Cost-Comparison Analysis of a Physician-Delivered Step-Count Prescription Strategy

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ABSTRACT

Background: Increments of 1000 steps/d predict cardiovascular disease (CVD) event reductions. In adults with type 2 diabetes and/or hypertension, our Step Monitoring to Improve Arterial Health (SMARTER) trial demonstrated a physician-delivered step-count prescription strategy to increase steps by more than this amount over 1 year, compared to usual care. In the present analysis, we aimed to determine the costs of the intervention compared to usual care, incorporating 1-year intervention costs and projected savings from lower CVD hospitalizations over the subsequent 5 years.

Methods: We considered Canadians aged 55 to 74 years with type 2 diabetes and/or hypertension. Using time estimates from our trial, we computed nursing costs corresponding to patient support time over 1 year, and pedometer costs for an anticipated 50% of patients without a smartphone. We estimated the number of CVD hospitalizations, the incremental costs of 1000 steps/d, and the association savings. We calculated the net cost (savings), the proportion of patients with their own device required for cost neutrality, and costs (savings) if all patients needed to be provided with a device.

Results: At an average intervention cost of $51.28/patient, the total cost would be $168 million. With an estimated 8875 CVD events in adults with diabetes and/or hypertension, to prevent CVD.

In 2016, an estimated 17.9 million people died from cardiovascular disease (CVD) globally, accounting for one-third of all deaths. Approximately 85% were due to myocardial infarction and stroke. The comorbidity associated with these events is substantial, as are the costs of CVD management. A large body of evidence demonstrates that greater amounts of walking are associated with reduced CVD risks in diabetes and hypertension, 2 critical and prevalent CVD risk factors. There is a need for cost-effective strategies to increase walking in adults with diabetes and/or hypertension, to prevent CVD.

A variety of step-counting devices and apps are available to capture steps per day. A recent systematic review reported that increasing steps by 1000 steps/d reduces both all-cause mortality and CVD events. We demonstrated that a physician-delivered step-count prescription strategy (Step Monitoring to Improve Arterial Health [SMARTER]) increases steps by 1200/d over 1 year, compared to usual advice to be active, in adults with type 2 diabetes and/or hypertension. The American Heart Association highlighted this as an evidence-based approach to technology integration into clinical care, and our strategy was adopted into the Diabetes Canada Clinical Practice Guidelines.

The aim of the current study was to examine the net costs (savings) of the strategy, accounting for intervention costs over 1 year and projected savings from reduced hospitalization with fewer CVD events over the subsequent 5 years. Demonstration of benefit could support efforts to integrate step-count prescription into clinical care pathways for type 2 diabetes and hypertension.

RESUMÉ

Contexte : Une augmentation de 1000 pas par jour est un facteur prédicatif de la réduction des événements attribuables à une maladie cardiovasculaire (MCV). Chez des adultes atteints de diabète de type 2 et/ou d’hypertension, l’essai SMARTER (Step Monitoring to Improve Arterial Health) que nous avons réalisé a démontré qu’une stratégie de prescription par un médecin d’un nombre quotidien de pas à effectuer permettait d’obtenir une augmentation du nombre de pas supérieur à cette valeur sur une période de un an, comparative- ment aux soins habituels. Dans la présente analyse, notre objectif était de déterminer les coûts de cette intervention par rapport à ceux des interventions habituelles, en incluant les coûts de l’intervention sur un an et une projection des économies que permettrait une baisse des hospitalisations pour cause de MCV au cours des cinq années subséquentes.

Méthodologie : Nous avons pris en considération des Canadiens âgés de 55 à 74 ans atteints de diabète de type 2 et/ou d’hypertension. À partir des estimations de temps effectuées dans notre essai, nous avons calculé les coûts correspondant au temps consacré par le per- sonnel infirmier au soutien des patients pendant une année et le coût d’un pedomètre pour les patients n’ayant pas de téléphone intelligent,
prevented. $208 million would be saved. This savings would result in ~$40 million in net savings with 50% device ownership, cost neutrality with 25% device ownership, and ~$42 million in net costs if all patients required the healthcare system to provide a device.

Conclusions: At current levels of smartphone ownership, adoption of the SMARTER strategy is cost-saving to cost-neutral from the healthcare system perspective.

Methods
We adopted the perspective of the publicly funded Canadian healthcare system. We used trial procedures and materials and costed these in terms of real-world settings to estimate per patient intervention costs over 1 year. We multiplied this by the total number of adults with type 2 diabetes and/or hypertension in Canada. We estimated CVD events in this population over the next 5 years and the expected reductions with a mean step-count increase similar to that achieved with our strategy. We calculated the savings that would result from the corresponding reduction in CVD hospitalizations. We then calculated the net cost (savings). We provide details below.

SMARTER trial summary and costs of step-count prescription
All participants in the SMARTER trial were adults who had type 2 diabetes and/or hypertension, a body mass index of 25 to 40 kg/m², and were walking <10,000 steps/d at baseline. Among 347 randomized, 174 were in the step-count prescription arm; they received a Yamax SW-701 pedometer, a validated step-counting device, and maintained a step log. At clinic visits over 1 year, they reviewed their logs with their physician and received a written step prescription. Steps per day targets were increased more progressively in participants with lower baseline step counts. Control arm participants were advised to engage in 30 to 60 minutes of activity daily. Both active arm and control arm participants were mailed back to the study centre in the stamped envelopes provided. Control arm participants were not provided with a pedometer for use during the trial intervention period, but they received one at the end of the trial in acknowledgement of their participation. There was a median of 3 visits over 1 year in both trial arms, consistent with recommended care. As noted, compared to the control arm, active arm participants achieved a net increase of 1200 steps/d.

During the actual trial, research assistants demonstrated device use and provided support as needed. In the present analysis, we therefore incorporated nursing time costs for each visit as an additional cost, assuming that clinic nurses would provide support. We calculated costs for 20 minutes of nursing time during the patient’s first visit and 10 minutes at each of the remaining 2 visits over 1 year, applying the median hourly wage of a nurse at a primary care clinic.

Physicians are remunerated by Medicare, and 3 visits per year are guideline concordant, so clinical visit remuneration was not included as a specific intervention cost. However, we incorporated 3 hours of physician training time for reading about the strategy and/or viewing an online module, applying the higher medical specialist vs family physician remuneration rates for professional development in Quebec. Given that a trained physician would be caring for multiple participants, the training cost was converted to a per-patient cost; we estimated at least 350 patients with diabetes and/or hypertension per physician, representing 20% of patients in a practice of 1750 patients, roughly the size of an average primary care practice in Canada.

The step-counting device was a key component of the active arm intervention. Given that an increasing number of persons own their own smartphone with step-counting functions, we incorporated this into our analysis. Per a survey conducted by the Pew Research Center, 59% of adults in the United States (US) aged 65 to 69 years, and 49% of US adults aged 70 to 74 years own a smartphone. Similarly, 60% of internet users aged over 65 years in Canada own a smartphone. In our main analysis, we assumed that 50% of our intervention population would own their own device and thus had access to a step-counting app. For the patients without their own step-counting device, in the interest of equity, we considered the cost of obtaining a step-counting device as a healthcare-level cost. We ascertained costs of commercially available devices and selected a price within this range.

Search strategies
We conducted literature searches to identify studies examining associations between steps per day and CVD event rates (PubMed citation index; from inception to September 7, 2020; keyword search string 'steps' AND ('pedometer' OR 'accelerometer') AND ('myocardial infarction' OR 'stroke' OR 'cardiovascular disease')) with an emphasis on identifying relevant systematic reviews. We used WorldCat, a search tool that includes books and reports that record statistics from provincial and federal governments of Canada, to ascertain the CVD event rate in Canada (key words 'Canada' AND 'Cardiovascular disease' AND 'Statistics' AND 'Stroke' AND 'Heart disease' OR 'myocardial infarction')) and the costs of hospitalization for myocardial infarctions and ischemic strokes (key words 'Canada'
AND 'direct health care costs' AND 'ischemic stroke' and then 'Canada' AND 'direct health care costs' AND 'myocardial infarction'). A filter was applied to narrow the search to publications from within the past 10 years.

Main analysis

Computations were performed in Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA). Given that SMARTER trial participants averaged age 60 years (standard deviation [SD] 11.2),9 we estimated the number of Canadians aged 55 to 74 years with type 2 diabetes and/or hypertension, using data sources identified through the literature searches described. We applied the estimated per-patient intervention cost to this total number, accounting for 50% of the cohort owning their own step-counting device. We calculated the expected number of CVD events over a 5-year horizon in this cohort and the reduction that would be realized by the intervention, assuming that an average increase of 1000 steps/d was achieved in the year prior. We calculated the savings obtained through this reduction in CVD events. We then computed the net cost (savings) over a 6-year period, with the implementation of the step-count prescription strategy during the first year. This particular 5-year follow-up period was selected based on the results of our review of associations between change in steps and CVD events, as described under Results (CVD events prevented with a step-count increase). A discounting rate of 1.5% was applied as recommended by the Canadian Agency for Drugs and Technologies in Health (CADTH).17

Sensitivity analyses

Given the inherent parameter uncertainty in an economic evaluation, we conducted several sensitivity analyses. First, we varied nurse support time and remuneration across a range of estimates, to examine the impact of both of these simultaneously on costs, using a 2-by-2 matrix. Second, we varied device costs across the range of prices for pedometers in Canada. Third, we conducted an analysis to estimate the proportion of the population that would have to have their own pedometer device for the strategy to be cost neutral, and another analysis in which none of the patients already owned a device. Fourth, we varied estimates of the increased rate of CVD events in patients with diabetes and/or hypertension. Finally, we varied the estimates of reductions in CVD events associated with higher step counts.

Results

Costs of 1-year step-count prescription strategy

The median Canadian wage of a nurse was determined to be $37.60/hour.18 Assuming that the nurse spends 40 minutes yearly, per participant, providing support, the cost of nursing support per patient is $25.07. For 3 hours of training, medical specialists in Quebec are reimbursed a maximum of $422.0019 and family physicians $354.50.20 Applying the higher specialist reimbursement rate translates to a per-patient cost of $1.21, assuming that each physician follows at least 350 patients. The cost of the Yamax SW-701 pedometer used in the SMARTER trial was $18.48, but pedometer costs vary based on the brand, number of pedometers ordered, step-count accuracy, and extra features. We identified pedometer unit costs (pre-tax) varying from $14.99 for a Sportline 340 Step & Distance Pedometer (Running Room, Edmonton, AB) and Fitbit Inspire 2 (Fitbit Inc, San Francisco, CA).

| Item Study value | Sensitivity-analysis values |
|------------------|-----------------------------|
| Cost of nursing support per patient | $25.07 | $12.04-$90.44 |
| Canadian wage of a nurse, $/h | $37.60 | $24.08-$45.22 |
| Time per patient for support, min | 40 | 30-120 |
| Cost of physician training per patient | $1.21 | $1.21 |
| Cost of training per physician | $1.21 | $1.21 |
| Number of patients treated/physician | 350 | 350 |
| Cost of pedometer* | $50.00 | $10.00-$130.00 |
| Average per-patient cost for physician-delivered step-count prescription strategy | 51.28 | $13.25-$221.65 |

Table 1. Cost of the physician-delivered step-count prescription strategy from a healthcare system perspective

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Estimated CVD event rates

The search string to identify yearly CVD events in Canada yielded 2203 results. The most relevant was a publication by the Public Health Agency of Canada that reported the 2005 and 2006 incidences of myocardial infarction and stroke hospitalizations in the group aged 55-64 years in Canada to be 343 and 143.8 per 100,000 persons, respectively.21 For the group aged 65-74 years, the rates were higher—590.7 and 365 per 100,000 persons, respectively.22 Summing these rates yields an average of 721.25 total hospitalizations per 100,000 persons for myocardial infarction or stroke. In patients with diabetes, the incidence of cardiovascular events increases by 2-3 times.22 Given that the myocardial infarction and stroke rates reported in Canada include those with diabetes or hypertension, we estimated that the rates in a population of only those with diabetes or hypertension would be 50% higher (ie, rather than threefold higher) compared to general population estimates. The result was an estimated 1082 total events per 100,000 persons per year.

CVD events prevented with a step-count increase

We identified 265 studies reporting associations between steps and CVD events, including a recent and relevant systematic review that captured all pertinent studies. The review reported that increasing steps by 1000/d from baseline
Costs of hospitalization for CVD events

The search string to identify the cost of myocardial infarction and stroke hospitalizations in Canada on WorldCat yielded 258 and 144 results, respectively. The 2 most pertinent studies were selected.\textsuperscript{27,28} It was estimated\textsuperscript{27} that the average cost of hospitalization for a myocardial infarction was $16,462.21. For stroke (disabling and non-disabling), the average cost for hospitalization and rehabilitation (for the first 3 months) was $40,624.\textsuperscript{28} Per the myocardial infarction and stroke hospitalizations rates above, the proportions of myocardial infarction and stroke were 65% and 35%, respectively. Using these proportions, the cost of a CVD event hospitalization was calculated to be $24,919.\textsuperscript{27,28}

Theoretical cohort

Our theoretical cohort was all Canadians aged 55 to 74 years with type 2 diabetes and/or hypertension. In 2014, the general Canadian population aged 55 to 74 years was 3,856,110 men and 4,008,408 women.\textsuperscript{29,30} The prevalence of hypertension in this time period was 32.5% and 27.3% in men and women aged 55 to 64 years, respectively, and 43.9% and 44.9% in men and women aged 65 to 74 years, respectively.\textsuperscript{30} The prevalence of diabetes in 2014 in men aged 55 to 59 years, 60 to 64 years, 65 to 69 years, and 70 to 74 years was 14.4%, 19.8%, 25.4%, and 29.8%, respectively. In women, it was 11.1%, 15.1%, 19.1%, and 22.6%, respectively.\textsuperscript{31} Therefore, approximately 1,425,313 men and 1,378,906 women had hypertension, and 806,403 men and 642,286 women had diabetes in Canada in 2014. A study showed that 67.1% of Canadians with diabetes also had hypertension.\textsuperscript{32} Therefore, of the 806,403 men and 642,286 women who had diabetes, 541,096 men and 430,974 women also had hypertension. In order to avoid double-counting, we subtracted these values from the above estimates of Canadians aged 55 to 74 years with hypertension, to determine the number of Canadians with hypertension alone (884,217 men and 947,932 women). By summing the estimate of the population with diabetes, which also includes people with diabetes and hypertension, and the estimate of the population with hypertension alone, we estimated that the Canadian population aged 55 to 74 years with diabetes and/or hypertension is 3,280,838.

Cost-comparison analysis results

As noted above, in a group of 100,000 patients with diabetes and/or hypertension, there would be an estimated 1082 CVD events per year. Therefore, in the 3,280,838 Canadians aged 55 to 74 years with diabetes and/or hypertension, there would be 35,499 total CVD events per year. A 5% reduction in events in this group translates to 1775 CVD events prevented yearly, or 8875 CVD events prevented over the 5 years following the 1-year intervention. With a discounting rate of 1.5%, the total savings associated with this change would be $208,416,006.

Our analysis above demonstrated that the 1-year step-count prescription strategy resulted in an average per-patient cost of $51.28 if half of the intervention population owned their own device. Therefore, implementation of the strategy for all Canadians aged 55 to 74 years with diabetes and/or hypertension would be $168,241,373. Therefore, in the case of 8875 CVD events prevented over 5 years, there would be a net savings of $40,174,633 with the strategy (Table 2).

Sensitivity analyses

According to the Interprofessional Health Federation of Quebec, the wage of a nurse may vary from $24.08/hour to $45.22/hour, depending on education level and work

| Item                                      | Study value   | Sensitivity-analysis values |
|-------------------------------------------|---------------|-----------------------------|
| Costs                                     |               |                             |
| Average cost of implementing SMARTER strategy (per patient) | $51.28         | $13.25-$221.65              |
| Canadians aged 55 to 74 years with diabetes and/or hypertension | $3,280,838     | $3,280,838                  |
| Total cost                                | $168,241,373  | $43-$727 million            |
| Savings                                   |               |                             |
| Yearly number of CVD events/100,000 Canadians with diabetes and/or hypertension | 1082           | 721-2164                    |
| Total annual number of CVD events among Canadians aged 55 to 74 years with diabetes and/or hypertension | 35,495        | 23,663-70,989               |
| Percent reduction in CVD events yearly    | 5             | 0-5                         |
| Estimated yearly decrease in number of events | 1775          | 0-3549                      |
| Number of years                           | 5             | 5                           |
| Cost of a cardiovascular event, $          | $24,919       | $24,919                     |
| Discount rate (applied to savings occurring over 5 years following a 1-year intervention), % | 1.50\textsuperscript{27,28} | 1.50\textsuperscript{27,28} |
| Total savings                             | $208,416,006  | $0-$417 million             |
| Net cost (savings)                        |               |                             |
| Total cost of implementing SMARTER strategy | $168,241,373  | $43-$727 million            |
| Total savings from potential CVD event prevention | $208,416,006 | $0-$417 million             |
| Net cost (savings)                        | ($40,174,633) | ($373)-$727 million         |

CVD, cardiovascular disease; SMARTER, Step Monitoring to Improve Arterial Health.
Simultaneously varying the nursing cost from $24.08/hour to $45.22/hour, and the yearly amount of nursing time per patient between 30 minutes and 2 hours, while keeping the per-patient physician training cost of $1.21 and the device cost of $25.00 constant, resulted in per-patient costs ranging from $38.25 to $116.65 (Supplemental Table S1).

When the pedometer cost was varied from $10.00 (bulk order) to $130.00, with the nursing costs, physician training costs, and proportion of patients with their own device held constant, the per-patient cost of the strategy varied between $31.28 and $91.28. Varying all 3 factors (pedometer cost, nursing wage, and yearly nursing time per patient), while keeping physician training costs and proportion of patients with their own device constant at $1.21 and 50%, respectively, resulted in costs ranging between $18.25 and $156.65.

If the healthcare system had to provide a pedometer to the entire intervention population, and we assumed a pedometer cost of $50, the per-patient cost of intervention would be $76.28. Similar variations in nursing hourly wage, time spent in nursing support per patient, and physician training cost as above would result in per-patient costs ranging between $23.25 and $221.65. On the other hand, if the entire population owned or procured their own device, the per-patient cost incurred by the healthcare system to deliver the SMARTER strategy over 1 year would decrease to $26.28. Variations would result in per-patient costs ranging from $13.25 to $91.65.

Therefore, the average per-patient cost of implementing the step-count prescription strategy can range to anywhere between $13.25 and $221.65. This large range is mainly due to the large variation in the device cost.

Assuming the cost of the intervention to be $26.28 for patients with their own pedometer, and $76.28 for patients without their own device, we estimated that approximately 25% of the population would need to own a pedometer for the net cost (savings) of the strategy to be zero.

To estimate the incidence of CVD events in patients with diabetes and/or hypertension, we assumed a 1.5-fold increase of the incidence rate compared to that in the general population. If the incidence rate ranged from that of the general population to a 3-fold increase, then the number of CVD events prevented from the SMARTER intervention over a 5-year period would range from 5915 to 17,745. Therefore, implementation of the strategy (average per-patient cost of $51.28) would vary from a net cost of $29,336,508 to a net savings of $248,473,221.

Furthermore, we adopted a 5% reduction in CVD events over a 5-year time horizon for our intervention. If there was no reduction obtained, the healthcare system would incur the entire $168,241,373 cost of the intervention without any benefits. If there was only a 2.5% reduction in CVD events over a 5-year period, then only 4435 CVD events would be prevented and implementation of the strategy would have a net cost of $64,092,079. Therefore, if the reduction in CVD events over a 5-year period ranged from 0% to 5%, the net cost (savings) of the intervention would vary between a cost of $168,241,373 and a savings of $40,174,633.

Varying the total number of CVD events from that of the general population to a 3-fold increase and the percent reduction due to the intervention from 0% to 5%, while keeping the average per-patient cost of the strategy constant at $51.28, would result in the net cost (savings) of the intervention ranging between a cost of $168,241,373 and a savings of $248,473,221. Simultaneously varying the average per-patient cost of the strategy from $13.25 to $221.65 would result in the net cost (savings) of the intervention ranging between a cost of $727,197,743 (if no reduction in CVD events were attained) and a savings of $373,243,490.

**Discussion**

The SMARTER intervention achieved a net increase of 1200 steps per day from baseline, which we have estimated would reduce the number of cardiovascular events by 8875 over 5 years in Canadians aged 55 to 74 years with type 2 diabetes and/or hypertension. We estimate that implementation of the strategy could lead to a net savings of $40,174,633 if half of the cohort owns their own device. If the device had to be provided to all patients, the strategy would have a net cost of $41,846,317 for the same 8875 CVD events prevented over 5 years. This translates to a cost of $12.75 per patient or $4715 per CVD event prevented. If approximately 25% of this population owned their own device, the strategy would be cost neutral. These findings clearly support the integration of step-count prescription delivery, training, and monitoring into clinical services for adults with type 2 diabetes and/or hypertension.

There are benefits that we did not capture in the present analysis, including mental health benefits and osteoarthritis symptom relief. Additionally, there are benefits such as years of life gained and morbidity reductions resulting from CVD prevention. Step count increments of 1000 steps/d are associated with reductions in mortality rates of 6%-36%. In 2007, a total of 43.5% of Canadians who reported having heart disease, and 57.2% of Canadians who reported living with effects post-stroke, rated their health as being fair or poor, compared to only 6.1% of Canadians without chronic conditions. Among Canadians who reported having heart disease and living with effects post-stroke, 30.3% and 59.5%, respectively, reported needing help with their daily activities of living, compared to 7.4% of Canadians without heart disease or stroke. Furthermore, 68.8% and 83.6%, respectively, reported having limitations doing activities they enjoyed, compared to 29.3% of Canadians without heart disease or stroke. These activity limitations have cost implications in terms of productivity loss and healthcare expenditures. We did not integrate these, as this would have required a wider set of assumptions; however, the prevention of mortality and morbidity is clearly valuable to society.

A key attraction of the SMARTER strategy is its simplicity and its structural similarity to other aspects of diabetes and hypertension care. Just as healthcare professionals provide self-management support with measuring and reviewing home blood pressure and glucose values, the SMARTER strategy involves self-management support for step counting. Our in-depth interviews with physicians and patients indicate high enthusiasm for the strategy but a need for support from other clinic staff, similar to that provided by the coordinator in our original trial. In the present analysis, we demonstrate that...
integrating such support into clinical practice is a worthwhile investment, translating into overall cost savings in certain situations.

In our study, we estimated that half of our intervention population owned their own step-count measuring device, such as a smartphone with a step-counting app. Given that with time the proportion of the population with a suitable device will continue to grow, the per-patient cost to the healthcare system could become lower than estimated. In addition, bulk purchase by the healthcare system could reduce costs further. Some private medical insurance plans have incorporated physical activity monitoring into plans, providing potential for discounted rates if certain activity thresholds are achieved. This stream of funding for devices could thus lower costs further. Moreover, as technology evolves, these devices may become less expensive.

In the present analysis, we compared the cost of implementing the SMARTER intervention over one single year with the savings associated with the CVD events prevented in the subsequent 5 years. Ideally, we hope that participants would continue to monitor their step counts, either daily or intermittently as a check, and that their physicians would continue to support and motivate them to incrementally further increase or maintain their daily step count. Moreover, as participants continue beyond 1 year, physical activity may become a habit. The pedometer cost and the cost associated with physician training are one-time costs incurred at the onset of the strategy. The nursing time costs are arguably most relevant in the first year, for instruction on step monitoring and pedometer or app use and troubleshooting; thereafter, the patient would be expected to be sufficiently experienced. Therefore, given that the physician visit is covered by Medicare, and additional nursing support beyond 1 year is less likely to be needed, we believe it is reasonable to estimate intervention-related costs beyond 1 year as being zero from a healthcare system perspective.

There are limitations to our analysis. Our original trial was not large or long enough to provide all relevant information within a single study. We therefore had to rely on a combination of data sources, including our trial, observational studies of steps/day and long-term impact on CVD, and published estimates of hospitalization costs. The observational study examining associations of step-count changes over 1 year to subsequent reductions in 5-year CVD events was well suited to our purpose and included nearly 10,000 participants; however, as for all observational studies, reverse causality cannot be excluded, despite prospective follow-up. Furthermore, as discussed, it was beyond the scope of our study to investigate considerations of quality-adjusted life years. Despite these limitations, we believe that by combining various data sources, we have derived reasonable estimates of savings and costs associated with implementing a physician-delivered step-count prescription strategy.

Walking is a form of physical activity that is feasible for many people and is often endorsed as a preferred form of exercise by persons with diabetes and/or hypertension. Nonetheless, there are environmental factors that may be limiting for outdoor walking, including cold temperatures and precipitation, and “walkability” of neighbourhoods in terms of sidewalks, green spaces, variety and proximity of points of interest, intersection density, safety, and other factors, as we and others have described. However, accumulation of steps may also be achieved indoors, walking up and down stairs and hallways, and even stepping in place. The use of a pedometer to achieve targets, indoors or outdoors, renders the SMARTER intervention appealing to patients and physicians.

Conclusions

Our cost-comparison analysis demonstrates that at current levels of smartphone ownership, adoption of the SMARTER strategy in adults with type 2 diabetes and/or hypertension is cost saving to cost neutral from the healthcare system perspective. The cost to implement the strategy and prevent cardiovascular disease events would arguably remain reasonable if the device was provided to all participants.

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Supplementary Material

To access the supplementary material accompanying this article, visit CJC Open at https://www.cjcopen.ca/ and at doi:10.1016/j.cjco.2021.04.009.