

Chapter 1: Key Messages

- Bone health is critically important to the overall health and quality of life of Americans. Healthy bones provide the body with a frame that allows for mobility and for protection against injury. Bones serve as a storehouse for minerals that are vital to the functioning of many other life-sustaining systems in the body. Unhealthy bones, however, perform poorly in executing these functions and can lead to debilitating fractures.
- The bone health status of Americans appears to be in jeopardy, and left unchecked it is only going to get worse as the population ages. Each year an estimated 1.5 million individuals suffer an osteoporotic-related fracture.
- Great improvements in the bone health status of Americans can be made “simply” by applying in a timely manner that which is already known about prevention, assessment, detection, diagnosis, and treatment.
- There is a large gap between what has been learned and what is applied by American consumers and health care providers. The biggest problem is a lack of awareness of bone disease among both the public and health care professionals.
- An area of particular concern relates to serving ethnic and racial minorities and other underserved populations, including the uninsured, underinsured, and those living in rural areas. Closing this gap will not be possible without specific strategies and programs geared toward bringing improvements in bone health to all currently underserved populations.
- The area of bone health is ideally suited to a public health approach to health promotion. This Surgeon General’s report is calling for Federal, State, and local governments (including State and local public health departments) to join forces with the private sector and community organizations in a coordinated, collaborative effort to promote bone health. This type of approach can serve as the primary vehicle for improving the bone health status of Americans. Some of the work has already begun, but much more work remains.

Chapter 1

A PUBLIC HEALTH APPROACH TO PROMOTE BONE HEALTH

This first report of the Surgeon General on bone health and osteoporosis, which was requested by Congress, comes at a critical time. Tremendous progress has been made in bone health in the last several decades, particularly in the past 15 years. Research has accelerated markedly, enabling the medical community to develop a much more detailed understanding of the factors that promote bone health and cause bone disease and fractures. This enhanced level of knowledge has led to significant advances in the ability to prevent, assess risk factors for, diagnose, and treat bone disease.

Physical activity and calcium and vitamin D intake are now known to be major contributors to bone health for individuals of all ages. Even though bone disease often strikes late in life, the importance of beginning prevention at a very young age and continuing it throughout life is now well understood. Advances in knowledge about risk factors have allowed work to begin on tools that assess the potential for bone disease in an individual. These risk-factor assessment tools help to identify high-risk individuals in need of further evaluation. With respect to diagnosis, the development of noninvasive tools to measure bone density and bone mass has been one of the most significant advances in the last quarter century. As a result, it is now possible to

detect bone disease early and to identify those at highest risk of fracture. Therapeutic advances in bone disease have equaled if not surpassed advances in the areas of prevention and diagnosis. Within the last 10–15 years, new classes of drugs have been developed that, for the first time, have been shown in large-scale trials to significantly reduce the risk of fractures in individuals with bone disease. Large-scale trials have also confirmed the value of vitamin D and calcium supplementation in reducing bone loss and the risk of fractures in some populations.

Research has also led to a much better understanding of the role of secondary factors in the development of bone disease, including use of certain medications and the presence of certain diseases. For example, glucocorticoids are now known to be a significant contributor to osteoporosis. As a result, interventions are available that help minimize the risk of bone disease in those who need these drugs. Similarly, much more is now understood about a leading cause of fractures in the elderly—falls in those who have weakened bones. Enhanced knowledge about why people fall has led to interventions that target the risk factors for falls, such as avoiding or minimizing use of medications that cause dizziness, making environmental modifications in the home, and training to improve strength and balance.

In short, the last several decades represent an era of great excitement and progress in the field of bone health. Thirty years ago, relatively little was known or could be done about osteoporosis; both the disease and the fractures that go along with it were thought of as an inevitable part of old age. Today, however, advances in scientific knowledge have ushered in a new era in bone health, one in which bone diseases can be prevented in the vast majority of individuals and identified early and treated effectively in those who do get them.

However, the tremendous potential offered by this new era of bone health has yet to become a reality. Bone diseases, including osteoporosis, Paget's disease of the bone, osteogenesis imperfecta, rickets, osteomalacia, renal osteodystrophy, and hyperparathyroidism, remain a major public health problem in this country. They affect more than 10 million individuals today, a figure that will rise significantly in the decades ahead unless action is taken now. They cause approximately 1.5 million fractures each year, fractures that impose tremendous physical and emotional costs on those who suffer them and their family members. They represent a significant financial burden to both individuals and society at large. Many of these costs are avoidable, since much is already known about how to effectively prevent, diagnose, and treat bone disease throughout the life span. However, much of what could be done to reduce this burden is not being done today, largely due to a lack of awareness of the problem and the failure to apply current knowledge. In fact, many in the public and even the medical community believe that osteoporosis is a natural consequence of aging and that nothing can be done about it. This view must be changed. The intent of this first-ever report of the Surgeon General on bone health and osteoporosis is to serve as a catalyst for the

development of a public health approach to promoting bone health. The central focus of this effort is to alert individuals and the medical community to the meaning and importance of bone health, including its impact on overall health and well-being, and of the need to take action to ensure the timely prevention, assessment, diagnosis, and treatment of bone disease and fractures throughout life.

This report comes at a very critical time. Like many nations, the United States faces the prospect of an aging population and with it the expectation that the burden of chronic diseases, including osteoporosis, will increase. In fact, without concerted action to address this issue, it is estimated that in 2020 one in two Americans over age of 50 will have, or be at high risk of developing, osteoporosis. If these predictions come true, they will have a devastating impact on the well-being of Americans as they age. In fact, a major theme of this report is that **bone health is critically important to the overall health and quality of life of Americans**. Healthy bones provide the body with a frame that allows for mobility and for protection against injury. Bones also serve as a storehouse for minerals that are vital to the functioning of many other life-sustaining systems in the body. Unhealthy bones, however, perform poorly in executing these functions. They also lead to fractures, which are by far the most important consequence of poor bone health since they can result in disability, diminished function, loss of independence, and premature death.

In recognition of the importance of promoting bone health and preventing fractures, the President has declared 2002–2011 as the *Decade of the Bone and Joint*. With this designation, the United States has joined with other nations throughout the world in committing resources to accelerate progress in a variety of areas related

to the musculoskeletal system, including bone disease and arthritis. As a part of its *Healthy People 2010* initiative, the U.S. Department of Health and Human Services (HHS) has developed two overarching goals that are highly relevant to bone health and osteoporosis. The first goal is increased quality and years of healthy life. In other words, the hope is that Americans can *live long and live well*. As life expectancy has increased, attention has turned to living healthfully throughout life. Fractures, the most common and devastating consequence of bone disease, frequently make it difficult, if not impossible, for elderly individuals to continue to live well. The second goal is to eliminate health disparities across different segments of the population. In addition, the President has launched the HealthierUS initiative and, as a part of this effort, HHS has implemented *Steps to a HealthierUS*, both of which emphasize the importance of physical activity and a nutritious diet. This Surgeon General's Report fits into these larger efforts to highlight the importance of the musculoskeletal system to the health status of Americans and to provide individuals, clinicians, public health officials, policymakers, and other stakeholders with the information and tools they need to improve bone health in all Americans.

The Magnitude of the Problem

Realizing the vision of a "bone-healthy" America will be challenging, given the magnitude of the problem. **The bone health status of Americans appears to be in jeopardy**, a fact that represents another key theme of this report. Fractures due to bone disease are common, costly, and often become a chronic burden on individuals and society. An estimated 1.5 million individuals suffer a bone disease-related fracture each year (Riggs and Melton 1995, Chrischilles et al. 1991). However, this figure significantly

understates the true impact of bone disease, because it captures the problem at a point in time. The impact of bone disease is more appropriately evaluated over a lifetime. Four out of every 10 White women age 50 or older in the United States will experience a hip, spine, or wrist fracture sometime during the remainder of their lives; 13 percent of White men in this country will suffer a similar fate (Cummings and Melton 2002). While the lifetime risk for men and non-White women is less across all fracture types, it is nonetheless substantial, and may be rising in certain populations, such as Hispanic women (Zingmond et al. 2004).

Fractures can have devastating consequences for both the individuals who suffer them and their family members. For example, hip fractures are associated with increased risk of mortality. The risk of mortality is 2.8–4 times greater among hip fracture patients during the first 3 months after the fracture, as compared to the comparable risk among individuals of similar age who live in the community and do not suffer a fracture. Those who are in poor health or living in a nursing home at the time of fracture are particularly vulnerable (Leibson et al. 2002, Richmond et al. 2003). For those who do survive, these fractures often precipitate a downward spiral in physical and mental health that dramatically impairs quality of life. Nearly one in five hip fracture patients, for example, ends up in a nursing home, a situation that a majority of participants in one study compared unfavorably to death (Salkeld et al. 2000). Many fracture victims become isolated and depressed, as the fear of falls and additional fractures paralyzes them. Spine fractures, which are not as easily diagnosed and treated as are fractures at other sites, can become a source of chronic pain as well as disfigurement.

Osteoporosis is the most important underlying cause of fractures in the elderly. Although

osteoporosis can be defined as low bone mass leading to structural fragility, it is difficult to determine the extent of the condition described in these qualitative terms. Using the World Health Organization's quantitative definition based on bone density measurement, there are roughly 10 million Americans over age 50 with osteoporosis and an additional 34 million with low bone mass or "osteopenia" of the hip, which puts them at risk for osteoporosis, fractures, and their potential complications later in life (NOF 2002).

Left unchecked, the bone health status of Americans is only going to get worse, due primarily to the aging of the population. In fact, the prevalence of osteoporosis and osteoporotic-related fractures will increase significantly unless the underlying bone health status of Americans is significantly improved. By 2010, roughly 12 million individuals over age 50 are expected to have osteoporosis and another 40 million to have low bone mass. By 2020, those figures are expected to jump to 14 million cases of osteoporosis and over 47 million cases of low bone mass (NOF 2002). These demographic changes could cause the number of hip fractures in the United States to double or triple by 2040 (Schneider and Guralnik 1990).

While much less is known about the prevalence and treatment of other bone diseases, they too can have a severe impact on the health and well-being of those who suffer from them, especially if they are not diagnosed and treated in a timely manner. Many of the drugs that are used for osteoporosis are also effective as treatments for other bone diseases. While these diseases cannot be prevented, treatment can reduce levels of deformity and suffering. Further research on osteoporosis is likely to yield additional improvements in the treatment of these diseases, and may even yield insights into how they can be prevented.

Not surprisingly, bone disease takes a significant financial toll on society and individuals who suffer from it. The direct care expenditures for osteoporotic fractures alone range from \$12.2–\$17.9 billion each year, measured in 2002 dollars (Tosteson and Hammond 2002). Adding in the direct costs of caring for other bone diseases as well as the indirect costs (e.g., lost productivity for patients and family members) would likely add billions of additional dollars to this tab.

The Challenge

Much of this considerable burden can be prevented. There is no question that significant gaps in knowledge (and hence research needs) remain. **However, another important theme of this report is that great improvements in the bone health status of Americans can be made by applying what is already known about early prevention, assessment, diagnosis, and treatment.** In fact, the evidence clearly suggests that individuals can do a great deal to promote their own bone health. Prevention of bone disease begins at birth and is a lifelong challenge. By choosing to engage in regular physical activity, to follow a bone-healthy diet, and to avoid behaviors such as smoking that can damage bone, individuals can improve their bone health throughout life. Health care professionals can play a critical role in supporting individuals in making these choices and in identifying and treating high-risk individuals and those who have bone disease.

As noted earlier, the importance of achieving adequate levels of physical activity and calcium and vitamin D intake is now known, as is the need to begin prevention at a very young age and continue it throughout life. It is never too late for prevention, as even older individuals with poor bone health can improve their bone health status through appropriate exercise and calcium and vitamin D intake. Much is also

known about how to ensure timely diagnosis of bone disease. Thanks to the development of bone mineral density (BMD) testing, fractures need not be the first sign of poor bone health. It is now possible to detect osteoporosis early and to intervene before a fracture occurs. Promising new approaches to assessment and screening will likely provide an even better understanding of the early warning signs of bone disease in the future. On the treatment front, a variety of drugs have been developed that improve bone health and reduce the incidence of fractures. New and potentially more effective drugs are currently under development. There are effective treatments not only for osteoporosis, but also for other bone diseases such as Paget's disease, hyperparathyroidism, rickets, and osteomalacia. There are also promising new directions for the treatment of osteogenesis imperfecta.

However, too little of what has been learned thus far about bone health has been applied in practice. As a result, the bone health status of Americans is poorer than it should be. Perhaps the biggest problem is a lack of awareness of bone disease among both the public and health care professionals, many of whom do not understand the magnitude of the problem, let alone the ways in which bone disease can be prevented and treated.

Relatively few individuals follow the recommendations related to the amounts of physical activity, calcium, and vitamin D that are needed to maintain bone health. National surveys suggest that the average calcium intake of individuals is far below the levels recommended for optimal bone health (Wright et al. 2003.). Measurements of vitamin D in nursing home residents, hospitalized patients, and adults with hip fractures suggest a high prevalence of insufficiency (Webb et al. 1990, LeBoff et al. 1999, Thomas et al. 1998). Many Americans do not engage regu-

larly in leisure-time physical activity. As shown in Chapter 6, the participation by both adult men and women declines with age, with women being consistently less active than men (Schiller et al. 2004). In addition, only half those 12–21 years old exercise vigorously on a regular basis and 25 percent report no exercise at all (Gordon-Larsen et al. 1999).

Health care professionals can do a better job as well. Studies show that physicians frequently fail to diagnose and treat osteoporosis, even in elderly patients who have suffered a fracture (Solomon et al. 2003, Andrade et al. 2003, Kiebzak et al. 2002, Kamel et al. 2000, Feldstein et al. 2003). For example, in a recent study of four well-established Midwestern health systems, only one-eighth to a quarter of patients who had a hip fracture were tested for their bone density; fewer than a quarter were given calcium and vitamin D supplements; and fewer than one-tenth were treated with effective antiresorptive drugs (Harrington et al. 2002). Other studies have found low usage rates for testing and treatment among the high-risk population, including BMD testing (which ranged from 3–23 percent), calcium and vitamin D supplementation (11–44 percent), and antiresorptive therapy (12–16 percent) (Morris et al. 2004, Smith et al. 2001). In fact, most physicians do not even discuss osteoporosis with their patients, even after a fracture (Pal 1999). Finally, even when physicians do suggest therapy it often does not conform with recommended practice; for example, many patients with low BMD are not treated while others with high BMD are (Solomon et al. 2000).

Managed care organizations and other insurers that provide coverage to individuals under age 65 may not see the full impact of bone disease in their enrollees, since most will have moved on to Medicare by the time they suffer a fracture. Therefore, the commercial providers may

not pay sufficient attention to bone health and to the preventive strategies available to and suitable for younger people.

In short, therefore, the gap between clinical knowledge and its application in the community remains large and needs to be closed, a fact that represents another key theme of this report. Of particular concern is the fact that some populations suffer additional barriers in trying to achieve optimal bone health. Overcoming these barriers will not be possible without specific strategies and programs geared towards bringing improvements in bone health to these populations.

Some of the most important barriers relate to men and racial and ethnic minorities. Osteoporosis and fragility fractures are often mistakenly viewed by both the public and health care practitioners as only being a problem for older White women. This commonly held but incorrect view may delay prevention and even treatment in men and minority women who are not seen as being at risk for osteoporosis. While a relatively small percentage of the total number of people affected, these populations still represent millions of Americans who are suffering the debilitating effects of bone disease.

For the poor (especially the low-income elderly population), individuals with disabilities, individuals living in rural areas, and other underserved populations, timely access to care represents an additional important barrier. Poor access to care may be caused by any number of factors, such as limited knowledge about bone health; a lack of available providers; inadequate income or insurance coverage; the high costs of diagnosis and treatment; a lack of transportation; or the inability to take time off from work to attend to personal or family care needs. Whatever the causes, the goal of better bone health for all Americans cannot be reached without greater efforts to educate underserved populations about

bone health and without significant improvements in their access to appropriate preventive services and counseling, screening, diagnosis, and treatment. Today these underserved populations rely on an unorganized patchwork of providers (e.g., emergency rooms) that are ill-equipped to provide or even facilitate the coordinated, ongoing preventive and treatment services that are needed to maintain bone health and overall health and well-being.

Underserved populations not only have difficulty in accessing care, but there are also concerns about the quality of those services they do receive. A recent study by the Institute of Medicine concluded that racial and ethnic minorities tend to receive lower-quality health care than does the majority population, even after accounting for access-related factors (Smedley et al. 2003). These disparities are consistent across a wide range of services, including those critical to bone health. Moreover, in a large study of older adults who had suffered a hip or wrist fracture, certain groups of patients—including men, older persons, non-Whites, and those with comorbid conditions—were less likely than White women to receive treatment for their bone disease after their fractures (Solomon et al. 2003).

The Opportunity

This Surgeon General's Report looks upon the Nation's at-risk bone status as an opportunity to do better rather than as an intractable problem. A variety of factors make bone health an ideal candidate for a public health approach. These factors include: a) the prospects of declining bone health status due to an aging population; b) the significant gap between what we know and what we apply; c) the need for early prevention of an often "silent" disease; d) the fact that most bone disease does not strike until people are on Medicare; and e) the lack of sys-

tematic evaluation of the prevalence and impact of bone disease. This Surgeon General's Report is calling for Federal, State, and local governments (including State and local public health departments) to join forces with the private sector and community organizations in a coordinated effort to promote bone health and prevent disease. This type of approach can serve as the primary vehicle for improving the bone health status of Americans. To be successful it must involve all stakeholders—individual citizens; volunteer health organizations; health care professionals; community organizations; private industry; and government—and must emphasize policies and programs that promote the dissemination of best practices for prevention, screening, and treatment for all Americans.

Some of the work on this public health approach has already begun. The aforementioned *Healthy People 2010* initiative lays out 467 specific objectives in 28 different areas of health to be achieved during the first decade of the 21st century. Included in these objectives are targets for reducing the number of individuals with osteoporosis and the number of hip fractures, along with increasing levels of calcium intake and physical activity. (See Table 1-1 for more information on those *Healthy People 2010* goals that relate to osteoporosis and bone health.)

One of the purposes of this Surgeon General's Report is to build support at many levels to include current *Healthy People 2010* objectives in health agendas and activities at the Federal, State, and local levels. Developing data systems to track progress on these objectives will be critical to achieving improvements in bone health status. Going forward, it is anticipated that the number of objectives related to osteoporosis and bone health will increase when *Healthy People 2020* objectives are developed, and that existing measures will be refined as our

understanding of the science and our data collection and measurement systems improve.

The Charge

Recognizing that bone health can have a significant impact on the overall health and well-being of Americans, Congress instructed that this report cover a range of important issues related to improving bone health, including: challenges in the diagnosis and treatment of osteoporosis and related bone diseases; the impact of these diseases on minority populations; promising prevention strategies; how to improve health provider education and promote public awareness; and ways to enhance access to key health services. (See Appendix A for more details.)

To initiate the development of the report, an interagency work group was convened by the Surgeon General with staff representatives from the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), the Health Resources and Services Administration (HRSA), the Agency for Healthcare Research and Quality (AHRQ), the Administration on Aging, the Centers for Medicare and Medicaid Services (CMS), the Office of Disease Prevention and Health Promotion, the Office on Women's Health, the Office on Minority Health, the President's Council on Physical Fitness and Sports, the Regional Health Administrators, and the U.S. Department of Agriculture.

As a second step, a Surgeon General's Workshop was convened in December 2002 that brought together a wide range of researchers, public health experts, and patient representatives to discuss key areas that should be addressed in the report. Prior to the workshop, public comments on what the priorities for the report should be were solicited through the Surgeon General's

Table 1–1. Healthy People 2010 Osteoporosis and Bone Health Objectives

Healthy People 2010 Objective Number	Healthy People 2010 Objective	1998 Baseline	2010 Target
Objective 2.9	Reduce cases of osteoporosis	10 percent of adults aged 50 years and older had osteoporosis as measured by low total femur bone mineral density (BMD) in 1988–94 (age adjusted to the year 2000 standard population).	8 percent
Objective 2.10	Reduce hospitalizations for vertebral fracture	17.5 hospitalizations per 10,000 adults aged 65 years and older were for vertebral fractures associated with osteoporosis in 1998 (age adjusted to the year 2000 standard population).	14.0 hospitalizations per 10,000 adults aged 65 years and older
Objective 15.28	Reduce hip fractures		
15-28a	Females aged 65 years and older	1,055.8 per 100,000	416 per 100,000
15-28b	Males aged 65 years and older	592.7 per 100,000	474 per 100,000
Objective 19.11	Increase calcium intake	46 percent of persons aged 2 years and older were at or above approximated mean calcium requirements (based on consideration of calcium from foods, dietary supplements, and antacids) in 1988–94 (age adjusted to the year 2000 standard population).	75 percent
Objectives 22.1–22.15	Increase physical activity (there are 15 objectives for increasing physical activity)	—	—

Data Source 2.9 - National Health and Nutrition Examination Survey (NHANES), CDC, NCHS
 Data Source 2.10 - National Hospital Discharge Survey (NHDS), CDC, NCHS
 Data Source 15.28 - National Hospital Discharge Survey (NHDS), CDC, NCHS
 Data Source 19.11 - National Health and Nutrition Examination Survey (NHANES), CDC, NCHS

Source: USDHHS 2000.

Web site. Following the workshop, a summary of its key findings was released by the Surgeon General (Report 2003).

This report includes contributions from more than 50 authors across the country, while over 100 experts provided valuable guidance and insights in their reviews of initial drafts.

This report is intended to be a catalyst for the advancement of research in bone health, and for accelerating the translation of existing evidence on how to improve bone health status into everyday practice. The net result should be an improvement in the bone health status of Americans.

Evidence Base for the Report

This report is based on a review of the published scientific literature. The scope of the review encompassed studies written in English from throughout the world. The quality of the evidence, based on study design and its rigor, was considered as a part of this review. All studies used in the report are referenced in the text, with full citations at the conclusion of each chapter.

This report does not offer any new standards or guidelines for the prevention, diagnosis, or treatment of bone disease. Rather, it summarizes knowledge that is already known and can be acted upon.

The clinical literature in bone disease includes the full range of studies, from randomized controlled trials to case studies. Comprehensive reviews of the literature have been used for Chapters 2 through 9, and Chapter 11. Chapter 10, which is an attempt to summarize key, actionable findings for busy health care professionals, contains few references, as it largely draws on findings cited elsewhere in the report. Chapter 12 draws on both published studies and case studies of population-based initiatives in bone health,

which were selected in order to highlight particular lessons about such approaches. Additional information on the various kinds of evidence and studies that were used in preparing this report can be found in Appendix B, entitled, “How We Know What We Know: The Evidence Behind the Evidence.”

Experts in their respective fields of bone health contributed to this report. Each chapter was prepared under the guidance of a coordinating author for that chapter. Independent, expert peer review was conducted for all chapters. The full manuscript was reviewed by a number of senior reviewers as well as the relevant Federal agencies. All who contributed are listed in the Acknowledgments section of the report.

Organization of the Report

This report attempts to answer five major questions for a wide variety of stakeholders, including policymakers; national, State, and local public health officials; health system leaders; health care professionals; community advocates; and individuals. The report is organized around each of these five questions. The first section strives to define bone health and bone disease in terms that the public can understand. The second section reviews today’s less-than-optimal bone health status and documents the magnitude of the problem facing the Nation. The third, fourth, and fifth sections of the report tackle the issue of what can be done to improve bone health—first from the perspective of the individual, then from the perspective of the health care professional, and finally from the perspective of the larger health system. The final section lays out a vision for the future.

Part One: What Is Bone Health?

This introductory part of the report defines bone health as a public health issue with an emphasis on prevention and early intervention to

promote strong bones and prevent fractures and their consequences. This first chapter describes this public health approach along with the rationale for the report and the charge from Congress and from the Surgeon General. Chapter 2 provides a brief overview of the fundamentals of bone biology, helping the reader to understand why humans have bones; how bones work; how bones change during life; what keeps bones healthy; what causes bone disease; and what is in store in the future. Chapter 3 offers a summary review of the more common diseases, disorders, and conditions that both directly and indirectly affect bone. While much of Chapter 3 focuses on osteoporosis (including other diseases and medications that can cause it), it also covers other bone diseases, including rickets and osteomalacia, renal osteodystrophy, Paget's disease of bone, developmental skeletal disorders, and acquired skeletal disorders. Both Chapters 2 and 3 should be considered as important scientific background for the remainder of the report.

Part Two: What Is the Status of Bone Health in America?

This part of the report describes the magnitude and scope of the problem from two perspectives. The first is the prevalence of bone disease within the population at large, and the second is the burden that bone diseases impose on society and those who suffer from them. Chapter 4 provides detailed information on the incidence and prevalence of osteoporosis, fractures, and other bone diseases. Where available, it also provides data on bone disease in men and minorities and offers projections for the future. Chapter 5 examines the costs of bone diseases and their effects on well-being and quality of life, both from the point of view of the individual patient and society at large. It includes some real-life vignettes that highlight the impact that os-

teoporosis, Paget's disease, osteogenesis imperfecta, and other related bone diseases can have on those who suffer from them and their family members.

Part Three: What Can Individuals Do To Improve Their Bone Health?

This part of the report examines factors that determine bone health and describes lifestyle approaches that individuals can take to improve their personal bone health. Chapter 6 provides a thorough review of the evidence on how nutrition, physical activity, and other factors influence bone health, including those behaviors that promote it (e.g., physical activity, adequate calcium intake) and those that can impair it (e.g., smoking). Chapter 7 provides practical, real-world guidance on lifestyle approaches that individuals can take to improve their own bone health, including the following: what foods are the best sources of calcium and vitamin D; how to calculate daily calcium intake; when calcium and/or vitamin D supplementation should be considered; and what types of physical activity can contribute to bone health and overall health.

Part Four: What Can Health Care Professionals Do To Promote Bone Health?

This part of the report describes what health care professionals can do with their patients to promote bone health. Chapter 8 examines the potential risk factors for bone disease; highlights red flags that signal the need for further assessment; reviews the use of formal assessment tools to determine who should get a bone density test; and provides detailed information on how to use BMD for both assessment and monitoring purposes. The chapter also provides a glimpse into the future of bone disease assessment and diagnosis. It includes real-life vignettes that highlight the need for the medical profession to become

aware of the potential for severe osteoporosis to develop in younger men and women. Chapter 9 focuses on preventive and therapeutic measures for those who have or are at risk for bone disease. It reviews a “pyramid approach” to treating bone diseases and to preventing falls and fractures, with maintenance of bone health through calcium, vitamin D, physical activity, and fall prevention representing the base of the pyramid for all individuals, including those with bone disease. The second level of the pyramid relates to addressing and treating secondary causes of osteoporosis. The third level of the pyramid is pharmacotherapy. The chapter describes currently available anti-resorptive, anabolic therapies and hormone therapies and offers a glimpse into future directions for pharmacologic treatment of osteoporosis. The chapter also reviews the treatment and rehabilitation of osteoporotic fractures and highlights treatment options for other bone diseases. Chapter 10 “puts it all together” for health care professionals by translating the research into practical advice for preventing, diagnosing, and treating bone disease in patients of all ages. Key symptoms of major metabolic bone diseases are identified, as are red flags that signal a need for further intervention.

Part Five: What Can Health Systems and Population-Based Approaches Do To Promote Bone Health?

This part of the report examines how health systems and population-based approaches can promote bone health. Chapter 11 looks at the key systems-level issues and decisions that affect bone health care, including evidence-based medicine; clinical practice guidelines; training and education of health care professionals; quality assurance; coverage policies; and disparities in

prevention and treatment. It also evaluates the key roles of various stakeholders in promoting a more systems-based approach to bone health care, including individual clinicians; medical groups; health plans and other insurers; public health departments; and other stakeholders. Chapter 12 describes the various potential components of population-based approaches at the local, State, and Federal levels to promote bone health and reviews the evidence supporting their use. This chapter also includes several detailed profiles of innovative and/or effective population-based programs, each of which was selected to illustrate an important concept in population-based health. Chapter 12 also draws lessons for bone health from population-based approaches that have been used in other areas of health, such as the National Cholesterol Education Program, to reduce cholesterol levels in Americans.

Part Six: Challenges and Opportunities: A Vision for the Future

The final part summarizes the key themes of the report, highlights those opportunities that have been identified for promoting bone health, and lays out a vision for how these opportunities can be realized so that bone health can be improved today and far into the future. The key to success will be for public and private stakeholders—including individual consumers; voluntary health organizations and professional associations; health care professionals; health systems; academic medical centers; researchers; health plans and insurers; public health departments; and all levels of government—to join forces in developing a collaborative approach to promoting timely prevention, assessment, diagnosis, and treatment of bone disease throughout life.

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