heritage. Optimal BMI cut-points also may vary by health outcome.

At the present time, it appears more research is needed that specifically examines how health outcomes may vary across populations that are screened using different indicators of overweight and obesity. More research is also needed to address concerns such as patient stigma and utility of waist circumference vs. BMI in clinical settings. Research studies on mortality should carefully address confounding and bias, including the effect of treatment for comorbid conditions (such as medications for hypertension or high cholesterol) among overweight and obese individuals. Perhaps most important is the need for research on effective interventions, at both the individual- and population-level, to prevent and treat adverse health outcomes related to unhealthy body weight, regardless of how body weight is categorized.

In general, the relative risk of adverse health outcomes appears to increase with increasing body size. Thus, measurements of body size, however crude, should be done to monitor change in body size over time, as part of a comprehensive health examination. While more research is needed about the effectiveness of lifestyle counseling by physicians in all patients, there is evidence that

high risk individuals may benefit from such counseling. Prevention of weight gain in adulthood should be encouraged in most patients, outside of pregnancy, intense athletic training, or necessary weight restoration following starvation or illness.

RECOMMENDATIONS

The Council on Science and Public Health recommends that the following be adopted and the remainder of this report be filed:

1. That our American Medical Association (AMA) reaffirm Policy D-440.971, "Recommendations for Physician and Community Collaboration on the Management of Obesity," which encourages physicians to incorporate body mass index (BMI) and waist circumference as a component measurement in the routine adult physical examination, recognizing ethnic sensitivities and its relationship to stature. (Reaffirm HOD Policy)

2. That our AMA support greater emphasis in physician educational programs on the risk differences among ethnic and age groups at varying levels of BMI and the importance of monitoring waist circumference in individuals with BMIs below 35 kg/m^2. (Directive to Take Action)

3. That our AMA support additional research on the efficacy of screening for overweight and obesity, using different indicators, in improving various clinical outcomes across populations, including morbidity, mortality, mental health, and prevention of further weight gain. (Directive to Take Action)

4. That our AMA support more research on the efficacy of screening and interventions by physicians to promote healthy lifestyle behaviors, including healthy diets and regular physical activity, in all of their patients to improve health and minimize disease risks. (Directive to Take Action)

Fiscal Note: $1000

References

1. National Institutes of Health National Heart, Lung and Blood Institute. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. NIH publication No. 98-4083; 1998.

2. National Center for Health Statistics. Health, United States, 2006, with chartbook on trends in the health of Americans. Hyattsville, MD; 2006.

3. Ford ES, Mokdad AH, Giles WH. Trends in waist circumference among U.S. adults. *Obesity Res.* 2003;11:1223-1231.

4. WHO Expert Committee on Physical Status. The use and interpretation of anthropometry. Report of a WHO Expert Committee. Geneva: World Health Organization; 1995.

5. WHO Consultation on Obesity. Obesity: preventing and managing the global epidemic: Report of a WHO Consultation. Geneva: World Health Organization; 2000.

6. Krebs NF, Himes JH, Jacobson D, Nicklas TA, Guilday P, Styne D. Assessment of child and adolescent overweight and obesity. *Pediatrics.* 2007;120:S193-S228.

7. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet.* 2004;363:157-163.

8. Janssen I, Katzmarzyk PT, Ross R. Body mass index, waist circumference, and health risk: evidence in support of current National Institutes of Health guidelines. *Arch Intern Med.* 2002;162:2074-2079.

9. Janssen I, Heymsfield SB, Allison DB, Kotler DP, Ross R. Body mass index and waist circumference independently contribute to the prediction of nonabdominal, abdominal subcutaneous, and visceral fat. *Am J Clin Nutr.* 2002;75:683-688.

10. Klein S, Allison DB, Heymsfield SB, et al. Waist circumference and cardiometabolic risk: a consensus statement from Shaping America's Health: Association for Weight Management and Obesity Prevention; NAASO, The Obesity Society; the American Society for Nutrition; and the American Diabetes Association. *Am J Clin Nutr.* 2007;85:1197-1202.

11. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. *Am J Clin Nutr.* 2004;79:379-384.

12. Ardern CI, Katzmarzyk PT, Janssen I, Ross R. Discrimination of health risk by combined body mass index and waist circumference. *Obesity Res.* 2003;11:135-142.

13. Zhu S, Heshka S, Wang Z, et al. Combination of BMI and waist circumference for identifying cardiovascular risk factors in whites. *Obesity Res.* 2004;12:633-645.

14. Sanchez AM, Reed DR, Price RA. Reduced mortality associated with body mass index (BMI) in African Americans relative to Caucasians. *Ethn Dis.* 2000;10:24-30.

15. Fontaine KR, Redden DT, Wang C, Westfall AO, Allison DB. Years of life lost due to obesity. *JAMA.* 2003;289:187-193.

16. Wilson AR, McAlpine DD. The effectiveness of screening for obesity in primary care: weighing the evidence. *Med Care Res Rev.* 2006;63:570-598.

17. Fernandez JR, Heo M, Heymsfield SB, et al. Is percentage body fat differentially related to body mass index in Hispanic Americans, African Americans, and European Americans? *Am J Clin Nutr.* 2003;77:71-75.

18. Gallagher D, Visser M, Sepulveda D, Pierson RN, Harris T, Heymsfield SB. How useful is body mass index for comparison of body fatness across age, sex, and ethnic groups? *Am J Epidemiol.* 1996;143:228-239.

19. Henderson SO, Haiman CA, Wilkens LR, Kolonel LN, Wan P, Pike MC. Established risk factors account for most of the racial differences in cardiovascular disease mortality. *PLoS ONE.* 2007;2:e377.

20. Thomas AJ, Eberly LE, Davey Smith G, Neaton JD, Stamler J, for the Multiple Risk Factor Intervention Trial Research Group. Race/ethnicity, income, major risk factors, and cardiovascular disease mortality. *Am J Public Health.* 2005;95:1417-1423.

21. Patt MR, Yanek LR, Moy TF, Becker DM. Assessment of global coronary heart disease risk in overweight and obese African-American women. *Obes Res.* 2003;11:660-667.

22. Shiwaku K, Anuurad E, Enkhmaa B, et al. Overweight Japanese with body mass indexes of 23.0-24.9 have higher risks for obesity-associated disorders: a comparison of Japanese and Mongolians. *Int J Obes Relat Metab Disord.* 2004;28:152-158.

23. Rush EC, Goedecke JH, Jennings C, et al. BMI, fat and muscle differences in urban women of five ethnicities from two countries. *Int J Obes (Lond).* 2007;31:1232-1239.

24. Villareal DT, Apovian CM, Kushner RF, Klein S. Obesity in older adults: technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *Am J Clin Nutr.* 2005;82:923-934.

25. Ode JJ, Pivarnik JM, Reeves MJ, Knous JL. Body mass index as a predictor of percent fat in college athletes and nonathletes. *Med Sci Sports Exerc.* 2007;39:403-409.

26. Lynch NA, Ryan AS, Evans J, Katzel LI, Goldberg AP. Older elite football players have reduced cardiac and osteoporosis risk factors. *Med Sci Sports Exerc.* 2007;39:1124-1130.

27. Harp JB, Hecht L. Obesity in the National Football League. *JAMA.* 2005;293:1061-1062.

28. George CFP, Kab V, Levy AM. Increased prevalence of sleep-disordered breathing among professional football players. *N Engl J Med.* 2003;348:367-368.

29. Strawbridge WJ, Wallhagen MI, Shema SJ. New NHLBI clinical guidelines for obesity and overweight: will they promote health? *Am J Public Health.* 2000;90:340-343.

30. Schneider HJ, Glaesmer H, Klotsche J, et al. Accuracy of anthropometric indicators of obesity to predict cardiovascular risk. *J Clin Endocrinol Metab.* 2007;92:589-594.

31. See R, Abdullah SM, McGuire DK, et al. The association of differing measures of overweight and obesity with prevalent atherosclerosis: the Dallas Heart Study. *J Am Coll Cardiol.* 2007;50:752-759.

32. Allison DB, Fontaine KR, Manson JE, Stevens J, VanItallie TB. Annual deaths attributable to obesity in the United States. *JAMA.* 1999;282:1530-1538.

33. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. *JAMA.* 2005;293:1861-1867.

34. Gronniger JT. A semiparametric analysis of the relationship of body mass index to mortality. *Am J Public Health.* 2006;96:173-178.

35. Romero-Corral A, Montori VM, Somers VK, et al. Association of bodyweight with total mortality and with cardiovascular events in coronary artery disease: a systematic review of cohort studies. *Lancet.* 2006;368:666-678.

36. Ajani UA, Lotufo PA, Gaziano JM, et al. Body mass index and mortality among US male physicians. *Ann Epidemiol.* 2004;14:731-739.

37. Gelber RP, Kurth T, Manson JE, Buring JE, Gaziano JM. Body mass index and mortality in men: evaluating the shape of the association. *Int J Obes (Lond).* 2007;31:1240-1247.

38. Manson JE, Willett WC, Stampfer MJ, et al. Body weight and mortality among women. *N Engl J Med.* 1995;333:677-685.

39. Lee IM, Manson JE, Hennekens CH, Paffenbarger RS Jr. Body weight and mortality: a 27-year follow-up of middle-aged men. *JAMA.* 1993;270:2823-2828.

40. Hu FB, Willett WC, Li T, Stampfer MJ, Colditz GA, Manson JE. Adiposity as compared with physical activity in predicting mortality among women. *N Engl J Med.* 2004;351:2694-2703.

41. Baik I, Ascherio A, Rimm EB, et al. Adiposity and mortality in men. *Am J Epidemiol.* 2000;152:264-271.

42. Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW Jr. Body-mass index and mortality in a prospective cohort of U.S. adults. *N Engl J Med.* 1999;341:1097-1105.

43. Bender R, Jockel KH, Trautner C, Spraul M, Berger M. Effect of age on excess mortality in obesity. *JAMA.* 1999;281:1498-1504.

44. Allison DB, Heo M, Flanders DW, Faith MS, Carpenter KM, Williamson DF. Simulation study of the effects of excluding early deaths on risk factor-mortality analyses in the presence of confounding due to occult disease: the example of body mass index. *Ann Epidemiol.* 1999;9:132-142.

45. Gregg EW, Cheng YJ, Cadwell BL, et al. Secular trends in cardiovascular disease risk factors according to body mass index in US adults. *JAMA.* 2005;293:1868-1874.

46. Douketis JD, Paradis G, Keller H, Martineau C. Canadian guidelines for body weight classification in adults: application in clinical practice to screen for overweight and obesity and to assess disease risk. *CMAJ.* 2005;172:995-998.

47. De Lorenzo A, Del G, V, Premrov MG, Bigioni M, Galvano F, Di Renzo L. Normal-weight obese syndrome: early inflammation? *Am J Clin Nutr.* 2007;85:40-45.

48. Karelis AD, St Pierre DH, Conus F, Rabasa-Lhoret R, Poehlman ET. Metabolic and body composition factors in subgroups of obesity: what do we know? *J Clin Endocrinol Metab.* 2004;89:2569-2575.

49. Karelis AD, Faraj M, Bastard JP, et al. The metabolically healthy but obese individual presents a favorable inflammation profile. *J Clin Endocrinol Metab.* 2005;90:4145-4150.

50. Klein S, Fontana L, Young VL, et al. Absence of an effect of liposuction on insulin action and risk factors for coronary heart disease. *N Engl J Med.* 2004;350:2549-2557.

51. National Task Force on the Prevention and Treatment of Obesity. Dieting and the development of eating disorders in overweight and obese adults. *Arch Intern Med.* 2000;160:2581-2589.

52. Sui X, LaMonte MJ, Laditka JN, et al. Cardiorespiratory fitness and adiposity as mortality predictors in older adults. *JAMA.* 2007;298:2507-2516.

53. Deckelbaum RJ, Fisher EA, Winston M, et al. Summary of a scientific conference on preventive nutrition: pediatrics to geriatrics. *Circulation.* 1999;100:450-456.

54. Screening for obesity in adults: recommendations and rationale. *Ann Intern Med.* 2003;139:930-932.

55. Snow V, Barry P, Fitterman N, Qaseem A, Weiss K. Pharmacologic and surgical management of obesity in primary care: a clinical practice guideline from the American College of Physicians. *Ann Intern Med.* 2005;142:525-531.

56. Behavioral counseling in primary care to promote a healthy diet: recommendations and rationale. *Am J Prev Med.* 2003;24:93-100.

57. American Academy of Family Physicians. Summary of Policy Recommendations for Periodic Health Examinations. Revision 5.4, August 2003. Leawood, KS: American Academy of Family Physicians; 2003.

58. American Academy of Family Physicians Initiative. AIM Americans In Motion. Available at: http://www.aafp.org/online/en/home/clinical/publichealth/aim/foryouroffice.html. Accessed 03/10/08.

59. U.S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary Guidelines for Americans, 2005. 6th ed. Washington, DC: U.S. Government Printing Office; 2005.

60. Haskell WL, Lee IM, Pate RR et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc.* 2007;39:1423-1434.

TABLE 1. World Health Organization classification of adult weight by BMI[5,7]

Classification	**BMI** (kg/m^2)	**Risk of comorbidities**
Underweight	< 18.5	Low (but risk of other clinical problems increased)
Normal range	18.50-24.99	Average
Overweight	≥ 25.00	
Preobese	25.00-29.99	Increased
Obesity	≥ 30.00	
Obese class I	30.00-34.99	Moderate
Obese class II	35.00-39.99	Severe
Obese class III	≥ 40.00	Very severe

TABLE 2. National Heart Lung and Blood Institute classifications of overweight and obesity by BMI and waist circumference in adults [1]

		Risk of type 2 diabetes, hypertension, and CVD *relative* to normal weight and waist circumference*	
	BMI (kg/m^2)	**Men ≤ 40 in Women ≤ 35 in**	**Men ≥40 in Women ≥ 35 in**
Underweight	< 18.5	---	---
Normal weight	18.5 – 24.9	---	---
Overweight	25.0 – 29.9	Increased	High
Obesity (Class I)	30.0 – 34.9	High	Very High
Obesity (Class II)	35.0 – 39.9	Very High	Very High
Extreme obesity (Class III)	≥ 40	Extremely High	Extremely High

*NHLBI guidelines note that increased waist circumference can indicate increased disease risk even in individuals considered normal weight.

TABLE 3. Guidelines on screening for overweight and obesity in adults

Organization	Policy, recommendation, and/or guidelines
AMA	Encourages physicians to properly screen for overweight and obesity using BMI and waist circumference in adults, while recognizing ethnic sensitivities and their relationship to stature (also see Appendix). National Obesity Summit recommendations encourage routine measurement of BMI and waist circumference.
American Academy of Family Physicians (AAFP)	Recommends measuring height and weight periodically in all patients and uses CDC definitions of overweight and obesity. The AAFP has educational toolkits to help physicians measure BMI.
American Association of Clinical Endocrinologists (AACE) and American College of Endocrinology (ACE)	Recommend assessing body fat via weight-for-height, BMI, waist-to-hip ratio, waist circumference, and "any other valid methods" as part of a comprehensive medical examination.
American College of Preventive Medicine (ACPM)	Recommends periodic measurement of BMI in all adults and endorses the NIH practical guidelines in advising overweight and obese patients.
American Heart Association and the American College of Cardiology Foundation	Recommend screening for both BMI and waist circumference, but note that some obese people classified as obese may have normal amounts of body fat and a large muscle mass and are not at increased risk of coronary heart disease (CHD), while some people with a normal BMI have high body fat and small muscle mass and are at increased risk of CHD.
Health Canada Guidelines for Body Weight Classification in Adults	Classify body weight using same BMI and waist circumference categories as WHO and NHLBI as part of overall health risk assessment.
Centers for Disease Control and Prevention (CDC)	Classify body weight by NHLBI BMI categories. Recommends assessing additional risk using waist circumference and other risk factors.
The Endocrine Society and the Hormone Foundation	Overweight and obesity classified using NHLBI definitions.
National Heart, Lung, and Blood Institute (NHLBI) and the North American Association for the Study of Obesity (NAASO)	Body weight classified using categories of BMI (kg/m^2) as defined in Table 2. Recommends measuring waist circumference in individuals with a BMI of 25-34.9 kg/m^2
US Preventive Services Task Force (USPSTF)	Recommends screening for overweight and obesity using BMI[54]

World Health Organization (WHO)	Body weight classified using categories of BMI (kg/m^2) as defined in Table 1. Additional cut-points of 23, 27.5, 32.5, and 37.5 kg/m^2 are recommended for public health action in many Asian populations. Recommends measuring waist circumference but has not defined cut-points.

APPENDIX.
Relevant AMA policy related to obesity

Policy D-440.971 Recommendations for Physician and Community Collaboration on the Management of Obesity

Our AMA will: (1) work with the Centers for Disease Control and Prevention to convene relevant stakeholders to evaluate the issue of obesity as a disease, using a systematic, evidence-based approach; (2) continue to actively pursue measures to treat obesity as an urgent chronic condition, raise the public's awareness of the significance of obesity and its related disorders, and encourage health industries to make appropriate care available for the prevention and treatment of obese patients, as well as those who have co-morbid disorders; (3) encourage physicians to incorporate body mass index (BMI) and waist circumference as a component measurement in the routine adult physical examination, and BMI percentiles in children recognizing ethnic sensitivities and its relationship to stature, and the need to implement appropriate treatment or preventive measures; (4) promote use of our *Roadmaps for Clinical Practice: Assessment and Management of Adult Obesity* primer in physician education and the clinical management of adult obesity; (5) develop a school health advocacy agenda that includes funding for school health programs, physical education and physical activity with limits on declining participation, alternative policies for vending machines that promote healthier diets, and standards for healthy a la carte meal offerings. Our AMA will work with a broad partnership to implement this agenda; and (6) collaborate with the CDC, the Department of Education, and other appropriate agencies and organizations to consider the feasibility of convening school health education, nutrition, and exercise representatives, parents, teachers and education organizations, as well as other national experts to review existing frameworks for school health, identify basic tenets for promoting school nutrition and physical activity (using a coordinated school health model), and create recommendations for a certificate program to recognize schools that meet a minimum of the tenants. (CSA Rep. 4, A-05)

H-150.953 Obesity as a Major Public Health Program

Our AMA will: (1) urge physicians as well as managed care organizations and other third party payers to recognize obesity as a complex disorder involving appetite regulation and energy metabolism that is associated with a variety of comorbid conditions; (2) work with appropriate federal agencies, medical specialty societies, and public health organizations to educate physicians about the prevention and management of overweight and obesity in children and adults, including education in basic principles and practices of physical activity and nutrition counseling; such training should be included in undergraduate and graduate medical education and through accredited continuing medical education programs; (3) urge federal support of research to determine: (a) the causes and mechanisms of overweight and obesity, including biological, social, and epidemiological influences on weight gain, weight loss, and weight maintenance; (b) the long-term safety and efficacy of voluntary weight maintenance and weight loss practices and therapies, including surgery; (c) effective interventions to prevent obesity in children and adults; and (d) the effectiveness of weight loss counseling by physicians; (4) encourage national efforts to educate the public about the health risks of being overweight and obese and provide information about how to achieve and maintain a preferred healthy weight; (5) urge physicians to assess their patients for overweight and obesity during routine medical examinations and discuss with at-risk patients the health consequences of further weight gain; if treatment is indicated, physicians should encourage and facilitate weight maintenance or reduction efforts in their patients or refer them to a physician

with special interest and expertise in the clinical management of obesity; (6) urge all physicians and patients to maintain a desired weight and prevent inappropriate weight gain; (7) encourage physicians to become knowledgeable of community resources and referral services that can assist with the management of overweight and obese patients; and (8) urge the appropriate federal agencies to work with organized medicine and the health insurance industry to develop coding and payment mechanisms for the evaluation and management of obesity. (CSA Rep. 6, A-99)