



Whole-Body Vibration Therapy for Osteoporosis: Technical Brief Number 10

U. S. Department of Health and Human Services, Agency for Healthcare Research and Quality

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Osteoporosis is a skeletal system disease characterized by low bone density and deterioration of bone tissue. The clinical ranges for osteoporosis, osteopenia, and normal bone density are presented. Osteoporosis affects 2 percent of men and 10 percent of women over the age of 50 in the United States. In addition, 49 percent of older women and 30 percent of older men in the United States have low bone density or osteopenia. Osteoporosis is a significant public health problem that leads to increased bone fragility and greater fracture risk, especially of the wrist, hip, and spine. In an epidemiological study conducted in Switzerland, 50 percent of all fractures in women and 24 percent in men were considered osteoporotic. In the United States an estimated 1.5 million yearly osteoporotic fractures result in more than 500,000 hospitalizations, 800,000 emergency room visits, 2.6 million physician office visits, and 180,000 nursing home placements. Hip fractures, in particular, are associated with an increased risk of death. Fractures can also cause pain, height loss, and functional disability, as well as complications such as pressure sores and pneumonia. By 2020, approximately half of all older Americans will be at risk for fractures from osteoporosis or osteopenia. The U.S. Preventive Services Task Force recommends active screening for osteoporosis and early intervention to prevent bone fractures. Current clinical guidelines recommend dietary and pharmacological interventions to treat osteoporosis and prevent bone fractures. An increase of 1 standard deviation in bone mineral density in women would prevent 33 percent of hip fractures and 77 percent of vertebral fractures. Despite proven effectiveness, these treatments may have low rates of long-term adherence. Pharmacological interventions can result in adverse outcomes, commonly minimal trauma atypical fractures, esophageal irritation, renal toxicity, and osteonecrosis of the jaw. Additionally, requirements of pharmacological interventions may be burdensome for patients. How vibration therapy increases bone density is not well understood. One hypothesis suggests that vibration signals transmit and amplify into bone tissue, directly activating mechanosensors in bone cells. Animal studies have demonstrated that vibration increases the anabolic (bone building) activity of bone tissue and increases bone density. Another hypothesis suggests that whole-body vibration, like other weight-bearing exercise, improves muscle strength and power by increasing neuromuscular activation. Human studies on healthy volunteers examined adaptive muscle strength and performance after vibration therapy and found its effects to be similar to those of short-term resistance exercise. Several studies have shown whole-body vibration therapy to improve muscle and bone circulation, increasing the supply of nutrients needed to build bones. This technical brief describes the state of the science and summarizes the key issues related to the use of whole-body vibration therapy to improve bone density for the prevention and treatment of osteoporosis, including modalities, standards, relevant patient populations, outcomes measured, and implications for future research. This report's scope is confined to whole-body vibration platforms designed and marketed for prevention and treatment of osteoporosis; our review excludes exercise equipment with vibrating platforms intended for use in physical fitness or athletic regimens.

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