REVIEW ARTICLE

Daily step goal of 10,000 steps: A literature review

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Abstract

Background: This review looks at ways to increase physical activity, by walking and other sports and home activities, to reach the daily 10,000 steps goal. It also looks at a number of issues associated with achieving the daily step goal, such as considerations in walking, step counting and physical activity.
Methods: The review is based on MEDLINE (1982-2006) and Google searches using keywords "pedometer", "daily step goal", "physical activity", "exercise".
Results: Research has suggested a daily 10,000 step goal for maintaining a desirable level of physical activity for health. However, this is not normally achievable through routine daily activities. For many, there is a daily deficit of approximately 4000 steps (most from 3000 to 6000 steps), which must be gained from other more rigorous activities. This paper provides information based on the Compendium of Physical Activities, to help people to choose their physical activities to supplement their daily steps, through both sports activities and home activities. It thus helps people to better achieve the goals of Canada's Physical Activity Guide. There are issues to consider in counting steps. A pedometer is not an exact method to measure energy expenditure. Focusing on counting steps may lead to an obsessive attitude toward exercise. Excessive walking and physical activity may lead to certain health problems.
Discussion: Walking is a practical and fun way to change our sedentary life style and to improve the health of the nation. When there is a deficit in daily steps, both sports and home activities can be used to supplement the daily steps to reach the daily step goal. The user-friendly table provided in this paper helps people to identify the sports and home activities, and estimate the durations needed, to meet the daily step goal.
Keywords: Chronic diseases, Metabolic equivalent, Pedometer, Physical activity, Walking

Lack of physical activity in the modern sedentary lifestyle is associated with heart disease,[1,2] hypertension,[1,3,4] diabetes,[5,6,7] and certain cancers including lung,[8] prostate,[9] and colon.[10]

The objective of this review is to look at ways to increase physical activity, including walking, the daily step goal, the use of pedometers, as well as other sports and home activities that can be converted to daily steps for measuring the success of achieving the daily 10,000 steps goal. It also discusses a number of considerations in walking, step counting and physical activity.

Method

Literature search was carried out using MEDLINE[11] (1982 to 2006), as well as Google,[12] using the keywords "pedometer", "daily step goal", "physical activity", "exercise".

Results

1. The daily 10,000 step goal

Research has indicated that walking is an effective way to increase the level of physical activity,[13-15] especially since a pedometer (step counter)[16,17] can be used to measure the success in maintaining or increasing the daily steps. Many public health information booklets from the government and online sources recommend daily step goals of 10,000 steps for adults and 12,000 for youths.[16-22] For adults, 10,000 steps is about 8 kilometres or 5 miles, burns 300 to 400 calories,[16,17] and may be achieved with an active lifestyle that includes a 30-minute walk each day.[16-19,21,23]

TABLE 1. Average number of daily steps and deficit of steps from the daily 10,000 step goal

Study	Average Daily Steps	Daily Step Goal	Deficit from Daily Step Goal
The Pedestrian and Bicycle Information Centre[21]	4000-6000 steps	10,000 steps	4000-6000 steps
Stanten[22]	4000 steps	10,000 steps	6000 steps
University of Colorado step counting project[24]	5310 steps	10,000 steps	4690 steps
Richardson et al, 2005[25]	6019 steps	10,000 steps	3981 steps
Choi et al, 2007[26]	6685 steps	Adults 10,000 steps; Youths 12,000 steps	3315 steps

2. How achievable is the daily 10,000 step goal

For many people, the daily 10,000 step goal is not normally achievable through routine daily activities (Table 1). The Pedestrian and Bicycle Information Center estimates that in normal daily activity most people cover about 4000 to 6000 steps in a day.[21] Stanten estimates that most people walk about 4000 steps doing regular daily activities.[22] The University of Colorado step-counting project registered an average of 5310 steps a day in participants 13 years and older, and an average of 7036 steps a day in participants 13-17 years old.[24] Richardson et al reported an average of 6019 steps per day for their participants in a program at baseline.[25] Choi et al reported 6685 steps in their detailed study on the activities of a Canadian family.[26] Many people can only achieve about slightly more than half of the daily step goal; there is a daily deficit of approximately 4000 steps (with a range of about 3000 to 6000 steps) (Table 1).

3. Activities to increase the daily steps

The deficit of steps from the daily 10,000 step goal must be gained from additional more rigorous activities. Of course, people can choose to do sports, but they should realize that normal household work can also burn calories and increase daily steps. Table 2 provides a list of sports activities and home activities that may be used to supplement the daily steps to reach the daily step goal, based on the Compendium of Physical Activities.[27-29] The table classifies sports and home activities according to Metabolic Equivalent (MET) levels. Metabolic Equivalent is the ratio of the work metabolic rate to the resting metabolic rate. For example, one MET is defined as 1 kcal of energy per kg of body weight per hour, and is roughly equivalent to the energy cost of sitting quietly.[27] The table also shows the steps equivalent per minute for each MET level.

Thus, using whirlpool (sitting) or watching television (sitting) as a reference level (MET level 1), people may choose to do mild stretching or go on vaca-

TABLE 2. Sports activities and home activities that may be used to supplement the daily steps to reach the daily steps goal, based on the Compendium of Physical Activities.[27-29]

MET (1)	Steps equivalent per minute (2)	Sports Activities	Home Activities
12	300	squash, boxing, canoeing (competitive), in-line skating, ice-skating (competitive)	running (upstairs)
11	270	rock climbing, swimming (butterfly)	
10	250	running (on a track, team practice), judo/karate/ kick boxing, rugby, rope jumping, soccer (competitive)	
9	230	running (cross-country), football (competitive)	moving furniture upstairs
8	220	running (training), bicycling, football (general), basketball (competitive), lacrosse, polo, volley ball (competitive), ice hockey, cross-country skiing, snow shoeing	
7	180	**jogging**, tennis, badminton (competitive), soccer (general), roller skating, swimming (backstroke), ice skating (general), tobogganing	**carrying groceries upstairs**
6	150	hiking, weight lifting, fencing, basketball (general), swimming (leisure), water skiing, **downhill skiing**,	race walking (if you went any faster you'd be running), moving furniture, **home repair (outside house)**, gardening with power tools, shovelling snow by hand
5.5	140	health club exercise	mowing lawn
5	135	**ball room dancing**, baseball, children's games, skateboarding, kayaking, snorkeling	walking to work or class, **walking briskly** (like you're late for a bus), walking upstairs, cleaning gutters, painting (outside house), yard work
4.5	130	**badminton (general)**, golf	operating snow blower
4	125	horseback riding, table tennis, volley ball (general), juggling, Tai Chi, paddle boat, **curling**	walking for pleasure, scrubbing floors and bathtub, moving household items, raking lawn, **gardening (general)**
3.5	120	marching band, archery, sky diving, canoeing (general), snowmobiling	walking the dog, walking with purpose, mopping, vacuuming
3	100	light workout, miniature golf, bowling, frisbee playing, **fishing**, sailing	**walking inside the house**, walking downstairs, taking out the trash, picking up things around the house, sweeping floors, heavy cleaning (e.g. washing car), home repair (inside house), painting (inside house), loading/unloading a car, riding snow blower
2.5	70	camping, billiards, croquet, darts, bird watching	**walking shopping** (incl. grocery shopping), light cleaning (e.g. dusting), cooking or food preparation (walking), riding lawn mower or motorcycle
2	45	**mild stretching**	cooking or food preparation (standing), making bed, standing (e.g. talking on phone, reading), showering (standing), **touring/vacation**
1.5	20		retreat/family reunion activities (sitting, relaxing, talking, eating), using a computer, standing in line, sitting (e.g. light office work, card playing, talking on phone, reading), bathing (sitting)
1	0	**whirlpool (sitting)**	**watching television**, riding in a car or bus, reclining (e.g. talking on phone, reading)

(1) MET (Metabolic Equivalent), the ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 kcal/kg/hour and is roughly equal to the energy cost of sitting quietly.[27]

(2) Steps equivalent per minute are based on several sources.[16,18,19,23] They are rough estimates, based on the average 68-kg (150-lb) person with an average step length of 75 cm (2.5 ft) .[23]

tion (MET level 2), go fishing or walk inside the house (MET level 3), practise curling or do gardening (MET level 4), do ballroom dancing or walk briskly (MET level 5), go downhill skiing or do home repair outside the house (MET level 6), go jogging or carry groceries upstairs (MET level 7), and so on.

If one has decided, for example, that an additional gain of 4000 steps each day is required to reach the goal, then this can be achieved by performing activities at MET level 5 (e.g., walking briskly), equivalent to about 135 steps/min (Table 2), for approximately 30 min everyday. This corresponds to health experts' recommendations such as accumulating at least 30 min of additional activity (beyond normal daily life), such as walking, most days of the week.[16-19,21,23]

For activities that are below or above MET level 5 (Table 2), the duration may be more or less, respectively, than the daily 30 min of walking. A daily deficit of 4000 steps means a weekly deficit of about 28,000 steps. For example, one may choose to go shopping (MET level 2.5, about 70 steps/min) for two 3.5-hour shopping sessions per week, play badminton (MET level 4.5, about 130 steps/min) for two 2-hour sessions per week, or go downhill skiing (MET level 6, about 150 steps/min) for one 3.5-hour session per week.

Canada's Physical Activity Guide provides a simple guideline to stay healthy by accumulating physical activity everyday: vigorous effort (20-30 min), moderate effort (30-60 min), light effort (60 min).[18,19] To link this guideline to the Compendium of Physical Activities (Table 2), vigorous effort is roughly MET level 5 or higher, moderate effort is MET level 2.5 to 5, and light effort is MET level 1 to 2.5.

4. Considerations in counting steps

It must be pointed out that counting steps is a simple and practical way, but not an exact and scientific way, to measure energy expenditure. Caloric expenditure depends on the number of steps, as well as height, weight and age of the individual,[30] average step length (distance from the heel of one foot to the heel of the other foot when taking a step),[23,31] whether walking is done on a level surface or at an incline,[27] and other factors.[23]

Focusing on counting steps may increase the likelihood of developing an obsessive attitude toward exercise. Extreme levels of exercise are known to cause health problems such as a disorder similar to anorexia nervosa.[32] Excessive walking may not be suitable for individuals with certain health conditions, and therefore one must check with the doctor before starting a walking program.[17,21,33] Vigorous walking may cause sprains and strains and other injuries.[23] The "Talk Test" may therefore be helpful - if one can carry a conversation while walking briskly, one is setting a good pace; if one is breathless and unable to talk, one is going too fast.[17]

One must also keep safety and tactics in mind when planning the route and time of the walk.[33,34] Similarly, while some activities, such as shopping or going to parties, can increase steps,[26] indulgence can create other health and socio-economic problems such as addiction to shopping, over-spending, over-eating and over-drinking.

Discussion

The traditional approach to physical fitness follows the principle of no gain without pain. Exercise programs are designed to be vigorous enough to keep the heart rate up in the target zone in order to burn calories. This has caused many people to drop out of exercise programs altogether. The recommended active living approach stresses the importance of doing activities that are moderate and fun.[18,19] Active living is more than just physical fitness or exercise. It means making physical activity a part of daily living.

This review provides a practical guide to identify the target and ways to increase the daily steps. By using a pedometer to find out the actual daily steps, it is simple to estimate the daily deficit, and then choose the appropriate kind of additional activities to best increase the steps to meet the daily step goal. The daily

deficit in physical activity can be supplemented not just by sports activities, but also by home activities. For example, doing home repair outside the house is metabolically equivalent to downhill skiing (about 150 steps/min), and both can be fun.

The key to increasing the daily steps is to "get off the chair".[26] By definition, sitting on a chair means deprivation of the opportunity to walk. How about meetings at work that encourage everyone to stand? Standing meetings will likely be short and prevent long hours of sitting that may lead to health problems such as back pain. How about walking to co-workers' offices to talk to them, instead of sending them emails? Reading documents while standing could be preferable to sitting. If it is getting too cold or snowing outside, try walking indoors around the office floor to say hello to some co-workers. At home the message is to "get off the couch". How about walking on a treadmill while watching TV news, or doing house work while listening to music? At school it is difficult to encourage getting off the chair in class, but it may be important to encourage gymnasium classes, lunch hour swimming sessions, and physical exercise breaks.[35]

Canada's Physical Activity Guide recommends accumulating 30 to 60 minutes of moderate activity on most days of the week.[18,19] Walking is a practical and fun way to change our modern sedentary life style and to improve the health of the nation.

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