Effectiveness of a computer-tailored print-based physical activity intervention among French Canadians with type 2 diabetes in a real-life setting

François Boudreau1*, Gaston Godin2 and Paul Poirier3
1Department of Nursing, Université du Québec à Trois-Rivières, 3351 boul. des Forges, Trois-Rivières, QC, Canada G9A 5H7, 2Canada Research Chair on Behaviour and Health, Faculty of Nursing, Laval University, Pavillon Ferdinand-Vandry, 3e étage, 1050 rue de la Médecine, QC, Canada G1V 0A6 and 3Faculty of Pharmacy, Laval University, Institut universitaire de cardiologie et de pneumologie de Québec, 2725 Chemin Sainte-Foy, QC, Canada G1V 4G5.

*Correspondence to: F. Boudreau. E-mail: francois.boudreau@uqtr.ca

Received on February 6, 2010; accepted on February 3, 2011

Abstract

The promotion of regular physical activity for people with type 2 diabetes poses a challenge for public health authorities. The purpose of this study was to evaluate the efficiency of a computer-tailoring print-based intervention to promote the adoption of regular physical activity among people with type 2 diabetes. An experimental design was used; 325 participants between the age of 35 and 55 years old were randomized in one of two experimental conditions: the computer-tailoring intervention and the generic intervention. The two dependent variables were the frequency of participation and the intention to participate in leisure-time physical activities. Among the research hypotheses, only one was confirmed: the first computer-tailoring print on the practice of physical activity was more efficient than the first generic intervention at 1-month follow-up. Other similar studies will be necessary to determine the real potential of this type of approach for people with type 2 diabetes in a real-life setting.

Introduction

In Canada, one of two people with type 2 diabetes does not succeed in mastering their glycaemia (A1C ≥ 7.0%) [1], which exposes them to a greater risk of micro and macrovascular complications associated with this disease. However, the results of a pan-Canadian consultation about the prevention and care of diabetes indicate that waiting lists for educational programmes are frequent, which suggests that many people with diabetes are unable to take part in them [2]. Furthermore, a recent Canadian study revealed that numerous educators specialized in diabetes believe they do not have the required knowledge and training to guide people with diabetes in regards to physical activity [3].

An educational intervention designed according to computer-tailoring principles [4] could constitute an innovative approach to meet the needs of this clientele. One of the advantages of this approach lies in its capacity to gather in an interactive manner a large public while developing ‘customized’ educational messages for each of its members [5]. While referring to the use of a print base (letter, booklets and magazine), which corresponds to the first generation of computer-tailoring, the results of Noar’s meta-analysis [6] indicate that this approach is generally efficient in fostering the adoption of health-related behaviours [effect size r = 0.074; IC95% (0.066–0.082)].

To our knowledge, in the field of regular physical activity promotion for people with type 2 diabetes, little or no evaluation studies relative to computer-tailoring have been published in a real-life setting.
setting—delivered exclusively via mailed print materials. As this approach represents an innovative way to promote the adoption of this behaviour for Canadians with type 2 diabetes, other evaluation studies are necessary. In short, the purpose of this study was to evaluate the effect of a computer-tailoring intervention in promoting the adoption of regular physical activity for people with type 2 diabetes. Four research hypotheses were formulated: (i) participants exposed to a single computer-tailoring print will demonstrate, after a month, a higher level of physical activity practice (H1) and intention (H2) than those exposed only to a single generic print; (ii) participants exposed to two computer-tailoring prints will demonstrate, after 1- and 3-month follow-ups, a higher level of physical activity practice (H3) and intention (H4) than those who were exposed to two generic prints.

**Theoretical framework and intervention development**

The theoretical assumptions of the computer-tailoring intervention were mainly developed based on a motivational/post-motivational perspective [7]. In the motivational phase, participants were exposed to educational messages based on the results of a study conducted by our research team on the determinants of intention [8]. Based mainly on the theory of planned behaviour [9], the results of this study enabled the formulation of three educational goals in order to develop in the participants a positive intention to practice physical activity. To do so, objectives of the intervention were (i) to create a positive attitude towards regular physical activity, (ii) to increase the feeling of self-efficiency for regular physical activity and (iii) to develop a feeling of moral obligation towards regular physical activity. The post-motivational phase included participants motivated to respect the recommendations issued in regards to physical activity. A planning strategy (action and coping planning) was developed with the ‘health action process approach’ model [7], which aimed at facilitating the progression from motivation to behaviour. In the present intervention, two customized prints were created, six and seven page long, respectively. Tables I and II summarize both computer-tailoring prints.

**Methods**

**Research design and study population**

A pre-test/post-test experimental design was used. Participants were randomized into one of the two following conditions: (i) computer-tailoring intervention, (ii) generic intervention. Figure 1 presents the evaluation sequence of the research protocol. The research protocol was approved by the ethics committees of Université Laval (2005–18) and Université du Québec à Trois-Rivières (CER-07-123-06.14).

The targeted population of this study was men and women between 35 and 55 years of age with type 2 diabetes, whose main language was French, living in private households of all health regions of the province of Quebec (Canada), with the exception of Cree and Inuit regions. The sample size was calculated from the software package G*Power [10]. Therefore, according to a mixed plan 2 (computer-tailoring group and generic group) × 3 (Time 0, Time 2 and Time 3), considering a statistical power of 0.80 and an alpha value of 0.05, a total sample size of 164 participants was necessary to detect a small effect size ($f = 0.10$).

Inclusion criteria were the following: (i) be affected by type 2 diabetes, (ii) practice leisure-time physical activity less than three times per week and (iii) not have any major contraindications to regular practice of physical activities. Considering these criteria, a document containing the contact information of 2000 people with diabetes was obtained from the Régie de l’assurance-maladie du Québec (Quebec Health Insurance Board). These potential participants were living over the 17 administrative regions of the province of Quebec, an area of 1 667 441 km$^2$. However, 222 individuals without diabetes were registered by mistake in the document provided by Quebec Health Insurance Board. After exclusion of these individuals, the potential sample was 1778 individuals with diabetes. Following the study recruitment phase detailed below, 518 (29%) participants expressed an interest in participating
and submitted their consent form. Background data on age and gender indicated that the non-respondents \((n = 1260)\) and respondents \((n = 518)\) differed only on age \((\text{mean age} 49.7 \pm 5.2 \text{ versus} 48.9 \pm 5.2, P = 0.005)\). Finally, among the 518 respondents, 193 did not meet the inclusion criteria and the other 325 were randomized to the computer-tailoring \((n = 166)\) or the generic intervention \((n = 159)\) group.

### Table I. Overview of the first-tailored print communication

<table>
<thead>
<tr>
<th>Section (title)</th>
<th>Theoretical framework</th>
<th>Objective</th>
<th>Educational methods</th>
<th>Number of potential messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why could this informational print be of use to you?</td>
<td>—</td>
<td>Present the content of the print to the participant, underlining that its contents were prepared specifically for him/her based on the evaluation questionnaire</td>
<td>Information</td>
<td>1</td>
</tr>
<tr>
<td>Are you a physically active person?</td>
<td>PAPM</td>
<td>-Inform him/her about his/her exact participation in leisure-time physical activities.</td>
<td>Descriptive feedback</td>
<td>48</td>
</tr>
<tr>
<td>Where is your level of physical activity situated in comparison with other people with diabetes?</td>
<td>PAPM</td>
<td>Inform him/her about his/her exact participation in leisure-time physical activities in comparison with other people with type 2 diabetes.</td>
<td>Comparative feedback</td>
<td>18</td>
</tr>
<tr>
<td>What are the physical activity recommendations for people with diabetes?</td>
<td>—</td>
<td>Allow the participant to compare his/her level of participation in leisure-time physical activities according to the issued recommendations.</td>
<td>Information</td>
<td>2</td>
</tr>
<tr>
<td>How do you evaluate yourself, motivation wise?</td>
<td>TPB</td>
<td>Allow the participant to take acknowledge his/her motivation in regards to achieving the issued recommendations.</td>
<td>Descriptive feedback</td>
<td>12</td>
</tr>
<tr>
<td>What is our advice?</td>
<td>TPB</td>
<td>Motivational Phase: develop in the participant a positive intention towards the practice of leisure-time physical activity (attitude, barriers, moral norm).</td>
<td>Persuasive communication</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>TIB</td>
<td>Post-motivational Phase: help the participant translate his/her motivation into behaviour.</td>
<td>Testimonies</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>GST</td>
<td></td>
<td>Goal setting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HAPA</td>
<td>Action planning (where, when, how)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Coping planning</td>
<td>Quiz</td>
<td>1</td>
</tr>
</tbody>
</table>

A last word! — Encourage the participant to review previous sections (2–6) in order to examine skills learned.

PAPM = Precaution adoption process model; TPB = Theory of planned behaviour; TIB = Theory of interpersonal behaviour; GST = Goal-setting theory; HAPA = Health action process approach and II = Implementation intentions.

Main objective: present to each participant a global portrait of his/her physical activity situation and make him/her progress towards the practice of regular physical activity.

### Experimentation and data collection procedure

In February 2007, participants of both groups first received an envelope by mail containing four elements: (i) a letter of invitation for the research project, including the eligibility criteria, signed by the researchers; (ii) the consent form; (iii) the first research questionnaire (Time 0) and (iv) a pre-addressed return envelope. The mail was used in
this study because we wanted to get closer as much as possible to an intervention in a real-life setting, with no face-to-face contact between participants and researchers.

The participants were invited to complete and return the consent form and the first research questionnaire. The customized message contents of the first print for participants randomized in the computer-tailoring intervention were defined according to the data collected. For the participants randomized in the generic intervention, the contents of the first print were independent from the questionnaire completed at Time 0. Approximately 4 weeks after returning the first questionnaire (Time 0), the participants of both groups received the first print (March 2007). Then, 4 weeks after receiving

<table>
<thead>
<tr>
<th>Section (title)</th>
<th>Theoretical framework</th>
<th>Objective</th>
<th>Educatve methods</th>
<th>Number of potential messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why a second informational print?</td>
<td>—</td>
<td>Present the content of the print to the participant, underlining that its content is linked to the changes observed after the first print.</td>
<td>Information</td>
<td>1</td>
</tr>
<tr>
<td>A small quiz to start off?</td>
<td>—</td>
<td>Bring the participant to reflect upon his/her participation in leisure-time physical activities since the first print.</td>
<td>Quiz</td>
<td>1</td>
</tr>
<tr>
<td>Has your level of physical activity changed?</td>
<td>CT</td>
<td>Inform the participant of the ‘behavioural’ change observed since the last print.</td>
<td>Evaluative feedback</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>SCT</td>
<td>Encourage the participant independently from the change observed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is your level of physical activity now situated in comparison with other people with diabetes?</td>
<td>CT</td>
<td>Allow the participant to evaluate his/her behaviour in comparison with other people with diabetes.</td>
<td>Comparative feedback</td>
<td>24</td>
</tr>
<tr>
<td>How would you evaluate yourself in regards to recommendations about physical activity?</td>
<td>CT</td>
<td>Allow the participant to evaluate his/her behaviour according to the issued recommendations.</td>
<td>Descriptive feedback</td>
<td>24</td>
</tr>
<tr>
<td>Motivation wise, have you noticed a change?</td>
<td>TPB</td>
<td>Inform the participant of the ‘motivational’ change observed since the last print.</td>
<td>Evaluative feedback</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>SCT</td>
<td>Encourage the participant independently from the change observed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our advice… Continued?</td>
<td>TPB</td>
<td>Motivational Phase: develop in the participant a positive intention towards the practice of leisure-time physical activity (attitude, barriers, moral norm).</td>
<td>Persuasive communication</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>TIB</td>
<td>Post-motivational Phase: help the participant translate his/her motivation into behaviour</td>
<td>Testimonies Goal setting</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>GST</td>
<td>TIB = Theory of interpersonal behaviour; GST = Goal-setting theory; HAPA = Health action process approach and II = Implementation intention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HAPA</td>
<td>HAPA = Health action process approach.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>II = Implementation intention.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Main objective: present to each participant a ‘new’ portrait of his physical activity situation based on the changes observed since the initial print.
this first print, the second questionnaire (Time 1) was sent by mail (April 2007), along with a pre-addressed return envelope. Once more, for participants randomized in the computer-tailoring intervention, the contents of the second print were developed according to the data collected at Time 1, taking into account, if necessary, behavioural or motivational modifications since the first questionnaire (Time 0). The participants of both groups received their second print approximately 4 weeks later (May 2007). The third and fourth research questionnaires were sent by mail, respectively 1 month (Time 2, June 2007) and 3 months (Time 3, September 2007) following the reception of the second print (Fig. 1).

Generic intervention
Participants randomized in the generic intervention received two prints promoting physical activity developed in a format very similar to those from the computer-tailoring intervention. In fact, particular attention was paid to ensure that the prints presented an equivalent number of sections, words, lines and figures to those of the computer-tailoring intervention. However, contrary to this latter intervention, the contents of the educational messages promoting physical activity habits were of rather general order. This content was selected from prints, brochures and websites promoting physical activity.

Research questionnaires
All participants completed a self-administered questionnaire on four occasions. The main objective of the first questionnaire (Time 0) was to measure the participation level in leisure-time physical activities from a question developed and validated by Godin et al. [11, 12], as well as psychosocial variables associated with regular practice of physical activities, namely intention [three items, Cronbach’s alpha (α) = 0.86], attitude (eight items, α = 0.91), behavioural beliefs (nine items, α = 0.71), perceived behavioural control (four items, α = 0.82), control beliefs (nine items, α = 0.89) and moral norm (two items only, thus r = 0.56). This questionnaire ended with questions related to participants’ socio-demographic characteristics (gender, age, education and marital status) as well as their health status (type of diabetes, contraindications to the practice of physical activity).

Besides measuring the participation level in leisure-time physical activities and the psychosocial variables mentioned above, the second questionnaire (Time 1) also included questions measuring the reaction of participants to the first print. These questions were adapted from other evaluation studies related to computer-tailoring [13, 14]. The third and fourth research questionnaires, at Times 2 and 3 respectively, included the measure of the participation level in leisure-time physical activities and the intention to participate in leisure-time physical activities. Furthermore, the third questionnaire included items from the second, which enabled the measurement of participants’ reaction after the second print.

Dependant variables
Participation level in leisure-time physical activities
The participation level in leisure-time physical activities was evaluated according to a question
developed by Godin et al. [11, 12]: ‘Within the last month, how often did you participate in one or more physical activities of moderate intensity, totalling at least 30 min in a same day during your leisure time?’. Participants were presented with seven response options: (i) not at all, (ii) once, (ii) approximately two or three times, (iv) approximately once a week, (v) approximately twice a week, (vi) approximately three times a week and (vii) four or more times a week. The reliability indicator of this scale for test-retest is 0.64 [11].

**Intention to participate in leisure-time physical activities**

Following Ajzen & Fishbein’s recommendations [15], the intention to participate in leisure-time physical activities was evaluated according to three items. For example, the first item was: ‘At the moment, my plans are to practice one or more physical activities in my leisure time during the next month’. A seven level bipolar scale was presented to participants, ranging from ‘Completely disagree’ (+1) to ‘Completely agree’ (+7). The average of the three items determined the final intention measurement. A test-retest conducted [8] with a sample of people with type 2 diabetes demonstrated that this measurement has acceptable psychometric qualities (α = 0.76; intraclass correlation coefficient = 0.80).

**Statistical analyses**

Comparison tests (Chi-square, t-test, Mann–Whitney) were first conducted at Time 0 in order to ensure the equivalence of both groups in regards to socio-demographic and dependant variables. Then, predictors of dropout were executed by means of binary logistic regression. As such, the following characteristics were considered as independent variables at baseline, namely group, gender, age, education, marital status and participation level in leisure-time physical activities.

The efficacy of a single computer-tailoring print about the practice of physical activity (H1) and intention (H2), after 1 month, was verified with a 2 (computer-tailoring group and generic group) × 2 (Time 0 and Time 1) repeated-measures analysis of variance (ANOVA). The combined efficacy of both prints on the practice of physical activity (H3) and intention (H4), after 1- and 3-month follow-ups, was verified with a type 2 (computer-tailoring group and generic group) × 3 (Time 0, Time 2 and Time 3) repeated-measures analysis of covariance. The participation in leisure-time physical activities (Time 1) and the intention to participate in leisure-time physical activities (Time 1) were considered covariables for this last analysis. All analyses were performed again according to an intention-to-treat approach (last observation carried forward procedure) [16]. SPSS software (version 16) was used to conduct the statistical analyses.

**Results**

Randomisation was successful given that comparison tests conducted at baseline (Time 0) indicate that participants in both groups did not differ with regard to age (tailoring: 49, 1 ± 7, 8 versus generic: 49, 3 ± 5, 1), gender (tailoring: 53, 6% men versus generic: 54, 1% men) and education (tailoring: 15, 1% university degree versus generic: 20, 8% university degree) (all P > 0.05). They differed only in their marital status (Mann–Whitney U = 11695.5, P < 0.05). The marital status, however, was not considered as a covariable in the verification of hypotheses, as no significant statistical correlation was observed between this variable and the dependant variables, physical activity [r(323) = 0.07, P = 0.20] and intention [r(323) = 0.02, P = 0.74]. Besides, no significant statistical difference was observed between the two groups at baseline for the participation level in leisure-time physical activities [t(323) = 0.31, P = 0.76] and the intention to participate in leisure-time physical activities [t(323) = 0.27, P = 0.79].

Among participants admissible at baseline, 76 (46%) and 98 (62%), respectively, completed and returned the research questionnaires at Times 1, 2 and 3 (Fig. 2). Younger participants [OR = 0.95; IC95% (0.91–0.99)] as well as those randomized in the computer-tailoring intervention [OR = 1.93; IC95% (1.23–3.04)] were more susceptible not to
complete the various inherent phases of the research project. For this last aspect, although the loss of participants was greater for the computer-tailoring group (54%) than for the generic group (38%), no significant difference was observed between these two groups for the frequency of participation \( t(149) = 0.79, P = 0.43 \) as well as for the intention to participate in leisure-time physical activities \( t(149) = 0.68, P = 0.50 \), age \( t(149) = 0.88, P = 0.149 \), gender \( \chi^2 (1, 151 = 0.40, P = 0.53) \) and education (Mann–Whitney \( U = 2522, P = 0.35 \)).

Among admissible participants having completed and returned the questionnaires at Times 1, 2 and 3, 15 participants in the computer-tailoring intervention group and 22 in the generic intervention group were not retained for the verification of research hypotheses for reasons explained at the bottom of Fig. 2. Thus, the analyses included the data from 137 participants, namely 61 in the computer-tailoring intervention group and 76 in the generic intervention group (Fig. 2).

Verification of research hypotheses

For the first hypothesis (effect of a single print on behaviour at 1-month follow-up), the repeated measures ANOVA indicated a significant group \( \times \) time effect, \( F(1, 135) = 4.50, P < 0.05, \eta^2 = 0.03 \). Analysis of the group effect indeed demonstrated that the score obtained at 1-month follow-up (Time 1) for the computer-tailoring intervention group was significantly superior to the score of the generic intervention group (Fig. 3, slopes on the left side), \( F(1, 135) = 4.79, P < 0.05 \). Exploratory analyses revealed that this effect is attributable to the participants situated in the motivational phase (Fig. 3, slopes at the centre), \( F(1, 94) = 3.08, P < 0.10, \eta^2 = 0.03 \). For the second (effect of a single print on intention at 1-month follow-up), third (combined effect of both prints on behaviour at 1- and 3-month follow-ups) and fourth hypotheses (combined effect of both prints on intention at 1- and 3-month follow-ups), the repeated measures indicated no group \( \times \) time effect (all \( P > 0.27 \)). However, several time effects were observed in both groups for all participants (Figs. 3–6, slopes on the left side) as well as for those in post-motivational (Figs. 3–6, slopes at the centre) and motivational (Figs. 3–6, slopes on the right side) phases. As announced, all the analyses relative to the research hypotheses were performed again based on an intention-to-treat approach. Except for the first research hypothesis where the intention-to-treat analysis revealed no group \( \times \) time interaction \( F(1, 323) = 1.60, P = 0.21 \), nor group effect \( F(1, 323) = 1.70, P = 0.19 \), the obtained results are generally similar to those previously presented.

Reaction to the educational prints

For the first print, the multivariate analysis of variance (MANOVA) was statistically significant, \( F(8, 126) = 4.93, P < 0.0001 \). Univariate tests revealed that three of seven dimensions differentiated the two groups (Table III). As for the second print, according to the MANOVA results \( F(8, 126) = 4.65, P < 0.0001 \), the univariate tests for each dimension revealed that three differentiated both groups (Table III).

Discussion

The main objective of the present study was to evaluate the effect of a computer-tailoring print-based intervention in promoting regular physical activity during leisure-time for people with type 2 diabetes in a real-life setting. Four research hypotheses were tested. Among these, only the first was confirmed. Prima facie, it appears difficult to put into perspective the observed results, as, to our knowledge, little similar print-based physical activity interventions were conducted among people with type 2 diabetes in a real-life setting. As a more specific link to the first research hypothesis, a careful examination of the results showed that the effect favouring the computer-tailoring group is attributable to participants in the post-motivational phase who adopted a leisure-time physical activity practice at a frequency about twice a week. In relation with a computer-tailoring print-based intervention conducted with healthy participants, the results of another study also showed that those characterized...
by a positive intention during the pretest adopted the desired behaviour (exercise) [17]. For participants of the present study, although a physical activity practice with an average frequency of twice per week is below recommendations for the regulation of glycaemia in people with type 2 diabetes [18], it, nonetheless, corresponds to the spirit in which the first print was created: enable participants to experiment at their own rhythm regular practice of a physical activity.

Concerning the second and fourth research hypotheses, the absence of a significant statistical difference between both groups regarding intention to practice regular leisure-time physical activities could be explained by a ceiling effect. For instance, as the majority of the computer-tailoring print participants (70%) were in the post-motivational phase with an average intention score of 5.95 (±0.49) on a seven-point scale, improvement of this measure appeared rather difficult. It was, however, anticipated
that the participants of the computer-tailoring group in the motivational phase would significantly increase their intention compared with those of the general intervention group. Data showed that both groups increased their level of intention between T0–T1 (see Fig. 4, right side), T0–T2 (see Fig. 6, right side) and T0–T3 (see Fig. 6, left side). The non-significant statistical difference observed between the computer-tailoring and generic groups could be explained by two reasons. Firstly, the meta-analysis by Noar et al. [7] suggests that four to five determinants should be targeted to obtain the anticipated effects. Unfortunately, this information was not known at the beginning of the present study that targeted no more than two determinants. Secondly, for the control group, the first print was conceived from the most relevant contents of prints, brochures and websites promoting physical activity. It is, therefore, possible that the quality of this print in terms of contents (attitude and self-efficacy) explains why the computer-tailoring print did not reveal itself superior.
In regards to the third research hypothesis about the combined effect of both computer-tailoring prints that pertain to the practice of leisure-time physical activities, no significant statistical difference was observed between groups after 1- and 3-month follow-ups. However, a time effect was observed for both groups of participants. For instance, the participants of the computer-tailoring group situated in the post-motivational phase who were sedentary at baseline (T0) reported a practice of physical activity twice a week at 1-month follow-up (T2) and once a week at the end of the study (T3) (see Fig. 5, slope in the centre). Recently, research projects on patients presenting heart disease suggested that following the adoption of regular physical activity practice, the maintenance of this behaviour could be submitted to two types of self-efficacy: maintenance self-efficacy [19, 20] and
recovery self-efficacy [19, 20]. A posteriori, there are reasons to believe that by focusing more on these two types of self-efficacy for the participants of the computer-tailoring group, which was not the case for the second print, might have allowed participants to successfully maintain their behaviour after the first print or to resume it after a pause for medical or other reasons.

**Practical implications**

For practitioners interested in promoting the practice of leisure-time physical activity for people with type 2 diabetes by means of the computer-tailoring approach, results of the present study suggest paying attention to certain aspects. Firstly, in the case where a diabetic person is motivated to undertake regular physical activity, the development of an action plan along with the initial print is suggested to facilitate the taking action. In connection with this element, the results of the present study demonstrated that the second computer-tailoring print was found ineffective in maintaining the benefits of the first print. According to this aspect, the emphasis on the feeling of self-efficacy could be an important element to consider. Moreover, in comparison with the participants in the generic intervention group, those in the computer-tailoring group found, in a larger proportion, that the prints had taken into consideration their personal characteristics and had been developed specifically for them. In order to be able to reproduce these results, it is suggested that practitioners develop educational messages while considering these three elements: message customization, feedback and content adaptation [21].

**Strengths and limitations of the study**

The main strength of this study is that both print communications intended for the general intervention group were developed in a format completely similar to those of the tailored intervention group. Indeed, a particular attention was paid to ensure that these two generic print communications had an equivalent number of sections, words, lines and figures that those of the tailored intervention group. In this respect, as reported by Dijkstra [21], few computer-tailoring evaluative studies have been undertaken in this way although such studies are the only one that demonstrate the relative efficiency of this persuasive approach. Finally, an additional genuine contribution is, to our knowledge, that no similar study has been realized in a real-life setting among individuals with type 2 diabetes.

Although efforts were made to minimize certain potential biases, certain limitations must be noted. Firstly, an objective measure of the participation level in leisure-time physical activities was rendered impossible on the grounds that participants

---

Table III. Participants reaction to the prints

<table>
<thead>
<tr>
<th></th>
<th>Print #1</th>
<th></th>
<th>Print #2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tailoring group</td>
<td>Generic group</td>
<td>Tailoring group</td>
<td>Generic group</td>
</tr>
<tr>
<td>I read the print in a proportion of …</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
</tr>
<tr>
<td>I discussed the print with other people</td>
<td>4.69   0.72</td>
<td>4.70   0.69</td>
<td>4.80   0.51</td>
<td>4.78   0.60</td>
</tr>
<tr>
<td>The print contained relevant information</td>
<td>1.80   0.90</td>
<td>1.67   1.08</td>
<td>1.79   0.95</td>
<td>1.86   1.09</td>
</tr>
<tr>
<td>The print took into account my personal characteristics regarding physical activity</td>
<td>3.67   1.15</td>
<td>3.21*  1.11</td>
<td>3.95   0.98</td>
<td>3.46** 1.02</td>
</tr>
<tr>
<td>The print was specifically written for me</td>
<td>3.63   1.13</td>
<td>2.80*** 1.23</td>
<td>3.79   0.95</td>
<td>2.99*** 1.06</td>
</tr>
<tr>
<td>The print was interesting</td>
<td>4.08   0.90</td>
<td>3.84   1.05</td>
<td>3.97   0.86</td>
<td>4.01   0.85</td>
</tr>
<tr>
<td>The print was understandable</td>
<td>4.25   0.82</td>
<td>4.54*  0.62</td>
<td>4.52   0.65</td>
<td>4.50   0.63</td>
</tr>
<tr>
<td>The visual aspect of the print was interesting</td>
<td>4.32   0.73</td>
<td>4.30   0.85</td>
<td>4.39   0.67</td>
<td>4.32   0.69</td>
</tr>
</tbody>
</table>

---

*a1 = 0% …not read, 2 = 25%, 3 = 50%, 4 = 75% and 5 = 100% …read it completely.*  
*b1 = not at all, 2 = a little, 3 = moderately, 4 = a lot and 5 = completely. *P < 0.05, **P < 0.01, ***P < 0.001.*
lived in all health regions of the province of Québec, an area of 1,667,441 km². Several studies, however, featured the relevance of the measure used in a context of participation in leisure-time physical activities [22–24]. Secondly, the proportion of participants who have not completed the various steps of the research was higher for the computer-tailoring group (54%) than for the generic group (38%), which can limit the internal validity of the study. The results of the statistical analyses, however, showed that this differential participant loss did not affect the equivalence of the groups at baseline. Thus, it is unlikely that the difference observed in terms of frequency of participation in physical activities at Time1, in favour of the computer-tailoring group, be attributable to the difference between participation levels.

Thirdly, it cannot be excluded that participants having accepted to take part in the study had a positive interest in physical activity, which limits the generalizable character of the observed results. Similarly, the fact that only 29% of people accepted to take part in the study also affects the generalizable character of the observed results. Nonetheless, similar studies of physical activity behaviour among the general population have also observed low participation (31% [17]; 23% [25]; 32% [26]).

Two reasons could explain the observed participation rate. Firstly, there were no ‘personal’ contacts between the participants and the research team, all contacts were made by means of regular mail. This approach was used in order to adopt a method as close as possible to a naturally real-life setting. In future studies realized in real-life setting other methods of recruitment as suggested by Dillman [27] could be adopted. Also, given the growing popularity of new technologies, ‘innovative’ approaches such as website (or CD-rom) and automated telephone reminders could also be used in future research. Secondly, the low participation rate could also be attributed to the fact that the recruitment phase of the study took place at the end of January, 2007. Given the quite low outside temperature at this time of the year [average daily temperature in January 2007 was –15.6°C (3.92°F)] [28], it is possible that this might have ‘moderate’ the enthusiasm of some individuals with type 2 diabetes. Finally, we also think that the high dropout rate observed (46%) can be attributed to the same reasons mentioned above. As it was recently suggested for computer-tailoring web-based physical activity interventions [29], additional research is needed for interventions delivered exclusively via mailed print materials. This would help to identify optimal recruitment and retention strategies for interventions offered at the population-level.

Conclusions

Based on the observed results, it appears that the print-based computer-tailored materials could be recommended for the promotion of leisure-time physical activity among sedentary French Canadians with type 2 diabetes. The intervention did not increase the level physical activity as much as anticipated but participants evaluated that the prints had taken into consideration their personal characteristics and had been developed specifically for them. Also, no harmful or detrimental effect was reported by the participants having completed the study. Further research is nonetheless needed to improve the content of the second print in order to facilitate the long-term maintenance of the behaviour.

Funding

Canadian Diabetes Association (AR-2-05-1818-GG).

Conflict of interest statement

None declared.

References

Tailored physical activity intervention in real life