

## Letter to the editor

September 24, 2012

Hiroshima Journal of Medical Sciences

Dear Editor,

It was with great interest that I read the recent article entitled “Longitudinal study on physical fitness parameters influencing bone mineral density reduction in middle-aged and elderly women: bone mineral density in the lumbar spine, femoral neck, and femur” by Iida et al<sup>4)</sup>. In that paper, the authors state: “As preventive measures against osteoporosis for middle-aged to elderly women, 10,000 steps per day and intense exercise have been reported to inhibit bone mineral density (BMD) reduction.” Readers should be made aware that the extent to which walking 10,000 steps per day will inhibit bone loss or prevent osteoporosis remains the topic of current research. To the best of my knowledge there is no definitive clinical evidence in the archival literature to suggest that the goal of 10,000 steps per day is the optimal target in terms of osteoporosis prevention or treatment. Although participation in daily walking programs has been associated with various health benefits, such as diabetes management, cardiovascular health, and weight control, important questions remain to be answered regarding the precise target of 10,000 steps per day as it relates to skeletal health.

To provide some perspective, it is interesting to examine the origins of the 10,000 steps per day concept. Tudor-Locke<sup>5)</sup> traced the origins of 10,000 steps per day target to a 1960’s advertising campaign by a Japanese manufacturer of pedometers. In the context of recommendations for daily physical activity Tudor-Locke<sup>5)</sup> noted that “neither the appropriateness nor the sustainability of a universal goal of 10,000 steps/day has been thoroughly examined” and that scientific evidence in support of “10,000 steps/day ... is currently lacking and it is doubtful that any universal goal exists applicable to all populations.” Tudor-Locke’s statements are in many ways consistent with the 2004 report on bone health and osteoporosis by the US Surgeon General<sup>6)</sup> in which the Surgeon General concluded that “the evidence does not lead to a specific set of exercises or practices” for promoting skeletal health. Although these views reflect the state of knowledge from approximately a decade ago, I believe a review of the current literature would indicate that these statements are still largely applicable today.

Several recent studies provide some insight into the question of the optimality of the 10,000 steps per day target. In a cross-sectional study of middle-aged adults Boyer et al<sup>1)</sup> estimated the number of steps per day and walking speed that would be required to maintain a bone mineral density T-score<sup>7)</sup> at the hip within the normal range of -1.0 or greater. While increasing the number of steps per day and increasing the walking speed were both predicted to be beneficial for skeletal health, for light weight individuals the target of 10,000 walking steps per day was predicted to be inadequate to maintain a T-score of -1.0, while the required number of steps per day for heavy weight individuals was less than 10,000. The study by Foley et al<sup>3)</sup> reported that the mean number of steps per day was positively correlated with hip BMD, although they found no threshold effect, i.e., a given number (e.g., 10,000) of steps per day did not represent a uniquely meaningful target. Both Boyer et al<sup>1)</sup> and Foley et al<sup>3)</sup> also found that the effects of walking on bone density differed between genders, suggesting that a daily step total that might provide a clinically relevant skeletal benefit will almost certainly be gender specific. Lastly, one could argue that any physical activity metric that only factors in the number of loading cycles (e.g., steps per day), but fails to account for the important influence of

the intensity of skeletal forces associated with an activity, neglects a key factor that is known to affect skeletal development, adaptation and maintenance<sup>2)</sup>.

Given the present state of knowledge, there is insufficient evidence to conclude that adherence to a 10,000 steps per day walking program will be either optimal or universally effective in osteoporosis prevention or treatment.

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## Reply to the editor

October 17, 2012

Dr. Norio Sakai  
 Editor-in-Chief  
 Hiroshima Journal of Medical Sciences

Dear Editor,

We thank Dr. Beaupre for his comments on issues related to our work<sup>1)</sup>. In brief, we agree with his opinion that more studies are needed before giving a specific recommendation regarding how many steps per day of walking would be required to prevent or delay the progression of osteoporosis, although the Ministry of Health, Labor and Welfare of Japan has recommended 10,000 steps/day of walking as a component of a healthy lifestyle for the prevention of lifestyle-related diseases including osteoporosis<sup>4)</sup>.

In our previous cross-sectional analysis involving 30 middle-aged and older women, there was a moderate positive correlation between the average number of steps walked per day during the study period and the young adult mean (YAM) % of the lumbar vertebrae bone mineral density at the end of study ( $r=0.040$ ,  $p=0.025$ )<sup>2)</sup>. Additional analysis of this dataset revealed that the number of steps needed to have T-score of -1.0 (equivalent YAM% is 88) would be 10,350 steps (95% confidence interval 6,510-14,210). Nevertheless, this analysis did not take into account of body weight, ground reaction force, or walking speed, which are purported to modify the relationship significantly<sup>3)</sup>. Moreover, prospective studies are needed in order to clarify how many steps per day are necessary to lower the rate of bone density decline during the follow-up.

Toward these ends, collaborative and strategic efforts are needed to obtain specific and more individualized information for better public skeletal health.

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