

# WellSpring

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## Watch Your Step: Pedometers and Physical Activity

### The Art and Science of Pedometer Programming

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Pedometers. That's right, pedometers. These seemingly improbable and innocuous personal-feedback gadgets are defying the fad label and becoming more and more mainstream. Program-deliverers, challenged to creatively incorporate pedometers into their programs, are scurrying around trying to immerse themselves in the art and science of pedometer programming. This article is intended to give some initial direction, using an example of a pedometer-based program developed in Canada.

#### How Pedometers Work

A pedometer has an internal, horizontal, spring-suspended lever arm that moves up and down with normal walking movements. With each movement, an electrical circuit closes and a "step" is recorded. This simplicity explains the pedometer's appeal—an appeal that has pedometer manufacturers working overtime to keep up with demand.

#### Why Program Theory Is Important

You could compare a pedometer to computer hardware—without the necessary "software" (e.g., program theory), the machine is useless (Tudor-Locke, 2002). Program theory is used to logically organize and explain what happens in the program and why it happens (Myers, 1999; Sidani & Braden, 1998).

A well thought-out program theory is useful in program development, implementation, and evaluation. Crucial elements of a program theory include

- problem definition;
- critical inputs;
- mediating processes;
- expected outcomes;
- extraneous factors; and
- implementation issues (Lipse, 1993; Sidani & Braden, 1998).

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Unfortunately, a great many programs out there are atheoretical, i.e., they lack a strong program theory and/or provide few program details essential for implementation and delivery in real-world settings.

## The First Step Program

### The Underlying Program Theory

The best way to explain program theory is to give an example. The First Step Program was originally developed to meet the lifestyle physical activity needs of individuals with Type 2 diabetes (Tudor-Locke, Myers, Rodger, & Ecclestone, 1998). We also designed this program to be easy to deliver, inexpensive, and effective. The First Step Program was developed from program theory (Tudor-Locke, Myers, & Rodger, 2001) in collaboration with diabetes educators and individuals with Type 2 diabetes (Tudor-Locke et al., 1998).

Constructing the program theory underlying the First Step Program began with a *problem definition*: this program was designed for people with Type 2 diabetes (who are characteristically sedentary, overweight/obese, and who can benefit greatly from increased physical activity).

We identified the program's *critical inputs*, or key components, from published literature and program deliverers and recipients. These critical inputs included group meetings, self-scheduled moderate-intensity walking, self-monitoring, and goal-setting. The program also used both a pedometer and calendar and took advantage of personal social support networks and planned follow-up contact.

Social cognitive theory (Bandura, 1997) informed the *mediating processes* (i.e., links between *critical inputs* and *expected outcomes*), especially the well known concepts of self-efficacy (i.e., self-confidence) and social support.

*Expected outcomes* (short-, intermediate-, and long-term program outcomes) of the program included

- an immediate and profound increase in physical activity (i.e., steps/day);
- reduced body composition indicators with adherence (e.g., waist girth);
- eventual reduction in cardiovascular risk factors (e.g., blood pressure).

*Extraneous factors* that can influence outcomes included participant and program-deliverer characteristics, program setting, and day-to-day home or work environments. The First Step Program attempts to increase participants' recognition and control of these extraneous factors.

Finally, *implementation issues* consisted of the procedures (e.g., recruiting, screening, tracking) and resources (e.g., facilities, equipment) needed for successful program delivery. For example, the First Step Program has few (and inexpensive) equipment requirements, can be easily delivered in a range of settings, and requires little training for program deliverers.

### An Overview of the Program

The First Step Program is an eight-week, pedometer-based lifestyle program designed to incrementally increase and sustain habitual physical activity behaviours in previously sedentary people.

The Canadian Centre for Activity and Aging in London, Ontario, coordinates the continued evaluation of



Dr. Catrine Tudor-Locke "walking the talk" of active living.

the First Step Program in diabetes education centres across Canada (supported by the Canadian Diabetes Association and Health Canada).

Recently, Prince Edward Island successfully adapted the First Step Program for delivery at office work-sites to general populations (funded by the Prince Edward Island Health Research Program).

We need to evaluate additional adaptations of the First Step Program in diverse populations and settings in order to refine the program theory underlying pedometer-based programs. Given the current widespread interest in pedometers, we can expect our knowledge of the art and science of pedometer programming to increase very quickly.

Dr. Catrine Tudor-Locke is the author of a new self-help book called *Manpo-kei: The Art and Science of Step Counting*. This book outlines straightforward ways of using an inexpensive and simple pedometer to increase physical activity as part of a weight-management program. For more information, visit the publisher's web site at [www.trafford.com/robots/02-1196.html](http://www.trafford.com/robots/02-1196.html).

References available from the Alberta Centre for Active Living ([www.centre4activeliving.ca](http://www.centre4activeliving.ca)).



### How Do Pedometers Work?

*By Dru Marshall, PhD, Lisa Workman, BPE, Graduate Student, and Carrie Melanson, BKin, Graduate Student, Faculty of Physical Education and Recreation, University of Alberta.*

The pedometer is a motion sensor that detects vertical movements (i.e., acceleration and deceleration) of the body (Vincent & Pangrazi, 2002). These vertical movements are expressed as the number of counts or steps taken during walking or running.

Most pedometers today are electronic (e.g., the Yamax Digiwalker). Electronic pedometers are activated when the foot hits the ground, producing an impulse that transfers to the pedometer case (Sequeira, Rickenbach, Wietlisback, Tullen, & Schutz, 1995).

The pedometer contains a lever arm with a pendulum attached to a spring. With each step, the pendulum moves and one electrical event is recorded on the digital read-out (Tudor-Locke, Ainsworth, Thompson, & Matthews, 2002).

You can wear a pedometer in a variety of places. (Some sites are more reliable than others.) Most users wear the pedometer on the waist, generally clipped on to a waistband or belt, over the centre of the leg. However, for standardization purposes, Tudor-Locke et al. (2002) suggests placing the pedometer over your dominant foot.

## The 10,000 Steps Rockhampton Physical Activity Promotion Project

W. Kerry Mummery, PhD, Associate Professor, School of Health and Human Performance, Central Queensland University, Rockhampton, Queensland, Australia.

### What Is the 10,000 Steps Project?

The 10,000 Steps Rockhampton Project is currently Australia's largest community-based physical activity promotion project. Now nearing the end of its first year, the project (which has gained much attention in Australia) promotes using pedometers as motivational tools to help people

increase the amount of incidental physical activity accumulated during their normal daily activities. Thousands of tiny step-counters are at work in the city, providing feedback to their wearers on the daily goal of accumulating 10,000 steps.

The pedometer is, however, only the tip of the health-promotion iceberg. Acting as the marketing hook for the promotion of physical activity, the pedometer is only one element within a much larger social-ecological framework of community-wide health promotion. The over-arching goal of the project is to positively affect the culture of a regional Australian city in terms of health-related physical activity.

### The Project Team

This project is being conducted by an experienced and knowledgeable team of physical activity researchers from Central Queensland University (CQU), the University of Queensland (UQ), and the Queensland University of Technology (QUT), in collaboration with members of the Rockhampton community.

The community has had significant input in developing the proposed project, setting the stage for continued collaboration and sustainability within Rockhampton. Community partners include the National Heart Foundation, Rockhampton City Council, Capricornia Division of General Practice, Local Health Services and the Central Public Health Unit, Sports Medicine Australia, Central Region Sport and Recreation, and local media services. The team combines a diverse range of proficiencies, including key community stakeholders and service providers, along with researchers with expertise in physical activity, public health, sociology, and behavioural epidemiology from the three universities. The project also has the support of federal and state members of parliament.

The project is being implemented by a Rockhampton-based, multi-disciplinary steering committee (the Local Physical Activity Task Force



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(LPATF)), who are working with the community to develop strategies and provide expertise. A health-promotion advisory and evaluation group, which includes several of Australia's leading practitioners in the planning, implementation, evaluation, and financial management of physical activity and other health-promotion projects, is providing training, consultation, and expertise. In addition, an international advisory panel of physical activity experts from Australia, North America, and Europe have helped to develop the project, ensuring a worldwide focus on Rockhampton over the next few years.

### About Rockhampton

Rockhampton is the major regional city of Central Queensland, with a population of 60,000 people. Serving a trading region of over 250,000 people, Rockhampton is known as "The Beef Capital of Australia."

The city's climate supports an outdoor lifestyle all year round.

Rockhampton sits on the Tropic of Capricorn and has two seasons—wet and dry—rather than the four seasons of the temperate zone. The city experiences three months of wet season, from December to February, and nine months of fine sunny weather. Average maximum temperatures range from 23–32 degrees Celsius, while average minimums are between 11 and 23 degrees Celsius.

### Our Approach

This project has focused on reaching and engaging socio-economically disadvantaged and sedentary men, women, older people, and unemployed people.

We are using five strategies (currently in various stages of development) to increase the prevalence of physical activity among the population. These strategies build on previous programs conducted by the project team and include the following.

- *Local media campaigns.* These campaigns raise awareness about the low levels of physical activity in the community, profile the program theme (i.e., 10,000 Steps Rockhampton), highlight community role models, and promote associated activities.
- *Promoting physical activity through general practice and other health services.* This strategy is guided by the active practice protocol that has been successfully trialled in New South Wales and Victoria. In addition, allied

health-care providers will make referrals to physical activity resources, disseminate current activity guidelines, and advocate behaviour change.


- *Improving social support among disadvantaged groups.* This strategy will involve working with community partners in the health, sport, recreation, and fitness sectors to provide leadership for activity programs that target the needs of disadvantaged and special-needs groups.
- *Policy and environmental change.* This strategy is being guided by the recently published *Creating Active Communities: Physical Activity Guidelines for Local Councils*, which focuses on developing an infrastructure to promote active living within the community.
- *Community initiatives.* A community fund is being established to support community-based initiatives and competitions to increase physical activity in local neighbourhoods, small workplaces, and non-government organizations.

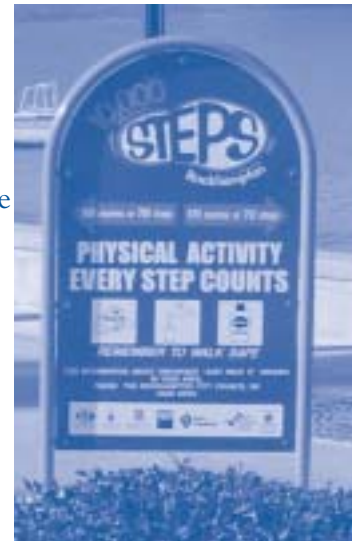
### Innovative Aspects of the Project

These proposed, multi-level strategies have never been implemented simultaneously in a single community, nor targeted specifically at the most disadvantaged.

Implementing these individually successful strategies all at once could have synergistic effects (more so than from implementing each strategy in isolation). Using a central coordinating theme, 10,000 Steps Rockhampton is an innovative approach that unifies a multi-strategy program. This unified theme, along with using pedometers to increase the knowledge about and prevalence of physical activity, is an Australian first.

For more information, contact the 10,000 Steps Project Office, Central Queensland University (10000steps@cqu.edu.au) or visit our web site at [www.10000steps.org.au](http://www.10000steps.org.au).

References available from the Alberta Centre for Active Living ([www.centre4activeliving.ca](http://www.centre4activeliving.ca)). 





# Buyer Beware: Pros and Cons of Pedometers

Dru Marshall, PhD, Lisa Workman, BPE, Graduate Student, and Carrie Melanson, BKin, Graduate Student, Faculty of Physical Education and Recreation, University of Alberta.

## Measuring Physical Activity

Increasing evidence points to the negative health effects of physical inactivity and the positive effects of regular physical activity. However, we need to know more about the health benefits of physical activity and the effectiveness of activity interventions. According to Lamonte and Ainsworth (2001), the precise amount and type of physical activity required to achieve specific health-related outcomes remains unclear. However, a major limiting factor in studying and monitoring physical activity behaviours and the associated health benefits has been the lack of a reliable, valid, and standardized assessment tool (Melanson & Freedson, 1996).

Currently, there is no universally accepted “gold standard” method for measuring physical activity (Melanson & Freedson, 1996). Assessing physical activity is a complex and challenging issue (Kinningham, 2001). There are both direct (e.g., motion sensors, observation, diaries, logs) and indirect (e.g., fitness measures, heart-rate monitoring, questionnaires, and surveys) ways to assess physical activity in a variety of populations (Prentice, 2002; Tudor-Locke & Myers, 2001a).

Essentially, these methods should be reliable, valid, sensitive to changes in individual activity patterns, applicable to diverse

groups, economically viable, and unobtrusive (Dishman, Washburn, & Schoeller, 2001; Melanson & Freedson, 1996).

**“Currently, there is no universally accepted ‘gold standard’ method for measuring physical activity...Assessing physical activity is a complex and challenging issue...”—Dru Marshall, Lisa Workman, and Carrie Melanson.**

## What You Should Know before Using a Pedometer

Pedometers typically measure the number of steps that a person takes over a set period of time. More sophisticated units are able to estimate the total distance travelled and/or energy expenditure during a certain time-frame (Freedson & Miller, 2000).

However, there are problems associated with these more sophisticated pedometers. The total distance travelled, for example, depends on an individual’s stride length. Stride length itself depends on body shape and size and walking speed (Bassett et al., 1996). Thus, people with a smaller stride length will not cover the same distance as people with larger stride lengths, even when an equal number of steps is taken.

To estimate distance, people need first to determine their stride length. Measure stride length by having the individual walk a predetermined number of strides, measure the distance covered, and then divide the distance covered by the number of strides taken (Bassett et al., 1996).

Pedometers that estimate the number of calories burned require you to enter stride length plus other specific variables, such as body weight and age. Since both distance travelled and the number

of calories are estimated values, they are associated with greater error than the number of steps recorded by the pedometer.

## Advantages of Pedometers

There are a number of advantages associated with pedometers. Pedometers are inexpensive, ranging from CDN\$15 to \$75, with an average cost of CDN\$30 per unit (Tudor-Locke & Myers, 2001a). Because the pedometer is relatively small and light-weight (similar to the size of a pager), it is not intrusive (Welk et al., 2000). In addition, virtually all segments of the population (including children, adults, and people with disabilities) can wear pedometers (Vincent & Pangrazi, 2002).

The benefits of using pedometers are both personal and situation-specific. Pedometers give people immediate feedback about how many steps they have taken during the day (Tudor-Locke, 2001). This feedback can increase self-efficacy (personal confidence) and may increase motivation to achieve a certain number of steps per day (Bassett, 2000).

Moreover, a pedometer can be used as a coaching and self-monitoring tool (Freedson & Miller, 2000) to help people set goals (Bassett, 2000). A pedometer can also work as a behavioural modification tool—people can document change and recognize progress in their activity levels (Beighle, Pangrazi, & Vincent, 2001). As a result, the pedometer may help to increase physical activity levels.

Pedometers are also socially acceptable (Sequeira et al., 1995)

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and relatively simple to operate. People from a diverse number of cultures and languages can use pedometers because they provide objective numerical measurements (Sequeira et al., 1995). Unlike subjective measurement tools such as questionnaires, diaries, and logs, pedometers avoid self-report bias. Pedometers can thus provide an objective measure to help validate self-reported estimates of walking (Dishman, Washburn, & Schoeller, 2001).

As a whole, a pedometer has many advantages as a tool for measuring individual physical activity behaviour. In addition, when documenting activity levels of different populations, pedometer readings can provide researchers and/or practitioners with information about sedentary individuals and population participation rates (Tudor-Locke, Myers, & Rodger, 2001).

### Limitations of Pedometers

Despite the obvious benefits of pedometers, they also have limitations. The main problem is that they do not measure the intensity (how hard), duration (how long), or frequency (how often) of physical activity (Beighle, Pangrazi, & Vincent, 2001). It is also difficult to relate the number of steps taken to existing physical activity recommendations (Welk et al., 2000). For example, *Canada's Physical Activity Guide to Healthy Active Living* recommends that adults accumulate 60 minutes of physical activity on most days of the week.

In addition, pedometers generally underestimate the number of steps taken during higher intensity activities (Rowlands, Eston, & Ingledeu, 1999) and show consistently more errors during slow walking (Bassett et al., 1996). Discrepancies among different models of pedometers can also limit their usefulness (Freedson & Miller, 2000). Furthermore, pedometers store steps taken over a period of time and are not able to store single-day values over a period of many days. Thus, if daily records are important, the pedometer must be reset daily.

Pedometers are also not as accurate for people who do a fair amount of bending and/or who have excessive abdominal fat, as the pedometer may move away from the person's body (Tudor-Locke & Myers, 2001b).

Finally, pedometers cannot distinguish between walking and running (Bassett, 2000) and cannot measure static movements, non-locomotor activities, upper-body exercises, water sports, and cycling (Beighle, Pangrazi, & Vincent, 2001).

### Summing Up

Researchers and/or practitioners need to weigh all of these advantages and limitations before deciding to use the pedometer for measurement and as a motivational tool for daily physical activity for different populations and in a variety of situations.

References available from the Alberta Centre for Active Living ([www.centre4activeliving.ca](http://www.centre4activeliving.ca)).

## Stepping Out: Tips for Walkers

Joanne Gesell, MA, Education Coordinator,  
Alberta Centre for Active Living.

What is Canada's most popular physical activity? No, it isn't hockey or soccer. For most of us, walking is the single most beneficial, all-purpose physical activity. Walking is a gentle activity that treats the body with great respect by placing just the right amount of stress on the joints.

Walking is enjoyable, relaxing, and good for you! Regular brisk walking for 30 minutes on four to seven days a week reduces the risk of cardiovascular disease, diabetes, obesity, osteoporosis, and some cancers (Health Canada & CSEP, 1998). Habitual walkers also benefit from increased energy levels, more stamina, better sleep, and lower stress levels. No wonder 69% of Canadians reported walking, which makes it our most popular physical activity (Statistics Canada, 1999-2001).

### Getting Started

Pick a simple destination to start and try to focus on having fun while being more physically active.

Although walking doesn't require lessons, there are still some things to remember.



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- Choose clothing that is right for the season. Wear layers of comfortable clothing that won't restrict your movement.
- Protect your eyes and skin during all seasons. Wear a hat, sunglasses, and sunscreen on bright days.
- Good, inexpensive running shoes are great for walking. Look for shoes with a wide space for your toes and lots of flexibility under the forefoot (the ball of your foot). Make sure that your shoes feel comfortable—not too wobbly and not too stiff.
- Book your workouts into your day-timer. Choose walking times that suit your schedule and routine. Pick safe routes and think about walking with others.
- Perform gentle stretching exercises for the muscles in your lower leg and mobility exercises for your ankles.
- Start slowly and build up. Once you are more active, you will reap more health benefits from walking more quickly and adding more steps to your day.

### Setting Goals

Being motivated to make positive changes in your life is the first step toward a healthy lifestyle. People who set goals are much more likely to achieve them.

A SMART activity plan includes goals that are:

- *Specific.* Include enough detail so you know exactly how and when you will be active, e.g., “I will walk the dog for 30 minutes after work five times per week for the next two weeks.”
- *Measurable.* Decide how you will assess your progress. Will you measure the time you are active or the number of your steps? Measuring your activity gives you tangible evidence of your progress.
- *Attainable.* You are the best judge of your strengths and weaknesses and can use this information to maximize your chances of success.
- *Realistic.* You are more likely to be successful if you plan only a few things, rather than many things. Start small and include only what you can do.
- *Timely.* Note when you plan to work at your goal and how long it will take you to achieve.

### Measuring Your Progress

Use a logbook or calendar to record your physical activity goals. Logbooks are invaluable accountability tools. If your goal is to walk for 45 minutes during

lunch on a minimum of four days per week, then place a checkmark or a star on your logbook/calendar each day that you meet that goal.

Perhaps you have chosen to wear a pedometer to keep track of all the steps you take during the day. Record the number of steps at the end of each day to determine whether you have met your personal goal. You can see at a glance how you have progressed over time.

### Barriers (and Solutions) 101

Think of walking as a basic human need, a form of transportation, a beneficial way to be physically active and improve your health, and a fun and refreshing way to relax. Find ways to incorporate walking into your daily life, so that it becomes as natural as eating, showering, and sleeping.

But what if...

- *I don't have time to walk.*

On the days when you can't seem to set aside a half hour for a walk, find shorter periods of time when walking naturally fits into your schedule. Look at your calendar and check off the times that you could walk instead of driving. Try including walking meetings at work.


- *I haven't been physically active since high school.*

Even small lifestyle changes such as walking around a soccer field during a child's game or walking around the airport during a layover can improve your health. Walking allows you to accomplish several things at once. You can incorporate walking into your daily schedule, e.g., by walking to work, walking your kids to school, or walking when you're doing errands or visiting a friend.

- *I find walking boring.*

Inject some fun into walking to keep you motivated. For example, vary your routine, walk at different times of day, or explore new walking routes. If you always walk on a trail, try heading downtown or pick out an interesting neighbourhood to see new sights as you stroll. Create a daily walking habit. Adopt a “walking buddy” so that you share and enjoy long walks and good conversation.

Make a commitment to yourself to start walking today and reap the rewards of a healthier, longer, more independent life.

References available from the Alberta Centre for Active Living ([www.centre4activeliving.ca](http://www.centre4activeliving.ca)). 

### Mission statement of the Alberta Centre for Active Living

Working with practitioners, organizations, and communities to improve the health and quality of life of Albertans through physical activity.

### If you have suggestions or questions, we'd like to hear from you.

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## News from the Alberta Centre for Active Living

### SummerActive

The Alberta Centre for Active Living is proud to support SummerActive, a national six-week campaign that takes place every May and June to promote physical activity and help develop healthy lifestyles. The goal of this community-based campaign is to encourage people to have some fun on the road to a more active lifestyle. This year's campaign runs between May 9 and June 21. The Alberta Active Living Challenge will take place on May 28. This event challenges as many Albertans as possible to participate in at least 30 minutes of physical activity. For more information, please visit the SummerActive web site at [www.summeractive.canoe.ca](http://www.summeractive.canoe.ca).



The centre will be coordinating Hot Topics in Healthy Living to coincide with SummerActive. Working with partners in health promotion (including the Provincial Fitness Unit, Ever Active Schools, the Dietitians of Canada, and AADAC), we will distribute one Hot Topic during each week of SummerActive. Look for e-mail notices about these information sheets starting during the week of May 12.

### Centre's Resource Library Catalogue Live!

The Alberta Centre for Active Living's library houses materials on physical activity, active living, chronic disease prevention, the benefits of recreation, health promotion, population health, health determinants, nutrition, heart health, and workplace wellness. The collection is intended primarily for practitioners, researchers, and students. Information is available in a variety of formats, including periodicals, government documents, resource kits, videos, books, manuals, pamphlets, and fact sheets.

Our library catalogue is now on our web site. You can search it by keyword, title, author, publisher or sponsoring organization, or document type. To view the catalogue, visit the Resource Library section of our site ([www.centre4activeliving.ca](http://www.centre4activeliving.ca)).

### Healthy Living Newspaper Insert

The centre recently contributed active living information to a newspaper insert on healthy living that was distributed in newspapers across Alberta, including the *Edmonton Journal*, *Calgary Herald*, and all weekly newspapers. To view the insert, please visit the Nutrition File section of the Alberta Milk web site at [www.nutritionfile.ca](http://www.nutritionfile.ca).

### Canadian Health Network (CHN) Board Appointment

The Alberta Centre for Active Living, in partnership with the Leisure Information Network, manages the CHN Active Living Health Centre. The centre is pleased to announce that one of our founders, Dr. Art Quinney, has been invited to be a member of the CHN Advisory Board. Dr. Quinney is Deputy Provost at the University of Alberta. We congratulate Dr. Quinney, whose expertise will be a great asset to the work of the board in achieving CHN's vision and mission.

Alberta  
Centre for  
**Active Living**

Research and education for the promotion of physical activity