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Original Research

Identifying Behaviour Change Techniques and Motivational Interviewing Techniques in Small Steps for Big Changes: A Community-Based Program for Adults at Risk for Type 2 Diabetes

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Key Messages

- Comprehensive and detailed intervention reporting is essential to improve replicability, future research and implementation.
- Standardized and agreed-upon taxonomies allow for a common language to be used when reporting on intervention details.
- The detailed reporting of a diabetes prevention program used in this study can be used for future health behaviour change interventions.

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ABSTRACT

Background: The risk of developing type 2 diabetes (T2D) can be reduced through diet and exercise changes. Given the rapidly increasing prevalence of T2D and the associated burden on the health-care system, there is a need for affordable and scalable diet and exercise programs to be delivered in communities. Small Steps for Big Changes (SSBC) is an evidence-based diabetes prevention program for improving diet and exercise adherence in individuals at risk for developing T2D. Detailed reporting of intervention components as SSBC transitions from laboratory to communities is an essential step to understand its effectiveness and subsequent uptake.

Methods: The aim of this study was to identify comprehensively the behaviour change techniques (BCTs) and motivational interviewing techniques used within the community-based SSBC. Intervention components were extracted from the SSBC session protocols using the Behaviour Change Technique Taxonomy v1 and the Table of Motivational Interviewing Techniques.

Results: Forty-three BCTs (interrater reliability [kappa]=0.77; prevalence and bias-adjusted kappa=0.78) and 20 MI techniques (kappa=0.63; prevalence and bias-adjusted kappa=0.64) were identified within SSBC session protocols (mean BCTs per session=30, mean MI techniques per session=16).

Conclusions: Consistent and thorough reporting of intervention components as seen in the current analysis is crucial for future meta-analyses to accurately test which intervention components are eliciting change in desired outcomes and can inform which components should be adapted to different settings. SSBC sessions had an emphasis on BCT categories, including “Goals and Planning,” “Feedback and Monitoring” and “Repetition and Substitution,” and MI technique processes, including “Engaging” and “Evoking.” Use of these categories and processes can inform development of future effective diabetes prevention programs.

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RÉSUMÉ

Introduction : Des changements dans le régime alimentaire et l'exercice peuvent permettre de réduire le risque d'apparition du diabète de type 2 (DT2). Étant donné l'augmentation rapide de la prévalence du DT2 et son fardeau sur le système de soins de santé, des programmes de régime alimentaire et d'exercice accessibles et évolutifs doivent être offerts dans les communautés. Le programme Small Steps for Big Changes (SSBC) est un programme de prévention du diabète fondé sur des données probantes qui permet d'améliorer l'observance du régime alimentaire et de l'exercice des individus exposés au risque de DT2. Le compte rendu détaillé des volets de l'intervention alors que le programme SSBC passe du laboratoire aux communautés est une étape essentielle pour comprendre son efficacité et son adoption subséquente.
Méthodes : L'objectif de la présente étude était de définir de façon exhaustive les techniques de changement de comportement (TCC) et les techniques d'entretien motivationnel (EM) utilisées dans le programme communautaire SSBC. Les volets de l'intervention ont été extraits des protocoles des séances du programme SSBC à l'aide de la Taxonomie (v1) des techniques de changement de comportement et du Tableau des techniques d'entretien motivationnel.
Résultats : Quarante-trois TCC (fiabilité interévaluateur [kappa] = 0,77; kappa ajusté sur la prévalence et le biais = 0,78) et 20 techniques d'EM (kappa = 0,63; kappa ajusté sur la prévalence et le biais = 0,64) ont été trouvées dans les protocoles des séances du programme SSBC (nombre moyen de TCC par séance = 30, nombre moyen de techniques d'EM par séance = 16).
Conclusions : Le compte rendu cohérent et détaillé des volets de l'intervention comme nous l'avons observé dans l'analyse actuelle est crucial aux futures méta-analyses pour vérifier avec précision quels volets de l'intervention débouchent sur le changement dans les résultats escomptés et peut indiquer quels volets devraient être adaptés aux différents milieux. Les séances du programme SSBC mettaient en relief les catégories de TCC, notamment « Objectifs et planification », « Rétroaction et surveillance » et « Répétition et substitution », et les processus des techniques d'EM, notamment « Engagement » et « Rappel » (traduction libre). L'utilisation de ces catégories et de ces processus peut contribuer à l'élaboration de futurs programmes efficaces en matière de prévention du diabète.
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Introduction

Currently, 1 of every 3 Canadians is living with diabetes or prediabetes (1) and, by 2022, diabetes will cost the Canadian health-care system >$15 billion (2). Landmark diabetes prevention programs have demonstrated that the risk of developing type 2 diabetes (T2D) can be reduced by >50% through modifications to diet and exercise (3–5). However, adherence to behaviour change recommendations has been shown to decline over time, with physical activity levels decreasing by 50% in the year after a structured diabetes prevention program and returning to baseline levels within 5 years (6).

Given the increasing economic burden T2D places on the Canadian health-care system, there is a need to develop effective and scalable interventions to improve long-term adherence to diet and exercise within the community. Clear and detailed reporting of intervention components is essential for accurate assessment of what the active, key components of diabetes prevention programs are, and is critical for the progression of science in behaviour change. Unfortunately, current literature often fails to provide adequate details regarding intervention characteristics restricting the development of future interventions (7). To improve the quality and utility of published literature, interventionists have been strongly encouraged to identify mechanisms by which their program should work and provide explicit detail on the active intervention components (7,8).

Taxonomies of behaviour change

Taxonomies of behaviour change have been developed to systematically design, describe and test active intervention components (Behaviour Change Technique Taxonomy v1 [BCTTv1]) (9). In parallel fashion, taxonomies of client-centred counselling styles have been developed to describe the relational and content-based components within motivational interviewing (Table of Motivational Interviewing Techniques) (10). By using these standardized descriptions of behaviour change and counselling techniques, researchers can consistently report intervention components using a common language, and thus they are able to make more meaningful comparisons between interventions. Building on the use of a common language, future behaviour change research can then develop an evidence base for the extent to which behaviour change techniques (BCTs) bring about desired change across health-care settings.

Although BCTs represent the specific active ingredients of an intervention, BCT delivery may also have an impact on intervention effectiveness. One example of intervention delivery is motivational interviewing (MI). MI is a "collaborative conversation style for strengthening a person's own motivation and commitment to change" (11). Client-centred communication styles, such as MI, are an effective means of promoting health behaviour change, such as diet and physical activity maintenance (12,13), and management of chronic diseases, such as diabetes (14,15). Interventions that use MI typically consist of multiple techniques to support behaviour change, which are not included within the BCTTv1 (10). Although efforts have been made to characterize and assess the effectiveness of BCTs (13,16), the relational style of intervention delivery is often poorly reported (12). In fact, many physical activity interventions that use an MI style of communication provide only a brief description, lacking enough detail to facilitate replication of the MI techniques used (17,18). Simply reporting behavioural techniques used, and not the relational techniques of how intervention components were delivered, presents a considerable challenge to determining intervention efficacy, as critical pieces of contextual information are lost. By assessing the frequency of BCTs and MI techniques used across the Small Steps for Big Changes (SSBC) diabetes prevention program, in this study, we respond to calls to improve intervention reporting by clearly describing the methods

used to extract active intervention components and providing a comprehensive description of the active intervention components.

SSBC diabetes prevention program

SSBC provides brief one-on-one diet and exercise counselling and empowers individuals to develop self-regulatory skills to foster adherence beyond program completion. Efficacy of SSBC has been demonstrated within a feasibility study and randomized controlled trial (RCT) (19–21), and is now being implemented in partnership within 2 local YMCA sites in Kelowna, British Columbia, Canada (22). Although BCTs within the lab-based RCT have been recently reported elsewhere (23), implementation of the SSBC program into local YMCAs used a shared decision-making process (24) in which decisions were made jointly by researchers and community stakeholders, taking into account the best-available evidence in addition to the contextual, cultural and resource factors and preferences to improve program sustainability. Through this process, key theoretical tenets of SSBC remained the same; 2 major additions were made to tailor the program to the YMCA context, which may have resulted in different BCTs from those previously reported (23). First, the entire counselling intervention was adapted to be delivered in MI style, which is likely to result in different BCTs from those previously reported (23). Second, in response to client requests, dietary topics related to diabetes prevention were added to the intervention protocol. In this study, we provide a detailed description of the active intervention components and delivery method currently being used within SSBC to allow for future studies to understand what specific components are most/least effective in creating desired change while also allowing for future replication.

Methods

The intervention—SSBC

SSBC consists of an intervention phase and a 12-month follow-up phase. The intervention phase consists of 6 behavioural counselling and supervised exercise sessions over 3 weeks. The follow-up phase consists of a 1-month MI-informed behavioural counselling follow up, and a 6- and 12-month follow up to obtain outcome measurements. All sessions are one-on-one, take place at local YMCA sites and are conducted by a coach who has taken part in a 2-day MI training workshop and a 1-day SSBC practical training

Table 1
Behaviour change techniques present within intervention and follow-up protocols (sessions 1 to 6 and 1-month follow up)

BCT number	BCT	Number of sessions present	1 *	2	3	4	5	6	1 mfu
1.1	Goal setting (behaviour)	7	✓	✓	✓	✓	✓	✓	✓
1.2	Problem solving	6		✓	✓	✓	✓	✓	✓
1.3	Goal setting (outcome)	7	✓	✓	✓	✓	✓	✓	✓
1.4	Action planning	7	✓	✓	✓	✓	✓	✓	✓
1.5	Review behaviour goals	6		✓	✓	✓	✓	✓	✓
1.6	Discrepancy between current behaviour and goal	6		✓	✓	✓	✓	✓	✓
1.7	Review outcome goal(s)	6		✓	✓	✓	✓	✓	✓
1.9	Commitment	7	✓	✓	✓	✓	✓	✓	✓
2.1	Monitoring of behaviour by others without feedback	7	✓	✓	✓	✓	✓	✓	✓
2.2	Feedback on behaviour	7	✓	✓	✓	✓	✓	✓	✓
2.3	Self-monitoring of behaviour	6	✓	✓	✓	✓	✓	✓	
2.5	Monitoring of outcome(s) of behaviour without feedback	6	✓	✓	✓	✓	✓	✓	
2.6	Biofeedback	6	✓	✓	✓	✓	✓	✓	
3.1	Social support (unspecified)	7	✓	✓	✓	✓	✓	✓	✓
3.2	Social support (practical)	7	✓	✓	✓	✓	✓	✓	✓
3.3	Social support (emotional)	3			✓			✓	✓
4.1	Instruction on how to perform the behaviour	6	✓	✓	✓	✓	✓	✓	
4.2	Information about antecedents	7	✓	✓	✓	✓	✓	✓	✓
4.3	Reattribution	1			✓				
5.1	Information about health consequences	1			✓				
5.4	Monitoring of emotional consequences	6	✓	✓	✓	✓	✓	✓	
6.1	Demonstration of the behaviour	6	✓	✓	✓	✓	✓	✓	
6.2	Social comparison	7	✓	✓	✓	✓	✓	✓	✓
7.1	Prompts/cues	7	✓	✓	✓	✓	✓	✓	✓
8.1	Behaviour practice/rehearsal	6	✓	✓	✓	✓	✓	✓	
8.2	Behaviour substitution	6		✓	✓	✓	✓	✓	✓
8.3	Habit formation	6	✓	✓	✓	✓	✓	✓	
8.4	Habit reversal	2		✓		✓			
8.6	Generalization of target behaviour	6	✓	✓	✓	✓	✓	✓	
8.7	Graded tasks	2				✓		✓	
9.1	Credible source	3	✓	✓		✓			
10.4	Social reward	7	✓	✓	✓	✓	✓	✓	✓
11.2	Reduce negative emotions	1			✓				
12.1	Restructuring physical environment	6	✓	✓	✓	✓	✓	✓	
12.2	Restructuring social environment	2						✓	✓
12.4	Distraction	1			✓				
12.5	Adding objects to the environment	1	✓						
12.6	Body changes	6	✓	✓	✓	✓	✓	✓	
13.2	Framing/reframing	1						✓	
13.3	Incompatible beliefs	6		✓	✓	✓	✓	✓	✓
15.1	Verbal persuasion about capability	7	✓	✓	✓	✓	✓	✓	✓
15.3	Focus on past success	7	✓	✓	✓	✓	✓	✓	✓
15.4	Self-talk	1			✓				
	Total/session		27	33	37	34	31	35	22

BCT, behaviour change technique; *mfu*, month of behavioural counselling follow up.
* Session number.

workshop. Coaches are either YMCA staff members or university students.

The counselling sessions last approximately 30 to 50 minutes each. The aim of these MI-informed behavioural counselling sessions is to develop and test personalized diet and exercise plans. Clients are provided with a notebook in which they can choose to write down their daily diet and exercise goals. Each counselling session has a checklist and protocol for coaches to use outlining the targets for that specific session. These sessions have a primary focus of either exercise or simple dietary strategies (reducing sugar intake, reducing refined/processed carbohydrate intake, increasing vegetable consumption) that are linked to reduced risk of T2D. Counselling session protocols were developed by a clinical psychologist trained in MI using Diabetes Canada dietary recommendations and Canada's physical activity guidelines.

Immediately after the counselling sessions, clients are taken into the gym where they engage in moderate-intensity continuous training (e.g. continuous walking at a constant pace for 20 to 30 minutes) or high-intensity interval training (e.g. interval walking that involves alternating between 30 to 60 seconds of a brisk walk and 60 seconds of an easy walk for ~15 minutes). During week 1 of the program, clients are introduced to each of these exercise types and then they are subsequently provided with a choice of which type of exercise in which they would like to engage. Clients are also provided the choice between aerobic exercise equipment (e.g. treadmill, elliptical, stationary bicycle). Exercise session protocols were informed by those used within the RCT and were edited to be MI consistent by a clinical psychologist trained in MI. Refer to Supplementary Appendix A for a completed TIDieR checklist outlining the SSBC program intervention in more detail.

Procedures

Session protocols for each of the 6 counselling and exercise sessions and the 1-month MI-informed behavioural counselling follow up were managed using NVivo version 11 and were coded for active intervention components using the BCTTv1 (9) and the Table of MI Techniques (10).

BCTTv1 coding: The BCTTv1 (9) includes a comprehensive list of 93 BCTs grouped into 16 distinct categories. BCTs are the irreducible, active components of an intervention necessary to bring about behaviour change. Session protocols were independently coded by 2 authors (M.M. and T.D.), who completed the BCTTv1 online training. The developers of the BCT taxonomy developed both a coding manual and online training program that teaches new users how to map BCTs onto interventions (http://www.bct-taxonomy.com).

Identification of BCTs within SSBC session protocols involved 2 steps: independent coding and consensus. As per the BCTTv1 coding manual, independent coding began with the coders reading through the BCTTv1 to become familiar with the techniques and their definitions; these definitions were reread before assigning a code. Both coders were familiar with the intervention content and read the whole text before independently coding BCTs. Next, M.M. and T.D. coded session protocols for the presence of each of the 93 BCTs within the BCTTv1. A BCT was only coded when explicitly mentioned within the script, and was only reported once per script, even if it appeared several times within each script. In the case of code disagreements, M.M. and T.D. discussed the disagreement to come to a consensus. If no consensus could be reached, a third author (M.J.) was consulted.

MI technique coding: Hardcastle et al's (10) Table of MI Techniques provides a comprehensive list of 38 unique MI techniques grouped into 4 distinct processes and 2 broad categories (content-based techniques and relational techniques). Two authors with additional MI training (M.M. and K.C.) read through the table of MI techniques several times before coding to become familiar with the labels and definitions. Unlike the BCTv1, there is no additional training or coding manual currently available for the Table of MI Techniques. To ensure consistency in coding, the MI techniques coders followed the same general coding principles, as outlined previously for the BCT coding.

Analysis: Consistent with other studies reporting on BCTs (16,23,25), both the prevalence and bias-adjusted kappa statistic and Cohen's kappa were calculated to establish intercoder reliability; however, only Cohen's kappa is reported as there was negligible differences between the 2 coefficients. In addition, descriptive statistics were reported to provide information on the mean number of BCTs and MI techniques coded per session and across the session protocols. The most frequently coded BCT categories and MI process stages were obtained by totalling individual techniques across all session protocols.

Results

Behaviour change techniques

A total of 43 BCTs of a possible 93 were present within the SSBC content (45%). Intercoder agreement of BCTs present and absent as determined by Cohen's kappa and prevalence and bias-adjusted kappa were 0.77 and 0.78, respectively, indicating substantial agreement between coders. The number of BCTs used in a single session ranged from 22 to 37 (average 31 BCTs per session). See Table 1 for BCTs that were identified as present, and the sessions in which they occur.

Table 2
MI techniques present within intervention and follow-up protocols (sessions 1 to 6 and 1-month follow up)

MI technique no.	MI technique	Number of sessions present	1 *	2	3	4	5	6	1 mfu)
1	Open-ended questions	7	✓	✓	✓	✓	✓	✓	✓
2	Affirmation	7	✓	✓	✓	✓	✓	✓	✓
3	Reflective statements	7	✓	✓	✓	✓	✓	✓	✓
4	Summary statements	3	✓		✓				✓
7	Permission to provide information	7	✓	✓	✓	✓	✓	✓	✓
8	Elicit-provide-elicit	7	✓	✓	✓	✓	✓	✓	✓
10	Importance ruler	6	✓	✓	✓	✓	✓		✓
11	Confidence ruler	7	✓	✓	✓	✓	✓	✓	✓
12	DARN questions	4				✓	✓	✓	✓
14	Looking back	6	✓	✓	✓	✓	✓	✓	
17	Identify past successes	6		✓	✓	✓	✓	✓	✓
19	Brainstorming	7	✓	✓	✓	✓	✓	✓	✓
20	Troubleshooting	6		✓	✓	✓	✓	✓	✓
21	Values exploration	1	✓						
22	Reframing	1						✓	
24	Emphasize autonomy	7	✓	✓	✓	✓	✓	✓	✓
30	Normalizing	6		✓	✓	✓	✓	✓	✓
31	Explore change expectations	7	✓	✓	✓	✓	✓	✓	✓
33	Develop a change plan	7	✓	✓	✓	✓	✓	✓	✓
37	Review outcome goal	6		✓	✓	✓	✓	✓	✓
		Total MI techniques/ session	14	16	16	17	17	17	16

DARN, Desire, Ability, Reason, Need; *mfu*, month of behavioural counselling follow up; *MI*, motivation interviewing.
* Session number.

The overall composition of BCTs remained consistent throughout the session protocols. Sessions typically begin with a review of previously set goals (consisting of BCTs 1.5, 1.6, 1.7, 1.2). Next, the topic for that day is presented and new client goals are made (BCTs 1.1, 1.3, 1.4, 4.1, 7.1, 8.2). At the conclusion of the behaviour change counselling session, clients are asked to summarize the session and restate their goals, indicating their commitment to changing the behaviour (BCT 1.9). During the exercise session, 10 BCTs were present in 100% of the exercise protocols (2.2, 2.3, 2.6, 4.1, 5.4, 6.1, 8.1, 8.3, 12.6, 15.1).

Of the 16 broad BCT categories, at least 1 BCT was identified for 14 categories with no BCTs reported within the categories of "14: Scheduled Consequences" and "16: Covert Learning." Predominant BCT categories include categories "1: Goals and Planning," "2: Feedback and Monitoring" and "8: Repetition and Substitution" (accounting for 45% of the total BCTs used).

MI techniques

A total of 20 MI techniques of a possible 38 were present within the SSBC content (53%). Intercoder agreement of MI techniques present and absent, as determined by Cohen's kappa and prevalence and bias-adjusted kappa, were 0.63 and 0.64, respectively, indicating substantial agreement between coders. The number of MI techniques used in a single session ranged from 14 to 17 (average of 16 MI techniques per session). See Table 2 for MI techniques that were identified as present, and the session in which they occur. All 4 of the MI technique processes were used, with an emphasis on engaging and evoking techniques (accounting for 75% of the total MI techniques used).

Discussion

Through use of systematically developed taxonomies of content-based and relational techniques of behaviour change (BCTTv1 and Table of MI Techniques) (9,10), in this study we have provided a comprehensive overview of active intervention components present within the SSBC diabetes prevention program situated at 2 community sites. Our findings suggest that SSBC includes the delivery 43 BCTs and 20 MI techniques designed to promote long-term adherence to diet and exercise changes. Specifically, "Goals and Planning" (1), "Feedback and Monitoring" (2) and "Repetition and Substitution" (8) were the most frequently used BCT categories, whereas "Engaging" and "Evoking" were the most frequently used MI processes. This is unsurprising, as techniques within these categories are associated with increased effectiveness within physical activity and dietary interventions (26). Specifically, self-regulatory BCTs (goal setting, review of goals, self-monitoring, providing feedback on a behaviour) coupled with use of MI were associated with greater intervention effectiveness and have been recommended to maximize the efficiency of diabetes prevention programs (26). A more recent review found the BCTs' biofeedback, demonstration of behaviour, behaviour practice, graded tasks, instruction on how to perform behaviour, action planning and prompts/cues to be associated with effective physical activity maintenance (27).

In addition to individual BCT effectiveness, the total number of BCTs used within an intervention has been suggested to influence intervention effectiveness. Specifically, systematic reviews examining physical activity and dietary behaviour change in individuals with T2D have shown that more BCTs present within an intervention are associated with improved physical activity–related and diabetes-related outcomes (16,28). Given the complex and highly individual nature of behaviour change, the inclusion of a greater quantity of BCTs within the current SSBC program may facilitate behaviour change by targeting different aspects of the behaviour change process.

The number of BCTs found within these systematic reviews is much lower than what is reported in the current analysis and not all reviews have found this association between a greater number of BCTs and intervention effectiveness (25). For example, one systematic review found 42 distinct BCTs across 54 studies with an average of 7 BCTs per study (ranging from 3 to 17) (25). Coding of the BCTs within a systematic review and meta-analysis often rely on the reporting quality and accuracy within the published intervention articles and many reviews highlight that these intervention descriptions are often limited and lacking precision (13,16,29,30). This retrospective coding of published intervention descriptions may result in an underestimation of BCTs used (25), highlighting a need for more detailed publications regarding intervention components. The current analysis has demonstrated substantially more BCTs (43 distinct BCTs), which may be due to higher quality intervention protocols being coded compared with just descriptions of an intervention seen in a final publication. The number of BCTs within our analysis is similar to those seen in Gray's (31) comprehensive development and BCT mapping study, which reported 37 distinct BCTs within their intervention. Comprehensive characterization and publishing of active components in an intervention is the first step toward elucidating which components are essential in promoting behaviour change. To facilitate more informative meta-analyses regarding BCTs, future research should append to their main articles a supplemental file outlining the specific techniques implemented within their intervention.

Although no review to date has attempted to classify what individual MI techniques or quantity of MI techniques are associated with increased intervention effectiveness, MI interventions as a whole have been associated with improved physical activity

Table 3
BCT discrepancies between the Bourne et al study and the current coding of behaviour change techniques within SSBC

BCT number	BCT	Added since previous publication	Removed since previous publication
1.1	Goal setting (behaviour)	✓	
1.3	Goal setting (outcome)	✓	
1.7	Review outcome goal(s)	✓	
1.9	Commitment	✓	
2.1	Monitoring of behaviour by others without feedback	✓	
2.4	Self-monitoring of outcomes of behaviour		✓
2.7	Feedback on outcomes of behaviour		✓
3.3	Social support (emotional)	✓	
4.3	Reattribution	✓	
5.2	Salience of consequences		✓
5.6	Information about emotional consequences		✓
8.3	Habit formation	✓	
8.4	Habit reversal	✓	
8.7	Graded tasks	✓	
9.1	Credible source	✓	
10.2	Material reward (behaviour)		✓
10.3	Nonspecific reward		✓
10.9	Self-reward		✓
11.3	Conserving mental resources		✓
12.4	Distraction	✓	
12.6	Adding objects to the environment	✓	
13.1	Identification of self as role model		✓
13.3	Incompatible beliefs	✓	
13.5	Identity associated with changed behaviour		✓
14.5	Reward completion		✓
16.3	Vicarious consequences		✓
	Total	14	12

BCT, behaviour change technique; *SSBC*, Small Steps for Big Changes.

outcomes (12), (13) and self-efficacy (32). One way in which the construct of self-efficacy is targeted within SSBC is through the use of the MI technique confidence ruler. After the action planning phase in every behavioural counselling session, clients are asked to reflect on their beliefs about their capabilities (i.e. their self-efficacy) by rating their confidence in achieving their goals. In addition, within the SSBC intervention, relational techniques of open-ended questions, affirmations, reflections and summary statements, or "OARS" techniques, are applied consistently within and across sessions as a means to engage the client in the sessions. Every session has an emphasis on creating an autonomy-supportive environment whereby coaches elicit the client's own motivation for change and prompt clients to generate a menu of solutions to personally relevant barriers. Thus, the coach provides choices instead of prescribing solutions. Facilitating an individual's autonomous motivation has been shown to improve engagement in physical activity among individuals with T2D (33).

Comparison to SSBC BCTs used within the laboratory setting

As an intervention transitions from a laboratory-based RCT to an effectiveness trial situated in a real-world setting, the overall composition of BCTs is likely to change depending on the new context. Although intervention components identified as effective within the laboratory setting remained the same (supervised high-intensity interval training and moderate-intensity continuous training exercise sessions), our analysis ahowed discrepancies in 26 BCTs (see Table 3), with 12 BCTs absent and 14 BCTs present within the adapted SSBC diabetes prevention program situated in the community that were not present in the RCT (23). Many of the absent BCTs have a focus on external motivators and rewards, and negative consequences of behaviour (BCTs 5.2, 10.2, 10.3, 10.9, 14.5, 16.3), which are inconsistent with the spirit of MI. A limitation of the current study is that only the intervention protocols were coded, and this accounts for only the information brought up by the counsellor. For example, clients may discuss the ways in which their identity has changed (BCT 13.5) and how they view themselves as a role model for their children (BCT 13.1); however, these BCTs are not captured by the information provided by the counsellor within the intervention protocols and, therefore, were not coded. In addition, given the client-centred nature of the intervention, feedback may be given on behavioural outcomes (BCT 2.7), but only if a client specifically asks for such information.

Hardcastle et al (10) identified 16 MI techniques that fully overlap with BCTs. Our analyses identified the presence of 12 unique MI techniques beyond those that map onto a BCT within the SSBC program. The presence of 14 additional BCTs, coupled with the 12 unique MI techniques that are not associated with any BCTs, represent 26 active intervention components identified within the current program and include BCTs, such as goal setting and commitment, and MI techniques, such as emphasizing autonomy and providing affirmations that are present in 100% of the sessions and appear to be integral intervention components in SSBC. If unreported, these possibly crucial elements within the program may get lost when attempts are made to translate this program into different communities. In addition to understanding which elements emerge as crucial for this context, understanding the BCTs that remain consistent from the lab though community implementation can provide information on what may be the "core" intervention components within SSBC, and what BCTs may be necessary for program effectiveness regardless of context. BCT categories overarching the identified BCTs include "Goals and Planning" (1), "Feedback and Monitoring" (2), "Repetition and Substitution" (8), "Antecedents" (12) and "Self-beliefs" (15). Regardless of context (laboratory or YMCA community sites), these categories of BCTs remain prominent within the session protocols and should be considered as possible essential components when engaging in further implementation efforts.

Implications for future research

In this study, we have highlighted the utility of reporting both BCTs and MI techniques, which can allow for more comprehensive intervention fidelity measures, improve the ability for future meta-analyses to determine which BCTs and MI techniques are most effective and improve the implementation and effectiveness of SSBC uptake in other communities.

Fidelity: A recent review on MI health behaviour change interventions highlighted the lack of fidelity measures as a major limitation (12,17). Without fidelity checks, consumers of the research cannot be assured that an intervention is being provided in the same way it is being reported. Future MI- and BCT-based research should include fidelity checks to determine what MI techniques and BCTs are being delivered so that more accurate conclusions can be drawn relating to not only what BCTs are most effective, but also the communication style in which those BCTs are delivered.

Currently, MI fidelity within SSBC is being conducted through the MI Competency Assessment (MICA) (Jackson et al, unpublished manuscript, 2015). Although MICA is able to assess practitioner adherence to the spirit of MI through coding broad categories such as collaboration, empathy, autonomy and evocation, it does not have the ability to comment on adherence to MI as written within the intervention materials and protocol. To provide a more robust assessment of how MI is being used within the SSBC intervention, future researchers can use the comprehensive description of MI techniques and BCTs identified in this study to conduct fidelity checks on audiorecorded behavioural counselling sessions to determine not only the quality of MI delivery according to the MICA, but also whether the specific BCTs and MI techniques are being delivered as described in our intervention materials.

Effectiveness of BCTs and MI techniques: Retrospective coding often seen in meta-analyses may be systematically under-reporting the composition of BCTs being used in behaviour change interventions. Comprehensive reporting similar to that seen in the current analysis is needed to help build a cumulative knowledge base regarding behavioural and relational techniques used in effective interventions, which can, in turn, result in more accurate meta-analyses on how to best design and deliver behaviour change interventions. Specifically, by reporting an accurate number and composition of BCTs within interventions, future meta-analyses can more accurately identify the number and type of BCTs necessary for optimal behaviour change. Understanding which and how many BCTs are effective and whether there is a threshold after which the number of BCTs employed is no longer effective may result in more effective and economical interventions.

Our study has highlighted the feasibility of using both the Table of MI Techniques and the BCTTv1 in intervention reporting, which should be continually applied within MI-informed behaviour change interventions. Knowing what MI techniques and BCTs are used within behaviour change counselling is essential for future researchers to understand what components are contributing to its effectiveness. Although evaluating the effectiveness of SSBC was outside the scope of this study, specification of the active intervention components will help build cumulative evidence toward the delivery of replicable interventions effective in decreasing the risk of T2D. In addition, although we have not addressed which active intervention components may be more effective in enacting behaviour changes, we have allowed for future analyses to

determine which combination of BCTs and MI techniques used by counsellors are associated with better patient outcomes.

Implementation: Without a complete and readily available intervention description, future researchers or practitioners cannot reliably implement interventions that have been shown to be effective within a laboratory setting. In this study, we used systematically developed taxonomies of behaviour change and MI techniques to detail the active behaviour change ingredients of the SSBC program. This provides a blueprint of the active intervention components within the SSBC diabetes prevention program, which can improve the replicability and implementation of the current program into differing communities. To advance the science of behaviour change, researchers and interventionists need to explicitly report the components that make up an intervention to allow the effective translation of such interventions into practice while also allowing future research to build upon current findings.

In conclusion, using taxonomies, such as the BCTTv1 and the Table of MI Techniques, provides behaviour change interventionists the opportunity to use an agreed-upon set of operationalizations that allow for consistency with language and replicability of interventions. We have outlined how the BCTTv1 and Table of MI Techniques have been applied to a diabetes prevention program situated in the community, how the inclusion of both the relational and content-based techniques allows for a richer description of the intervention and how such a description can be applied in future research settings to improve intervention fidelity and implementation. The process used within our study provides guidance to future researchers on how to improve the reporting of behaviour change interventions. Similar to other health behaviour change programs, diabetes prevention programs are resource intensive. To ensure the efficiency, effectiveness, and scalability of future diabetes prevention programs, active intervention components must be consistently reported so that researchers can determine which specific components are driving intervention effectiveness.

Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Diabetes* at www.canadianjournalofdiabetes.com.

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Author Disclosures

Conflicts of interest: None.

Author Contributions

M.M. and M.J. conceived the idea of the current paper. M.M. was responsible for data analysis, interpretation and writing the manuscript. K.C. and T.D. were responsible for data analysis and editing the manuscript. M.M. was responsible for overseeing all aspects of the study, contributing to data interpretation, and editing the manuscript.

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Erratum

Erratum to "Identifying Behaviour Change Techniques and Motivational Interviewing Techniques in Small Steps for Big Changes: A Community-Based Program for Adults at Risk for Type 2 Diabetes"

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In the article titled "Identifying Behaviour Change Techniques and Motivational Interviewing Techniques in Small Steps for Big Changes: A Community-Based Program for Adults at Risk for Type 2 Diabetes" by Megan M. MacPherson, et al, Table 2 has been updated with the correct data for Total MI techniques/session. The revised table is below.

Table 2
MI techniques present within intervention and follow-up protocols (sessions 1 to 6 and 1-month follow up)

MI technique no.	MI technique	Number of sessions present	1 *	2	3	4	5	6	1 mfu)
1	Open-ended questions	7	✓	✓	✓	✓	✓	✓	✓
2	Affirmation	7	✓	✓	✓	✓	✓	✓	✓
3	Reflective statements	7	✓	✓	✓	✓	✓	✓	✓
4	Summary statements	3	✓		✓				✓
7	Permission to provide information	7	✓	✓	✓	✓	✓	✓	✓
8	Elicit-provide-elicit	7	✓	✓	✓	✓	✓	✓	✓
10	Importance ruler	6	✓	✓	✓	✓	✓		✓
11	Confidence ruler	7	✓	✓	✓	✓	✓	✓	✓
12	DARN questions	4				✓	✓	✓	✓
14	Looking back	6	✓	✓	✓	✓	✓	✓	
17	Identify past successes	6		✓	✓	✓	✓	✓	✓
19	Brainstorming	7	✓	✓	✓	✓	✓	✓	✓
20	Troubleshooting	6		✓	✓	✓	✓	✓	✓
21	Values exploration	1	✓						
22	Reframing	1						✓	
24	Emphasize autonomy	7	✓	✓	✓	✓	✓	✓	✓
30	Normalizing	6		✓	✓	✓	✓	✓	✓
31	Explore change expectations	7	✓	✓	✓	✓	✓	✓	✓
33	Develop a change plan	7	✓	✓	✓	✓	✓	✓	✓
37	Review outcome goal	6		✓	✓	✓	✓	✓	✓
		Total MI techniques/ session	14	16	17	17	17	17	17

DARN, Desire, Ability, Reason, Need; *mfu*, month of behavioural counselling follow up; *MI*, motivation interviewing.
* Session number.

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