BMJ Open

Can a three-hour educational workshop and the provision of practical tools encourage family physicians to prescribe physical activity as medicine? A pre-post study.

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2015-007920
Article Type:	Research
Date Submitted by the Author:	10-Feb-2015
Complete List of Authors:	Windt, Johann; University of British Columbia, Experimental Medicine Windt, Adriaan; University of British Columbia, Department of Family Practice Davis, Jennifer; University of British Columbia, Department of Population & Public Health, Petrella, Rob; University of Western Ontario, Family Medicine, Rehabilitation, Kinesiology and Cardiology Khan, Karim; The University of British Columbia, Centre for Hip Health & Mobility
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Medical education and training
Keywords:	Physical activity prescription, MEDICAL EDUCATION & TRAINING, Family Practice, Exercise Prescription

Johann Windt
2635 Laurel Street,
Vancouver, BC. V6Z 1M9.
(27)76-140-4985
JohannWindt@gmail.com

February 9th, 2015

Dr. Trish Groves, Editor in Chief
BMJ Open
London, UK

Dear Dr. Groves:

On behalf of my colleagues, I submit our manuscript of original research entitled "Can a three-hour educational workshop and the provision of practical tools encourage family physicians to prescribe physical activity as medicine? A pre-post study."

The current rates of physical activity prescription, particularly in written form, are low, with a national Canadian survey indicating that only 16% of physicians give written prescriptions. Very little data exists to indicate that such training will change physician behaviour and cause them to prescribe physical activity more frequently. We sought to answer this question in a specific group of family physicians in Abbotsford, British Columbia. Physicians attended a three-hour workshop and were given practical tools to facilitate prescription. They answered a 30-item questionnaire before, and four weeks after the intervention. A significantly greater proportion of physicians providing written prescriptions to their patients four weeks after the intervention.

The final manuscript has been read and approved by all study authors. No other persons other than those listed have contributed significantly to its preparation. The contents of this manuscript are our original work and have not been published, in whole or in part, prior to this submission to BMJ Open.

JW is funded by a graduate award by the Canadian Institutes of Health Research. AW is funded by the Clinician Scholar Program scholarship through the University of British Columbia. JCD is funded by the Michael Smith Foundation for Health Research Postdoctoral Fellowship Award and the Canadian Institute for Health Research Postdoctoral Fellowship Award. We attest that we have herein disclosed any and all financial or other relationships that could be construed as a conflict of interest and that all sources of financial support for this study have been disclosed and are indicated in the acknowledgements.

I hope this message finds you well, and would like to extend our sincere gratitude for taking the time to review our submission.

Respectfully yours,

Johann Windt

Can a three-hour educational workshop and the provision of practical tools encourage family physicians to prescribe physical activity as medicine? A pre-post study.

Johann Windt BHK[1], Adriaan Windt MD[2], Jennifer Davis PhD[3], Robert Petrella MD PhD[4], Karim Khan MD PhD[5]

[1] Department of Experimental Medicine, University of British Columbia, Vancouver, Canada

[2] Department of Family Medicine, University of British Columbia, Vancouver, Canada

[3] Department of Population & Public Health, University of British Columbia

[4] Schulich School of Medicine, Department of Family Medicine, University of Western Ontario, Canada

[5] Aspetar Orthopedic and Sports Medicine Hospital, Doha, Qatar

Key Words: Physical activity prescription, medical education, family practice, exercise prescription

Word Count: 3288

Corresponding Author:

Johann Windt.
2635 Laurel Street, Vancouver, BC V5Z 1M9.
Telephone: 1-604-557-8387, 27-76-140-4985; johann.windt@gmail.com

ABSTRACT

Objectives: To increase the proportion of family physicians in our sample who provided their patients with written physical activity prescriptions after the delivery of a three-hour educational workshop with the provision of practical tools to facilitate behaviour change.

Design: A pre-post study.

Setting: Abbotsford and Mission, British Columbia.

Participants: All 158 physicians registered with the Abbotsford (121) or Mission (37) Divisions of Family Practice were invited to participate.

Intervention: A three-hour educational workshop combined with practical tools. Educational content of the workshop included 1) assessing patients' physical activity levels, 2) using motivational interviewing techniques to encourage physical activity, and 3) providing written physical activity prescriptions when appropriate. Practical tools to facilitate physician behaviour changes included a 'physical activity vital sign', and copies of the Exercise is Medicine Canada Prescription Pad. Participating physicians completed a bespoke questionnaire before and four weeks after their attendance of the workshop.

Outcome Measures: The primary outcome was the change in the proportion of family physicians who reported providing written physical activity prescriptions. Exploratory outcomes included changes in other physical activity prescription behaviours, the perceived importance of various barriers to prescription, and knowledge and confidence in regards to physical activity prescription. McNemar's test evaluated changes in proportions before and after the workshop, while Wilcoxon signed-rank tests evaluated changes in Likert data.

Results: Twenty five family physicians completed the baseline questionnaire and attended the workshop, with 100% follow up response rate. The proportion of family physicians who reported providing written physical activity prescriptions in their clinical practice increased significantly ($p<0.05$), from 10 (40%) at baseline to 17 (68%) four weeks after the intervention (OR=8 [1.1, 355]).

Conclusion: Educational workshops combined with practical tools provide a promising method to encourage the use of written physical activity prescriptions among family physicians in this setting.

ARTICLE SUMMARY

Strengths and limitations of this study:

- Its novelty, as this is the first study to document changes in family physicians' reported written prescription behaviours following an educational workshop. Since many have called for the development of medical school education and continuing education in the area of physical activity prescription, it is encouraging to see that such education may be effective in changing current family physician behaviours.
- The small sample size consisted of more male than female physicians, and was limited to two cities in Southern British Columbia, Canada.
- Since all community physicians were invited, there was risk of self-selection bias, and there are inherent risks for inaccuracies when relying on self-reported data.
- The pre-post nature of the study lacks a control group for the intervention, and the four week follow up does not indicate long-term sustained behaviour change.

INTRODUCTION

In 400 BC, Hippocrates wrote, "Eating alone will not keep a man well; he must also take exercise" (12). Over two millennia later, researchers continue to substantiate the importance of physical activity (PA) for health, regardless of age, gender, background, or socioeconomic status. Regular physical activity is associated with reduced rates of cardiovascular disease, stroke, hypertension, colon and breast cancers, type 2 diabetes, osteoporosis, and all-cause mortality (19, 30, 31). Yet, 31.1% of adults worldwide fail to reach recommended levels of physical activity (10).

Primary care settings are one of the seven investments outlined by the 2010 Toronto Charter for Physical Activity, a Global Call for Action (15) that may help address the current pandemic (19) of physical inactivity. Physical activity prescriptions from family physicians have been shown to increase patients' self-reported physical activity levels (22), improve quality of life (17), reduce body mass index, and lower systolic blood pressure (23). Tailored interventions including a written component may have a greater effect on patient behaviour than brief advice alone (6, 24).

Unfortunately, only 16% of Canadian family physicians providing written physical activity prescriptions to their patients (29). The authors of this national survey suggested that the low frequency of written prescriptions indicated a need for targeted physician training (29). These low proportions are similar to those in the United States, where just one third of patients report receiving any form of physical activity counselling from their physician in the last year (1).

Physicians commonly cite lack of time, lack of education or knowledge, lack of compensation, and lack of tools or resources, as barriers to physical activity prescription (5, 11, 18, 21). Physicians who report having received training/education in physical activity report higher self-efficacy in physical activity prescription and prescribe it more frequently (14, 16, 29).

Therefore, we designed three-hour workshop aimed at 1) educating physicians on physical activity prescription, and 2) providing them tools to facilitate these prescriptions in their practice. We examined the effect of the workshop on the self-reported physical activity prescription behaviours of a group of family physicians in British Columbia. We hypothesized that the intervention would increase the proportion of family physicians providing patients with physical activity prescriptions. Our primary outcome was the proportion of family physicians who reported providing patients with written physical activity prescriptions. Exploratory outcomes included the change in (i) other physical activity prescription behaviours and the frequency with which they were performed, (ii) perceived barriers to physical activity prescription, and (iii) knowledge and confidence as indicated by physicians' self-report and knowledge of the Canadian physical activity guidelines.

METHODS

Study Design.

We used a single sample, pre-post study design with data collected at baseline and one month after the intervention.

Subjects.

Our study sample included family physicians practicing in the municipalities of Abbotsford, and Mission, British Columbia, Canada. Potential participants were identified through their registration with the Abbotsford Division of Family Practice (121 members) or Mission Division of Family Practice (37 members). All registered members were invited to complete a physical activity prescription questionnaire and attend the educational workshop.

Survey distribution.

The Abbotsford Division of Family Practice compiled the email and mailing addresses of the family physicians and completed the distribution of the surveys. One week prior to the distribution of the questionnaire, an introductory email detailed the study and invited physicians to participate when they received the mailed package. The baseline survey package was distributed in February 2014 to all 158 family physicians registered with the Divisions of Family Practice in Abbotsford, and Mission, British Columbia. It included a preaddressed, postage-paid return envelope, an informed written consent form, and the questionnaire. Follow up emails were sent to all physicians one and two weeks after the original distribution. Finally, all family physicians who registered to attend the workshop were sent an additional reminder to complete the baseline questionnaire prior to attending.

One month after the workshop, the same survey delivery procedure was performed to deliver follow up questionnaires all physicians who filled out the baseline questionnaire and attended the workshop. The follow up time of one month was chosen to maximize follow up response rate while allowing for a period of time for physicians to incorporate changes to clinical behaviour following the workshop.

All participants were informed that participation was voluntary and completed informed written consent with the baseline survey. The study was approved by the Behavioural Research Ethics Board at the University of British Columbia (H13-01977) and by the Fraser Health Authority Research Ethics Board (2014-013).

Survey instrument.

The bespoke five page questionnaire consisted of 30 questions divided into five main sections, detailed below. The survey took approximately ten minutes for subjects to complete. The survey

was pretested with a number of medical residents and non-family physician professionals. Minor amendments were made based on pretesting feedback.

Variables.

The survey included a brief section of demographic information (sex, age, years in practice, practice characteristics), before addressing five main sections related to physical activity prescription:

A) *Physical Activity Prescription Behaviours* – Emulating Petrella and colleagues' national survey (2007), we inquired whether the physicians: 1) ask their patients about their physical activity levels, 2) assess the physical activity levels or physical fitness of their patients, 3) refer their patients to other healthcare providers for fitness assessments, 4) provide their patients with verbal physical activity counselling, or 5) provide written physical activity prescriptions to their patients. Those who answered "Yes" to any of these categories were then asked to specify the proportion of patients whom they performed that behaviour (1-20%, 21-40%, 41-60%, 61-80%, 81-100%).

B) *Confidence and Knowledge*: Physicians self-reported their perceived knowledge and confidence regarding physical activity prescription on a 10 point Likert scale (1=not confident/knowledgeable, 10=extremely confident/knowledgeable), as well as listed the proportion of patients they believed would change their physical activity behaviours as a result of their counselling on a five point scale (1-20%, 21-40%, 41-60%, 61-80%, 81-100%).

C) *Perceived Barriers to Physical Activity Prescription*: Physicians were asked to rank how important they perceived a list of 12 previously documented barriers to be in preventing

them from prescribing physical activity more regularly (18) (1=Not Important, 5=Extremely Important).

D) *Knowledge of the Canadian Physical Activity Guidelines:* Physicians were asked two multiple choice questions regarding 1) how many minutes of moderate physical activity/week (60, 90, 160, 300), and 2) how many days/week (1, 2, 3, 4+) of muscle and bone strengthening activities were recommended by the Canadian Physical Activity Guidelines (2).

E) *Self-reported Physical Activity Levels:* Physicians completed the short form of the International Physical Activity Questionnaire (IPAQ), a validated measure of self-reported physical activity levels based on previous 7 day recall (4). Their results were used to estimate their MET-Minutes/week and categorical activity level (Low, Moderate, High) as per the IPAQ scoring protocol (8).

Workshop design, content and delivery.

The three-hour workshop was primarily developed by two authors – one strength and conditioning specialist (JW), and one local family physician (AW). The primary aims of the workshop were to educate local family physicians on the value of physical activity prescriptions, and provide them with the tools to assess and prescribe physical activity efficiently and effectively in their clinical practice.

The workshop outlined three main steps for physicians to follow with patients: (1) assess patients' physical activity levels; (2) utilize patient-centered Motivational Interviewing techniques (26) to change patients' physical activity behaviours, and (3) provide written physical activity prescriptions to patients when appropriate. The health benefits of physical activity and the Canadian Physical Activity Guidelines were also presented (2). Workshops were interactive

in nature and case studies were utilized for practice purposes. Educational material delivered to the physicians included digital and print copies of workshop content, copies of the PAR-Q+ physical activity screening forms (1), as well as the Canadian Physical Activity Guidelines.

Finally, two primary tools were provided to physicians to facilitate the process of physical activity prescription. First, physicians were provided with a 'physical activity vital sign' (3, 27), allowing them to quickly assess the physical activity levels of their patients. Second, they were given physical activity prescription pads, developed by the Exercise is Medicine Canadian Taskforce (7).

Physicians attended one of two identical workshops that were delivered on two consecutive Fridays in April 2014, led by AW. No booster sessions, reminders, or other follow-up training sessions were provided.

Statistical analysis.

Calculations for the required sample size of this study were conducted based on changes in the proportion of physicians prescribing physical activity in written format, as indicated by McNemar's test for paired proportions. In order to achieve a power of 0.80, with $\alpha = 0.05$, and to observe a change in proportions of at least 0.25 (9), 29 participants were required.

Basic descriptive analysis was performed in Microsoft Excel (Microsoft Office, 2013 Edition). All statistical tests were performed using R (Development Core Team, 2011).

Frequency distributions were carried out for all demographic and outcome variables. We used McNemar's chi-square test for paired data for primary outcome analysis to determine whether there was a significant change in the proportion of family physicians providing written physical activity prescription before and after the intervention (26). For exploratory outcomes,

McNemar's test evaluated the changes in binomial data before and after the intervention, Wilcoxon signed-rank tests assessed changes in paired five-point Likert data before and after the workshop, as well as self-reported physical activity levels before and after the intervention and paired t-tests assessed changes in self-reported knowledge and confidence (26). All analyses were performed with a significance level of .05.

RESULTS

Responder characteristics.

33 physicians attended the workshop. Of these, 26 filled out the baseline questionnaire prior to attending. An additional 15 physicians completed the baseline questionnaire but did not attend the workshop. One individual was excluded from the study as he was no longer practicing family medicine, leaving 25 family physicians eligible for inclusion. Of these, 21 were male (84%), and 4 were female (16%). The average age of participants was 51.3 (±11.0, range = 31-70) years, and average years in practice of 23.3 (±11.4, range = 1-43). Follow up questionnaires were received from all 25 family physicians (100%).

Physical activity prescription behaviours.

Table 1 outlines the proportion of family physicians in our sample who performed the five physical activity prescription behaviours before and after the intervention. The proportion of family physicians who provided written physical activity prescriptions increased significantly from 10 (40%) before the intervention, to 17 (68%) one month after the intervention ($p<0.05$). Specifically, the odds of a physician providing written physical activity prescriptions to their patients after the workshop were 8 times higher than the odds before the workshop (95% CI: 1.1, 355).

TABLE 1: Physical activity prescription behaviours pre- and post-intervention.

Behaviour	Pre-Intervention n (%)	Post-Intervention n (%)	OR (95% CI)	p-value
Ask (n=25)	25 (100%)	25 (100%)	0	1.0
Assess (n=24)	13 (54%)	18 (75%)	6 (0.7, 256)	0.13
Refer (n=25)	9 (36%)	16 (64%)	∞ (1.7, ∞)	0.004*
Verbally Counsel (n=25)	25 (100%)	25 (100%)	0	1.0
Written Prescription (n=25)	10 (40%)	17 (68%)	8 (1.1, 355)	0.04*

*p<0.05

ASK – do physicians ask their patients about their physical activity levels?
ASSESS – do physicians assess the physical activity levels or physical fitness of their patients?
REFER – do physicians refer their patients to other healthcare providers for fitness assessments?
VERBALLY COUNSEL – do physicians provide patients with verbal physical activity counselling?
WRITTEN PRESCRIPTION – do physicians provide patients with written physical activity prescriptions?

A significant increase was also seen in the proportion of physicians who reported referring patients for the purpose of physical activity assessment or appraisal, from 9 (36%) to 16 (64%) ($p<0.01$, OR = ∞ [1.7, ∞]). More physicians assessed their patients' physical activity levels after the intervention (52% to 76%), although this was not significant ($p=0.13$). There were no changes in the number of physicians who asked their patients about their physical activity levels or gave verbal counselling to their patients, as 100% of participating physicians reported engaging in these behaviours both before and after the workshop.

Physicians who responded "Yes" to performing any of these behaviours were asked to describe the frequency with which they did so by categorizing the percentage of patients (1-20, 21-40, 41-60, 61-80, 81-100) whom they performed each action with. Table 2 details these frequencies before and after the workshop for physicians who engaged in each of the five behaviours at baseline. Among these physicians, there was a significant increase in the percentage of patients

whom physicians asked (Wilcoxon signed-rank, $p<0.01$) and assessed (Wilcoxon signed-rank, $p<0.05$) in regards to physical activity.

TABLE 2**:** The frequency with which each behaviour was used among physicians who engaged in the behaviour both before and after the intervention.

BEHAVIOUR		**1-20% n**	**21-40% n**	**41-60% n**	**61-80% n**	**81-100% n**	**Difference (p-value)**
Ask	Before (n=25)	3	4	9	6	3	0.008*
	After (n=25)	2	1	11	7	4	
Assess	Before (n=13)	2	2	6	1	2	0.02*
	After (n=13)	0	1	6	4	2	
Refer	Before (n=9)	4	3	2	0	0	0.12
	After (n=9)	3	3	1	2	0	
Verbally counsel	Before (n=25)	3	5	9	4	4	0.62
	After (n=25)	3	4	10	7	1	
Written prescription	Before (n=10)	5	2	2	1	0	1.0
	After (n=10)	5	2	1	2	0	

Barriers to physical activity prescription.

Physicians' categorized the perceived importance of a number of common barriers to physical activity prescription before and after the workshop (Table 3). The most common barrier to physical activity prescription was lack of time, with 76% of physicians reporting it as "Important", "Very Important", or "Extremely Important" before the workshop, which increased to 84% after the workshop. Prior to the workshop, the next important barriers were lack of tools, lack of education, and lack of knowledge, with more than 65% regarding these as ≥ "Important".

TABLE 3: Perceived importance of selected barriers to physical activity prescription.

BARRIER		Not Important 1 n (%)	Somewhat Important 2 n (%)	Important 3 n (%)	Very Important 4 n (%)	Extremely Important 5 n (%)	I + VIP + EIP** n (%)	p-value
Lack of time	Before (n=25)	3 (12%)	3 (12%)	5 (20%)	8 (32%)	6 (24%)	**76%**	0.41
	After (n=25)	2 (8%)	2 (8%)	5 (20%)	10 (40%)	6 (24%)	**84%**	
Lack of tools	Before (n=24)	2 (8%)	5 (21%)	10 (42%)	6 (25%)	1 (4%)	**71%**	0.01*
	After (n=25)	8 (32%)	7 (28%)	4 (16%)	6 (24%)	0 (0%)	**40%**	
Lack of education	Before (n=25)	2 (8%)	6 (24%)	6 (24%)	10 (40%)	1 (4%)	**68%**	0.44
	After (n=25)	6 (24%)	3 (12%)	7 (28%)	7 (28%)	7 (28%)	**64%**	
Lack of knowledge	Before (n=25)	1 (4%)	7 (28%)	7 (28%)	8 (32%)	2 (8%)	**68%**	0.45
	After (n=25)	7 (28%)	9 (36%)	5 (20%)	3 (12%)	1 (4%)	**36%**	
Lack of continuing education	Before (n=25)	1 (4%)	8 (32%)	6 (24%)	8 (32%)	2 (8%)	**64%**	0.34
	After (n=25)	7 (28%)	3 (12%)	5 (20%)	8 (32%)	2 (8%)	**60%**	
Patients not interested	Before (n=25)	4 (16%)	6 (24%)	11 (44%)	2 (8%)	2 (8%)	**60%**	0.72
	After (n=25)	4 (16%)	9 (36%)	8 (32%)	3 (12%)	1 (4%)	**48%**	
Patients prefer pharmaceuticals	Before (n=25)	2 (8%)	8 (32%)	8 (32%)	4 (16%)	3 (12%)	**60%**	0.51
	After (n=25)	4 (16%)	8 (32%)	4 (16%)	8 (32%)	1 (4%)	**52%**	
Lack of guidelines	Before (n=25)	3 (12%)	7 (28%)	7 (28%)	5 (20%)	3 (12%)	**60%**	0.12
	After (n=25)	7 (28%)	4 (16%)	8 (32%)	6 (24%)	0 (0%)	**56%**	
Lack of incentive	Before (n=25)	7 (28%)	5 (20%)	9 (36%)	4 (16%)	0 (0%)	**52%**	0.02*
	After (n=25)	5 (20%)	5 (20%)	7 (28%)	6 (24%)	2 (8%)	**60%**	
Patients won't change	Before (n=25)	4 (16%)	11 (44%)	5 (20%)	3 (12%)	2 (8%)	**40%**	0.12
	After (n=25)	7 (28%)	10 (40%)	6 (24%)	1 (4%)	1 (4%)	**32%**	
Other changes more important	Before (n=24)	9 (38%)	7 (29%)	5 (21%)	1 (4%)	2 (8%)	**33%**	0.10
	After (n=25)	14 (56%)	4 (16%)	4 (16%)	3 (12%)	0 (0%)	**28%**	
Lack of evidence	Before (n=25)	18 (72%)	3 (12%)	0 (0%)	4 (16%)	0 (0%)	**16%**	0.66
	After (n=25)	17 (68%)	3 (12%)	1 (4%)	2 (8%)	2 (8%)	**20%**	

* p<0.05, ** I+VIP+EIP = Important + Very Important + Extremely Important

After the workshop, the most significant barriers were reported as time, education, continuing education, and financial incentive.

One month after the workshop, there was a significant decrease in the perceived importance of tools as a barrier to physical activity prescription ($p<0.05$). There was also a significant increase in the perceived importance of receiving a lack of incentive ($p<0.05$) for physical activity prescription. Lack of education, lack of knowledge, lack of continuing education, and lack of guidelines all decreased in the number ranking them as $\geq$ important, though none of these changes were significant.

Self-reported knowledge and confidence levels.

Physicians' self-reported confidence and knowledge were significantly correlated with one another before (Pearson $r=0.84$) and after (Pearson $r=0.95$) the intervention. There was a significant increase in self-reported knowledge ($p<0.01$) and confidence ($p<0.01$) one month after the intervention. However, there was no significant change in the proportion of patients physicians believed would change their behaviour as a result of their counselling ($p=0.83$).

Knowledge of Canada's physical activity guidelines.

The number of physicians who were able to correctly identify the Canadian Physical Activity Guidelines for aerobic activity and resistance training increased significantly from four (16%) to thirteen (52%) ($p<0.01$). More physicians correctly chose the aerobic guidelines than the strength guidelines both before (20 vs. 5) and after (21 vs. 13) the workshop.

Self-reported physical activity.

The mean MET minutes per week for physicians based on their IPAQ data decreased from 2586 to 1960 MET-minutes/week for physicians one month after the intervention, although this

difference was not significant. Since these data were not normally distributed, a Wilcoxon signed-rank test was used to determine that there was no significant change after the workshop ($p=0.92$).

DISCUSSION

This study evaluated the effects of a clinician-targeted workshop on the self-reported physical activity prescription behaviours of family physicians in Abbotsford and Mission, British Columbia. We found a significant increase in the proportion of family physicians who reported providing written physical activity prescriptions to their patients ($p<0.05$).

To our knowledge, only one other study has recorded changes in physical activity prescription behaviour after a clinician-targeted workshop (5). However, the study by Carroll and colleagues differed in a number of ways. They investigated a smaller number of physicians (n=10), their primary outcome was clinician use of the 5As Framework, as evaluated by change in patient-rated Physical Activity Exit Interview (PAEI) survey results, and the training intervention focused less on the provision of written prescriptions and emphasized the 5A framework and community referrals. They noted a significant improvement in the use of the 5As framework immediately after the intervention, but not at 6 month follow-up (5). Our current study extends their findings by demonstrating a brief intervention can change physician behaviour in terms of written physical activity prescriptions, with a significant change reported a month after training.

Addressing barriers to prescription.

It is possible that the provision of tools in conjunction with the educational intervention played an important role in increasing the proportion of physicians providing written prescriptions. Lack of tools was the only perceived barrier to prescription that decreased significantly one month

after the intervention. Notably, it was the second most cited barrier at baseline, and only the 9th most important barrier after the intervention. This finding encourages the provision of specific tools as a supplement to education alone.

Education and related factors have been repeatedly cited as barriers to physical activity prescription (11, 18, 21). Physicians who report having received education, or have a higher self-efficacy regarding PA prescription, are more likely to engage in these behaviours with their patients (14, 16, 29). 73% of US physicians feel there is a need for further education regarding physical activity prescription (32), and among 4th year medical students at the University of British Columbia, 86% thought their training in physical activity prescription was inadequate (13). The perceived barriers of education and knowledge can be also be seen in lack of guideline knowledge.

Our current data indicate a lack of knowledge of physical activity guidelines, seen in the low proportion of physicians (16%) were able to correctly identify that Canadian Physical Activity Guidelines prior to the workshop. Similarly, previous data indicate 23% of US physicians are familiar with the American College of Sports Medicine Guidelines (36). Our results show that providing continuing education may facilitate improvements in perceived knowledge and confidence of family physicians to prescribe physical activity. A significantly greater proportion of physicians were familiar with the Canadian Physical Activity Guidelines after the intervention. However, though the perceived importance of lack of standard guidelines, education, knowledge, and continuing education all decreased, none of these were significant.

Lack of time was the most significant barrier to PA prescription - a common finding in physician surveys (14, 21, 24). This did not change after the workshop. The only barrier that increased significantly in perceived importance was lack of financial incentive. For physical activity

prescriptions to become more common, it may be important that physicians receive training on how to prescribe in a time-efficient manner, or receive reimbursement that compensates them for the additional time spent performing physical activity counselling with their patients.

Strengths and limitations.

To our knowledge, this is the first study to report the change in the family physicians use of written physical activity prescriptions before and after a clinician-targeted intervention. Second, it investigates an intervention that is aimed at changing clinical practice, which is less commonly reported in the literature. Thirdly, it was not solely based on education, but provided practical tools that facilitated the targeted change, and significantly reduced this as a perceived barrier to physical activity prescription.

The present study has some limitations, including its single-group, pre-post study design, and relatively small sample size. The follow-up period of one month does not indicate sustained behaviour change. The use of educational workshops and written materials, like those utilized in this study, have been shown to produce mixed results in changing physician behaviour (32). Since all physicians in the two municipalities were invited, there was a risk of self-selection bias with more motivated physicians choosing to attend. This may help to explain why the baseline levels of all the physical activity prescription behaviours were higher than in previous cross sectional studies (21, 23, 29). Finally, due to the reliance on self-reported data for behaviour, there was a risk for response bias.

Future investigations should utilize more objective measurements to assess clinician behaviour, such as direct observation or audio recordings (4). Ideally, longitudinal trials should investigate

whether clinician-targeted interventions lead to patient behaviour and health outcome change, in addition to physician behaviour change.

We conclude that physician training workshops combined with practical tools provide a promising method of encouraging physical activity prescriptions in this type of setting.

Contributions: All authors were responsible for study concept and design. AW and JW were primarily responsible for designing the educational workshop. JCD and JW were responsible for the analysis of the study data. All authors contributed to writing and critical revision of the manuscript.

Acknowledgements: We would like to acknowledge the support of the BC Ministry of Health for physical activity promotion work in the Province of British Columbia.

Funding: JW is funded by a graduate award by the Canadian Institutes of Health Research. AW is funded by the Clinician Scholar Program scholarship through the University of British Columbia. JCD is funded by the Michael Smith Foundation for Health Research Postdoctoral Fellowship Award and the Canadian Institute for Health Research Postdoctoral Fellowship Award.

Competing interests: None

Provenance and peer review: Not commissioned, externally peer reviewed.

Data sharing statement: All of the data for the study are housed at the Centre for Hip Health and Mobility, in Vancouver BC. Only team members have access to the raw data for the sole purpose of dissemination of the results. Data analysis is ongoing.

Ethics approval: Approval was sought and subsequently granted from the Behavioural Research Ethics Board at the University of British Columbia (H13-01977) and by the Fraser Health Authority Research Ethics Board (2014-013).

References:

1. Barnes PM, Schoenborg CA. Trends in adults receiving a recommendation for exercise or other physical activity from a physician or other health professional. Hyattsville, MD: *National Center for Health Statistics* [Internet]; 2012 [cited 2014 October 8]; no. 86. 7 p. Available from: http://www.cdc.gov/nchs/data/databriefs/db86.pdf

2. Bredin SD, Gledhill N, Jamnik VK, et al. PAR-Q+ and ePARmed-X+. *Can. Fam. Physician.* 2013;59(3):273–7

3. Canadian Society for Exercise Physiology. CSEP - Get the Guidelines [Internet] 2014; [cited 2014 Oct 15] Available from: http://www.csep.ca/english/view.asp?x=804

4. Carroll JK, Antognoli E, Flocke SA. Evaluation of physical activity counseling in primary care using direct observation of the 5As. *Ann. Fam. Med*. 2011;9(5):416–22.

5. Carroll JK, Winters PC, Sanders MR, et al. Clinician-targeted intervention and patient-reported counseling on physical activity.. *Prev. Chronic. Dis*. [Internet] 2014 [cited 2014 Sep 7];11:130302. Available from: http://www.cdc.gov/pcd/issues/2014/13_0302.htm. doi:10.5888/pcd11.130302

6. Coleman KJ, Ngor E, Reynolds K, et al. Initial validation of an exercise "vital sign" in electronic medical records. *Med. Sci. Sports Exerc*. 2012;44(11):2071–6.

7. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med. Sci. Sports Exerc*. 2003;35(8):1381–95.

8. Douglas F, Torrance N, van Teijlingen E, et al. Primary care staff's views and experiences related to routinely advising patients about physical activity. A questionnaire survey. *BMC Pub. Health.* 2006;6:138

9. Eakin EG, Glasgow RE, Riley KM. Review of primary care-based physical activity intervention studies: effectiveness and implications for practice and future research. *J. Fam. Pract.* 2000;49(2):158–68

10. Exercise is Medicine Canadian Taskforce. Exercise Prescription & Referral Tool [Internet]. *Exercise is Medicine Canada*. [cited 2014 Oct 15] Available from: http://www.exerciseismedicine.ca/professional-resources/exercise-prescription-referral-tool

11. Guidelines for data processing and analysis of the international physical activity questionnaire [Internet] 2005; [cited 2014 Oct 13] Available from: http://www.ipaq.ki.se/scoring.pdf

12. Gunn J, Southern D, Chondros P, et al. Guidelines for assessing postnatal problems: introducing evidence-based guidelines in Australian general practice. *Fam. Pract.* 2003;20(4):382–9.

13. Hallal PC, Andersen LB, Bull FC, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. *The Lancet* 2012;380(9838):247–57.

14. Hébert ET, Caughy MO, Shuval K. Primary care providers' perceptions of physical activity counselling in a clinical setting: a systematic review. *Br. J. Sports Med*. 2012;46(9):625–31.

15. Hippocrates. *Regimen I*. Translated by W.H.S Jones. Cambridge: Harvard University Press; 1953. p. 229.

16. Holtz KA, Kokotilo KJ, Fitzgerald BE, et al. Exercise behaviour and attitudes among fourth-year medical students at the University of British Columbia. *Can. Fam. Physician* 2013;59(1):e26–32.

17. Howe M, Leidel A, Krishnan SM, et al. Patient-related diet and exercise counseling: do providers' own lifestyle habits matter? *Prev. Cardiol.* 2010;13(4):180–5.

18. Investments that work for physical activity. *Br. J. Sports Med*. 2012;46(10):709–12.

19. Jorgensen TK, Nordentoft M, Krogh J. How do general practitioners in Denmark promote physical activity? *Scand. J. Prim. Health Care.* 2012;30(3):141–6.

20. Kallings LV, Leijon M, Hellénius M-L, et al. Physical activity on prescription in primary health care: a follow-up of physical activity level and quality of life. *Scand. J. Med. Sci. Sports*. 2008;18(2):154–61.

21. Kennedy MF, Meeuwisse W. Exercise counselling by family physicians in Canada. *Prev. Med.* 2003;37(3):226–32.

22. Kohl 3rd HW, Craig CL, Lambert EV, et al. The pandemic of physical inactivity: global action for public health. *The Lancet.* 2012;380(9838):294–305.

23. Lobelo F, Duperly J, Frank E. Physical activity habits of doctors and medical students influence their counselling practices. *Br. J. Sports Med.* 2009;43(2):89–92.

24. McKenna J, Naylor PJ, McDowell N. Barriers to physical activity promotion by general practitioners and practice nurses. *Br. J. Sports Med.* 1998;32(3):242–7.

25. Orrow G, Kinmonth AL, Sanderson S, et al. Effectiveness of physical activity promotion based in primary care: systematic review and meta-analysis of randomised controlled trials. *Br. Med. J.* 2012;344(mar26 1):e1389–e1389.

26. Pagano M, Gauvreau K. *Principles of Biostatistics*. 2nd ed. Pacific Grove, CA: Duxbury Press; 2000. 592 p.

27. Petrella RJ, Koval JJ, Cunningham DA, et al. Can primary care doctors prescribe exercise to improve fitness?: The step test exercise prescription (STEP) project. *Am. J. Prev. Med.* 2003;24(4):316–22.

28. Petrella RJ, Lattanzio CN. Does counseling help patients get active? Systematic review of the literature. *Can. Fam. Physician* 2002;48:72–80.

29. Petrella RJ, Lattanzio CN. Physical activity counseling and prescription among canadian primary care physicians. *Arch. Intern. Med*. 2007;167(16):1774–81.

30. Rollnick S, Miller WR, Butler C. *Motivational Interviewing in Health Care: Helping Patients Change Behaviour*. Guilford Press; 2008. 225 p.

31. Sallis R. Developing healthcare systems to support exercise: exercise as the fifth vital sign. *Br. J. Sports Med.* 2011;45(6):473–4.

32. Smith WR. Evidence for the effectiveness of techniques to change physician behaviour. *Chest*. 2000;118(2 Supplement):8S – 17S.

33. Stanford FC, Durkin MW, Blair SN, et al. Determining levels of physical activity in attending physicians, resident and fellow physicians and medical students in the USA. *Br. J. Sports Med*. 2012;46(5):360–4.

34. Warburton DE, Charlesworth S, Ivey A, et al. A systematic review of the evidence for Canada's Physical Activity Guidelines for adults. *Int. J. Behav. Nutr. Phys. Act.* 2010;7(1):39.

35. Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. *Can. Med. Assoc. J*. 2006;174(6):801–9.

36. Williford HN, Barfield BR, Lazenby RB, et al. A survey of physicians' attitudes and practices related to exercise promotion. *Prev. Med*. 1992;21(5):630–6

BMJ Open

Can a three-hour educational workshop and the provision of practical tools encourage family physicians to prescribe physical activity as medicine? A pre-post study.

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2015-007920.R1
Article Type:	Research
Date Submitted by the Author:	11-May-2015
Complete List of Authors:	Windt, Johann; University of British Columbia, Experimental Medicine Windt, Adriaan; University of British Columbia, Department of Family Practice Davis, Jennifer; University of British Columbia, Department of Population & Public Health, Petrella, Rob; University of Western Ontario, Family Medicine, Rehabilitation, Kinesiology and Cardiology Khan, Karim; The University of British Columbia, Centre for Hip Health & Mobility
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Medical education and training
Keywords:	Physical activity prescription, MEDICAL EDUCATION & TRAINING, Family Practice, Exercise Prescription

Can a three-hour educational workshop and the provision of practical tools encourage family physicians to prescribe physical activity as medicine? A pre-post study.

Johann Windt BHK[1,6], Adriaan Windt MD[2], Jennifer Davis PhD[3,6], Robert Petrella MD PhD[4], Karim Khan MD PhD [1,5,6]

[1] Department of Experimental Medicine, University of British Columbia, Vancouver, Canada

[2] Department of Family Medicine, University of British Columbia, Vancouver, Canada

[3] Department of Population & Public Health, University of British Columbia

[4] Schulich School of Medicine, Department of Family Medicine, University of Western Ontario, Canada

[5] Aspetar Orthopedic and Sports Medicine Hospital, Doha, Qatar

[6] Centre for Hip Health and Mobility, University of British Columbia, Vancouver, Canada

Key Words: Physical activity prescription, medical education, family practice, exercise prescription

Word Count: 4229

Corresponding Author:

Johann Windt.
2635 Laurel Street, Vancouver, BC V5Z 1M9.
Telephone: 1-604-557-8387, 27-76-140-4985; johann.windt@gmail.com

ABSTRACT

Objectives: To increase the proportion of family physicians in our sample who provided their patients with written physical activity prescriptions after the delivery of a three-hour educational workshop with the provision of practical tools to facilitate behaviour change.

Design: A pre-post study.

Setting: Abbotsford and Mission, British Columbia.

Participants: All 158 physicians registered with the Abbotsford (121) or Mission (37) Divisions of Family Practice were invited to participate.

Intervention: A three-hour educational workshop combined with practical tools. Educational content of the workshop included 1) assessing patients' physical activity levels, 2) using motivational interviewing techniques to encourage physical activity, and 3) providing written physical activity prescriptions when appropriate. Practical tools to facilitate physician behaviour changes included a 'physical activity vital sign', and copies of the Exercise is Medicine Canada Prescription Pad. Participating physicians completed a bespoke questionnaire before and four weeks after their attendance of the workshop.

Outcome Measures: The primary outcome was the change in the proportion of family physicians who reported providing written physical activity prescriptions. Exploratory outcomes included changes in other physical activity prescription behaviours, the perceived importance of various barriers to prescription, and knowledge and confidence in regards to physical activity prescription. McNemar's test evaluated changes in proportions before and after the workshop, while Wilcoxon signed-rank tests evaluated changes in Likert data.

Results: Twenty five family physicians completed the baseline questionnaire and attended the workshop, with 100% follow up response rate. The proportion of family physicians who reported providing written physical activity prescriptions in their clinical practice increased significantly ($p<0.05$), from 10 (40%) at baseline to 17 (68%) four weeks after the intervention.

Conclusion: Educational workshops combined with practical tools appear to be a promising method to encourage the use of written physical activity prescriptions among family physicians in this setting, over the short term.

ARTICLE SUMMARY

Strengths and limitations of this study:

- Its novelty, as this is the first study to document changes in family physicians' reported written physical activity prescription behaviours following an educational workshop. Since many have called for the development of medical school education and continuing education in the area of physical activity prescription, it is encouraging to see that such education may be effective in changing current family physician behaviours.
- The small sample size consisted of more male than female physicians, and was limited to two cities in southern British Columbia, Canada.
- Since all community physicians were invited, there was risk of self-selection bias, and there are inherent risks for inaccuracies when relying on self-reported data.
- The pre-post nature of the study lacks a control group for the intervention, and the four week follow up does not indicate long-term behaviour change.

INTRODUCTION

In 400 BC, Hippocrates wrote, “Eating alone will not keep a man well; he must also take exercise”.[1] Over two millennia later, physical inactivity has become a major public health problem. 31.1% of adults worldwide are physically inactive,[2] and are therefore at increased risk of cardiovascular disease, stroke, hypertension, colon and breast cancers, type 2 diabetes, osteoporosis, and all-cause mortality.[3–5] Primary care settings are considered an important public health investment [6] that may help address the current inactivity pandemic [3] through the promotion of physical activity.

Randomized controlled trials have shown that physical activity prescriptions increase patients’ self-reported physical activity levels,[7] improve quality of life,[8] reduce body mass index, and lower systolic blood pressure.[9] Tailored interventions including a written component may have a greater effect on patient behaviour than brief advice alone [10,11], and have been preferred by physicians compared to verbal advice.[12] Collectively, such trials have documented the efficacy of physical activity prescription for patient outcomes, but few investigations have looked to disseminate these findings into changing physicians’ behaviour in real-world clinical practice.

The need for such dissemination is indicated, since just 16% of Canadian family physicians provide written physical activity prescriptions to their patients.[13] The authors of this national survey suggested that the low frequency of written prescriptions indicated a need for targeted physician training.[13] These low proportions are similar to those in the United States, where just one third of patients report receiving any form of physical activity counselling from their physician in the last year.[14]

Physicians commonly cite lack of time, lack of education or knowledge, lack of compensation, and lack of tools or resources, as barriers to physical activity prescription.[15–18] Addressing

these common barriers by providing training and tools may be a key step in the dissemination of physical activity prescription into routine primary care practice. Moreover, family physicians are more likely to have higher self-efficacy regarding physical activity prescription and prescribe physical activity more frequently if they have received relevant training/education,[19,20] and if they themselves engage in frequent physical activity.[21]

The RE-AIM framework has been suggested for the evaluation of large scale dissemination studies.[22] It details five dimensions which together contribute to the public health impact of an intervention. These dimensions are 1) **reach** (at an individual level, percent and representativeness of the target population that participates in the intervention), 2) **efficacy/effectiveness** (at an individual level, extent to which the intervention achieves its desired outcome) 3) **adoption** (at an organizational level, percent and representatives of settings that adopt an intervention), 4) **implementation** (at an organizational level, the degree to which the intervention is carried out as planned), and 5) **maintenance** (a measure of long-term behaviour change, at both the patient and organization level). In our current clinician-targeted intervention, we focused our evaluation on the reach and effectiveness of the intervention at the individual, physician level, and its level of implementation.

Specifically, we designed a three-hour workshop aimed at 1) educating physicians on physical activity prescription, and 2) providing them tools to facilitate these prescriptions in their practice. Reach was evaluated as the proportion of family physicians in our study population who chose to participate in the training intervention. Effectiveness was determined by evaluating pre-post survey results. Implementation was the fidelity of the delivered workshop to the original plan.

We hypothesized that the intervention would increase the proportion of family physicians providing patients with physical activity prescriptions. Our primary outcome was the proportion

of family physicians who reported providing patients with written physical activity prescriptions. Exploratory outcomes included the change in (i) other physical activity prescription behaviours and the frequency with which they were performed, (ii) perceived barriers to physical activity prescription, and (iii) knowledge and confidence as indicated by physicians' self-report and knowledge of the Canadian physical activity guidelines.

METHODS

Study Design.

We used a single sample, pre-post study design with data collected at baseline and one month after the intervention.

Subjects.

Our study sample included family physicians practicing in the municipalities of Abbotsford (124,000 residents), and Mission (38,000 residents), neighbouring cities in southern British Columbia, Canada. Potential participants were identified through their registration with the Abbotsford Division of Family Practice (121 members) or Mission Division of Family Practice (37 members). All registered members were invited to complete a physical activity prescription questionnaire and attend the educational workshop.

Survey distribution.

The Abbotsford Division of Family Practice compiled the email and mailing addresses of the family physicians and completed the distribution of the surveys. One week prior to the distribution of the questionnaire, an introductory email detailed the study and invited physicians to participate when they received the mailed package. The baseline survey package was distributed in February 2014 to all 158 family physicians registered with the Divisions of Family Practice in Abbotsford, and Mission, British Columbia. It included a preaddressed, postage-paid

return envelope, an informed written consent form, and the questionnaire. Follow up emails were sent to all physicians one and two weeks after the original distribution. Finally, all family physicians who registered to attend the workshop were sent an additional reminder to complete the baseline questionnaire prior to attending.

One month after the workshop, the same survey delivery procedure was performed to deliver follow up questionnaires all physicians who filled out the baseline questionnaire and attended the workshop. The follow up time of one month was chosen to maximize follow up response rate while allowing for a period of time for physicians to incorporate changes to clinical behaviour following the workshop.

All participants were informed that participation was voluntary and completed informed written consent with the baseline survey. The study was approved by the Behavioural Research Ethics Board at the University of British Columbia (H13-01977) and by the Fraser Health Authority Research Ethics Board (2014-013).

Survey instrument.

The bespoke five page questionnaire consisted of 30 questions divided into five main sections, detailed below. The survey took approximately ten minutes for subjects to complete. The survey was pretested with a number of medical residents and non-family physician professionals. Minor amendments were made based on pretesting feedback.

Variables.

The survey included a brief section of demographic information (sex, age, years in practice, practice characteristics), before addressing five main sections related to physical activity prescription:

A) *Physical Activity Prescription Behaviours* – Emulating Petrella and colleagues' national survey (2007), we inquired whether the physicians: 1) ask their patients about their physical activity levels, 2) assess the physical activity levels or physical fitness of their patients, 3) refer their patients to other healthcare providers for fitness assessments, 4) provide their patients with verbal physical activity counselling, or 5) provide written physical activity prescriptions to their patients. Those who answered "Yes" to any of these categories were then asked to specify the proportion of patients whom they performed that behaviour (1-20%, 21-40%, 41-60%, 61-80%, 81-100%).

B) *Confidence and Knowledge*: Physicians self-reported their perceived knowledge and confidence regarding physical activity prescription on a 10 point Likert scale (1=not confident/knowledgeable, 10=extremely confident/knowledgeable), as well as listed the proportion of patients they believed would change their physical activity behaviours as a result of their counselling on a five point scale (1-20%, 21-40%, 41-60%, 61-80%, 81-100%).

C) *Perceived Barriers to Physical Activity Prescription*: Physicians were asked to rank how important they perceived a list of 12 previously documented barriers to be in preventing them from prescribing physical activity more regularly (1=Not Important, 5=Extremely Important).[17]

D) *Knowledge of the Canadian Physical Activity Guidelines:* Physicians were asked two multiple choice questions regarding 1) how many minutes of moderate physical activity/week (60, 90, 160, 300), and 2) how many days/week (1, 2, 3, 4+) of muscle and bone strengthening activities were recommended by the Canadian Physical Activity Guidelines.[23]

E) *Self-reported Physical Activity Levels:* Physicians completed the short form of the International Physical Activity Questionnaire (IPAQ), a validated measure of self-reported physical activity levels based on previous 7 day recall.[24] Their results were used to estimate their MET-Minutes/week and categorical activity level (Low, Moderate, High) as per the IPAQ scoring protocol.[25] According to the protocol, those in the "Moderate" category obtain an equivalent of 30 minutes a day of physical activity on at least 5 days per week, which meets the recommended weekly activity for most public health guidelines.

Workshop design, content and delivery.

The three-hour workshop was primarily developed by two authors – one strength and conditioning specialist (JW), and one local family physician (AW). The primary aims of the workshop were to educate local family physicians on the value of physical activity prescriptions, and provide them with the tools to assess and prescribe physical activity efficiently and effectively in their clinical practice.

The workshop outlined three main steps for physicians to follow with patients: (1) assess patients' physical activity levels; (2) utilize patient-centered Motivational Interviewing techniques [26] to change patients' physical activity behaviours, and (3) provide written physical activity prescriptions to patients when appropriate. The health benefits of physical activity and the Canadian Physical Activity Guidelines were also presented.[23] Workshops were interactive in nature and case studies were utilized for practice purposes. Educational material delivered to the physicians included digital and print copies of workshop content, copies of the PAR-Q+ physical activity screening forms,[27] as well as the Canadian Physical Activity Guidelines.

Finally, two primary tools were provided to physicians to facilitate the process of physical activity prescription. First, physicians were provided with a 'physical activity vital sign',[28,29] allowing them to quickly assess the physical activity levels of their patients. Second, they were given physical activity prescription pads, developed by the Exercise is Medicine Canadian Taskforce.[30]

Physicians attended one of two identical workshops that were delivered on two consecutive Fridays in April 2014, led by AW. No booster sessions, reminders, or other follow-up training sessions were provided.

RE-AIM Evaluation

Reach is defined as the percentage and representativeness of eligible individuals that agree to participate. In this study, it was simply the % of registered, eligible physicians who attended the training workshop.

In the RE-AIM framework, "E" can stand for either efficacy or effectiveness. Since our intervention was delivered in a real-world setting for family physicians, effectiveness is more appropriate. This was the primary indicator evaluated in this study, as it examines the degree to which the intervention had its desired effect of changing physicians' behaviours. We used the results of the pre-post survey to describe the effectiveness of our intervention.

Adoption refers to the level and representativeness of uptake at an organizational level, which we did not evaluate in our current investigation, focusing instead on individual physician behaviour.

Implementation is the degree to which an intervention was delivered as originally intended, and is usually evaluated at the organizational level. In our current investigation, implementation was described as the level to which the training workshop was delivered as planned.

Finally, maintenance refers to long term change in behaviour, both in patients and providers. Due to the short duration of follow up, maintenance was not evaluated in this present study.

Statistical analysis.

Calculations for the required sample size of this study were conducted based on changes in the proportion of physicians prescribing physical activity in written format, as indicated by McNemar's test for paired proportions. In order to achieve a power of 0.80, with $\alpha = 0.05$, and to observe a change in proportions of at least 0.25,[31] 29 participants were required.

Basic descriptive analysis was performed in Microsoft Excel (Microsoft Office, 2013 Edition). All statistical tests were performed using R (Development Core Team, 2011).

Frequency distributions were carried out for all demographic and outcome variables. We used McNemar's chi-square test for paired data for primary outcome analysis to determine whether there was a significant change in the proportion of family physicians providing written physical activity prescription before and after the intervention.[32] Our investigation also investigated a number of exploratory outcomes. McNemar's test evaluated the changes in binomial data before and after the intervention. Wilcoxon signed-rank tests assessed changes in paired five-point Likert data before and after the workshop, including the frequency of prescription behaviours as well as changes in perceived barriers. They were also used to measure changes in self-reported physical activity levels before and after the intervention. Finally, paired t-tests assessed changes in self-reported knowledge and confidence.[32] All analyses were performed with a significance level of .05.

RESULTS

Responder characteristics.

33 physicians attended the workshop. Of these, 26 filled out the baseline questionnaire prior to attending. An additional 15 physicians completed the baseline questionnaire but did not attend the workshop. One individual was excluded from the study as he was no longer practicing family medicine, leaving 25 family physicians eligible for inclusion. Of these, 21 were male (84%), and 4 were female (16%). The average age of participants was 51.3 (±11.0, range = 31-70) years, and average years in practice of 23.3 (±11.4, range = 1-43). At baseline, 19 family physicians personally met the Canadian Physical Activity Guidelines. Follow up questionnaires were received from all 25 family physicians (100%).

Reach:

Of 158 physicians who were invited to the training workshops, 33 attended (21%). Data for those who did not complete the baseline questionnaire and attend the workshop was not available, so the representativeness of the attendees in relation to our specific study population in Abbotsford and Mission could not be evaluated. When compared to the 2014 National Physician Survey [33], the mean age of our study sample (51.3) was similar to the national average (50.9), while the % of male physicians (86%) in our study was higher than the national average (56%).

Effectiveness:

Physical activity prescription behaviours.

The proportion of family physicians who provided written physical activity prescriptions increased significantly from 10 (40%) before the intervention, to 17 (68%) one month after the intervention ($p<0.05$).

Insert Figure 1

Figure 1: Proportion of family physicians engaging in 5 specific physical activity prescription behaviours pre- and post-intervention.

TABLE 1: Physical activity prescription behaviours pre- and post-intervention.

Behaviour	Pre-Intervention n (%)	Post-Intervention n (%)	p-value
Ask (n=25)	25 (100%)	25 (100%)	1.0
Assess (n=24)	13 (54%)	18 (75%)	0.13
Refer (n=25)	9 (36%)	16 (64%)	0.004*
Verbally Counsel (n=25)	25 (100%)	25 (100%)	1.0
Written Prescription (n=25)	10 (40%)	17 (68%)	0.04*

*p<0.05

ASK – do physicians ask their patients about their physical activity levels?
ASSESS – do physicians assess the physical activity levels or physical fitness of their patients?
REFER – do physicians refer their patients to other healthcare providers for fitness assessments?
VERBALLY COUNSEL – do physicians provide patients with verbal physical activity counselling?
WRITTEN PRESCRIPTION – do physicians provide patients with written physical activity prescriptions?

A significant increase was also seen in the proportion of physicians who reported referring patients for the purpose of physical activity assessment or appraisal, from 9 (36%) to 16 (64%) (p<0.01). More physicians assessed their patients' physical activity levels after the intervention (52% to 76%), although this was not significant (p=0.13). There were no changes in the number of physicians who asked their patients about their physical activity levels or gave verbal counselling to their patients, as 100% of participating physicians reported engaging in these behaviours both before and after the workshop.

Physicians who responded "Yes" to performing any of these behaviours were asked to describe the frequency with which they did so by categorizing the percentage of patients (1-20, 21-40, 41-60, 61-80, 81-100) whom they performed each action with. Table 2 details these frequencies before and after the workshop for physicians who engaged in each of the five behaviours at baseline. Among these physicians, there was a significant increase in the percentage of patients whom physicians asked (Wilcoxon signed-rank, p<0.01) and assessed (Wilcoxon signed-rank, p<0.05) in regards to physical activity.

TABLE 2**:** The frequency with which each behaviour was used among physicians who engaged in the behaviour both before and after the intervention.

BEHAVIOUR		**1-20% n**	**21-40% n**	**41-60% n**	**61-80% n**	**81-100% n**	**Difference (p-value)**
Ask	Before (n=25)	3	4	9	6	3	0.008*
	After (n=25)	2	1	11	7	4	
Assess	Before (n=13)	2	2	6	1	2	0.02*
	After (n=13)	0	1	6	4	2	
Refer	Before (n=9)	4	3	2	0	0	0.12
	After (n=9)	3	3	1	2	0	
Verbally counsel	Before (n=25)	3	5	9	4	4	0.62
	After (n=25)	3	4	10	7	1	
Written prescription	Before (n=10)	5	2	2	1	0	1.0
	After (n=10)	5	2	1	2	0	

Barriers to physical activity prescription.

Physicians' categorized the perceived importance of a number of common barriers to physical activity prescription before and after the workshop (Table 3). The most common barrier to physical activity prescription was lack of time, with 76% of physicians reporting it as "Important", "Very Important", or "Extremely Important" before the workshop, which increased to 84% after the workshop. Prior to the workshop, the next important barriers were lack of tools, lack of education, and lack of knowledge, with more than 65% regarding these as ≥ "Important".

TABLE 3: Perceived importance of selected barriers to physical activity prescription.

BARRIER		Not Important 1 n (%)	Somewhat Important 2 n (%)	Important 3 n (%)	Very Important 4 n (%)	Extremely Important 5 n (%)	I + VIP + EIP** n (%)	p-value
Lack of time	Before (n=25)	3 (12%)	3 (12%)	5 (20%)	8 (32%)	6 (24%)	**76%**	0.41
	After (n=25)	2 (8%)	2 (8%)	5 (20%)	10 (40%)	6 (24%)	**84%**	
Lack of tools	Before (n=24)	2 (8%)	5 (21%)	10 (42%)	6 (25%)	1 (4%)	**71%**	0.01*
	After (n=25)	8 (32%)	7 (28%)	4 (16%)	6 (24%)	0 (0%)	**40%**	
Lack of education	Before (n=25)	2 (8%)	6 (24%)	6 (24%)	10 (40%)	1 (4%)	**68%**	0.44
	After (n=25)	6 (24%)	3 (12%)	7 (28%)	7 (28%)	7 (28%)	**64%**	
Lack of knowledge	Before (n=25)	4 (16%)	9 (36%)	8 (32%)	4 (16%)	0 (0%)	**48%**	0.45
	After (n=25)	7 (28%)	9 (36%)	5 (20%)	3 (12%)	1 (4%)	**36%**	
Lack of continuing education	Before (n=25)	1 (4%)	8 (32%)	6 (24%)	8 (32%)	2 (8%)	**64%**	0.34
	After (n=25)	7 (28%)	3 (12%)	5 (20%)	8 (32%)	2 (8%)	**60%**	
Patients not interested	Before (n=25)	4 (16%)	6 (24%)	12 (48%)	1 (4%)	2 (8%)	**60%**	0.72
	After (n=25)	4 (16%)	9 (36%)	8 (32%)	3 (12%)	1 (4%)	**48%**	
Patients prefer pharmaceuticals	Before (n=25)	2 (8%)	8 (32%)	8 (32%)	4 (16%)	3 (12%)	**60%**	0.51
	After (n=25)	4 (16%)	8 (32%)	4 (16%)	8 (32%)	1 (4%)	**52%**	
Lack of guidelines	Before (n=25)	3 (12%)	7 (28%)	7 (28%)	5 (20%)	3 (12%)	**60%**	0.12
	After (n=25)	7 (28%)	4 (16%)	8 (32%)	6 (24%)	0 (0%)	**56%**	
Lack of incentive	Before (n=25)	8 (32%)	5 (20%)	8 (32%)	4 (16%)	0 (0%)	**48%**	0.02*
	After (n=25)	5 (20%)	5 (20%)	7 (28%)	6 (24%)	2 (8%)	**60%**	
Patients won't change	Before (n=25)	4 (16%)	10 (40%)	6 (24%)	3 (12%)	2 (8%)	**44%**	0.12
	After (n=25)	7 (28%)	10 (40%)	6 (24%)	1 (4%)	1 (4%)	**32%**	
Other changes more important	Before (n=24)	9 (38%)	7 (29%)	5 (21%)	1 (4%)	2 (8%)	**33%**	0.10
	After (n=25)	14 (56%)	4 (16%)	4 (16%)	3 (12%)	0 (0%)	**28%**	
Lack of evidence	Before (n=25)	18 (72%)	3 (12%)	0 (0%)	4 (16%)	0 (0%)	**16%**	0.66
	After (n=25)	17 (68%)	3 (12%)	1 (4%)	2 (8%)	2 (8%)	**20%**	

* $p<0.05$, ** I+VIP+EIP = Important + Very Important + Extremely Important

After the workshop, the most significant barriers were reported as time, education, continuing education, and financial incentive.

One month after the workshop, there was a significant decrease in the perceived importance of tools as a barrier to physical activity prescription ($p<0.05$). There was also a significant increase in the perceived importance of receiving no incentive ($p<0.05$) for physical activity prescription. The number of physicians ranking lack of education, lack of knowledge, lack of continuing education, and lack of guidelines all appeared to decrease, though none of these changes were significant.

Self-reported knowledge and confidence levels.

Physicians' self-reported confidence and knowledge were significantly correlated with one another before (Pearson $r=0.84$) and after (Pearson $r=0.95$) the intervention. There was a significant increase in self-reported knowledge ($p<0.01$) and confidence ($p<0.01$) one month after the intervention. However, there was no significant change in the proportion of patients physicians believed would change their behaviour as a result of their counselling ($p=0.83$).

Knowledge of Canada's physical activity guidelines.

The number of physicians who were able to correctly identify the Canadian Physical Activity Guidelines for aerobic activity and resistance training increased significantly from four (16%) to thirteen (52%) ($p<0.01$). More physicians correctly chose the aerobic guidelines than the strength guidelines both before (20 vs. 5) and after (21 vs. 13) the workshop.

Self-reported physical activity.

The median MET-minutes per week for physicians based on their IPAQ responses was 1624 before, and 1704 MET-minutes/week one month after the intervention - this difference was not

significant. At baseline, 19 of the physicians (79%) were at least in the "Moderate" category of the IPAQ scoring system, meaning they reached the recommended levels of physical activity set forth by the Canadian Physical Activity Guidelines. At follow up, 21 (84%) of the physicians obtained at least this level of activity.

TABLE 4: Family physicians' self-reported physical activity levels

	Pre-Intervention (n=24)	**Post-Intervention (n=25)**
MET Minutes [Median (IQR)]	1624 (1026-2335)	1704 (1011-2542)
Low [n (%)]	5 (21%)	4 (16%)
Moderate [n (%)]	10 (42%)	10 (40%)
High [n (%)]	9 (37%)	11 (44%)

Low = Reported no physical activity or not enough to reach "Moderate" category.
Moderate = Equivalent to at least 5 days of activity with at least 30 minutes of activity on those days. Enough reported activity to reach public health recommendations.
High = A third category of physical activity associated with increased health benefits, equivalent to an hour of moderate activity daily.

Implementation

The small scale of our current investigation allowed very high levels of implementation at the intervention level. The study content was delivered by the same family physician (AW), on two consecutive weekends, with no adaptation of content between the deliveries.

DISCUSSION

We examined the reach, effectiveness, and implementation of a brief clinician-targeted workshop to increase physical activity prescriptions by family physicians in Abbotsford and Mission, British Columbia. The reach of the intervention was 21%, with 33 family physicians opting to participate in the training intervention, out of 158 that were invited. Given the brief, two week time period over which the intervention was delivered, implementation of the intervention was high. We investigated the effectiveness of our intervention by evaluating pre-post survey data.

Notably, we found an increase in the proportion – from 40% to 68% - of family physicians who reported providing written physical activity prescriptions to their patients.

Though many trials have examined the efficacy of physical activity prescription in controlled research environments, dissemination studies in real world clinical settings are rare. Previous large scale dissemination studies such as the 10,000 Steps Rockhampton Project [34] have utilized the RE-AIM framework. They demonstrated high levels of GP uptake, reasonable implementation levels, and increased rates of patients in the community being counselled on physical activity compared to a comparison community.[34] However, it may be noted that there was no increase in the self-reported rates of physical activity prescription by family physicians involved in their investigation. Compared to the Rockhampton Project, our intervention was much smaller in scale, and focused primarily on physician implementation of physical activity prescription in their routine clinical practice, and was able to demonstrate an increase in self-reported physical activity prescription.

To our knowledge, only one other study has recorded changes in physical activity prescription behaviour after a brief clinician-targeted training workshop.[35] Carroll and colleagues' study differed in a number of ways. They investigated a smaller number of physicians (n=10), their primary outcome was clinician use of the 5As Framework, as evaluated by change in patient-rated Physical Activity Exit Interview (PAEI) survey results, and the training intervention focused less on the provision of written prescriptions and emphasized the 5A framework and community referrals. They noted a significant improvement in the use of the 5As framework immediately after the intervention, but not at 6 month follow-up.[35] Our current study extends their findings by demonstrating a brief intervention can change physician's written physical activity prescription behaviours a month after training.

Barriers and facilitators to prescription.

It is possible that the provision of tools (Physical activity vital sign and EIM Canada's Exercise Prescription and Referral Tool) in conjunction with the educational intervention played an important role in increasing the proportion of physicians providing written prescriptions. Lack of tools was the only perceived barrier to prescription that decreased significantly one month after the intervention. Notably, it was the second most cited barrier at baseline, and only the 9th most important barrier after the intervention. This finding encourages the provision of specific tools as a supplement to education alone. Further, the preference of physicians for tailored written prescriptions over verbal advice alone in the successful Green Prescription program further supports the use of tools to facilitate physician behaviour change.[12]

Education and related factors have been repeatedly cited as barriers to the implementation of physical activity prescription.[17,18] Physicians who report having received education, or have a higher self-efficacy regarding physical activity prescription, are more likely to engage in these behaviours with their patients.[19,20] 73% of US physicians feel there is a need for further education regarding physical activity prescription,[36] and among 4th year medical students at the University of British Columbia, 86% thought their training in physical activity prescription was inadequate,[37] The perceived barriers of education and knowledge can be also be seen in lack of guideline knowledge.

Our current data indicate a lack of knowledge of physical activity guidelines, seen in the low proportion of physicians (16%) who were able to correctly identify the Canadian Physical Activity Guidelines prior to the workshop. Similarly, only 23% of US physicians were familiar with the American College of Sports Medicine Guidelines.[36] Our results show that providing continuing education may facilitate improvements in perceived knowledge and confidence of

family physicians to prescribe physical activity. A significantly greater proportion of physicians were familiar with the Canadian Physical Activity Guidelines after the intervention. However, though the perceived importance of lack of standard guidelines, education, knowledge, and continuing education all decreased, none of these were significant.

Family physicians' physical activity prescription behaviours are also associated with their own personal physical activity levels.[38] In our study, the majority of physicians, 79% at baseline and 84% at follow up, were at least moderately active, accumulating the recommended levels of physical activity by the Canadian guidelines. This may help to explain why the baseline levels of all the physical activity prescription behaviours were higher than in previous cross sectional studies.[13,17]

Lack of time was the most significant barrier to physical activity prescription - a common finding in physician surveys.[16–18] This did not change after the workshop. The only barrier that increased significantly in perceived importance was lack of financial incentive. For physical activity prescriptions to become more common, it may be important that physicians receive training on how to prescribe in a time-efficient manner, or receive reimbursement that compensates them for the additional time spent performing physical activity counselling with their patients.

Strengths and limitations.

To our knowledge, this is the first study to report a change in family physicians' use of written physical activity prescriptions before and after a brief clinician-targeted intervention. Second, it investigates the effectiveness of a real-world intervention that aimed at changing clinical practice, which is less commonly reported in the literature. Third, the smaller scale and short

time period of the study allowed for high levels of implementation in delivering the training. Finally, the intervention was not solely based on education, but provided practical tools that facilitated the targeted change, and significantly reduced this as a perceived barrier to physical activity prescription.

The present study has some limitations, including its single-group, pre-post study design, and relatively small sample size of 25, below the power calculation of 29. Not all indicators of the RE-AIM framework were investigated, as the short-term follow up prevented evaluation of maintenance, and the targeted of individual physicians preventing the evaluation of adoption. Further, the lack of data on non-responders prevented a full examination of the representativeness of participating physicians with the local population. The external validity of the study is a limitation, as we invited physicians from only two cities in Western Canada. Finally, the effectiveness of the educational workshops and written materials may have been enhanced by a more comprehensive intervention, and maintenance encouraged with follow up sessions and reminders.[39]

Due to the reliance on self-reported data for behaviour, there was an inherent risk for response bias. Since all physicians in the two municipalities were invited, there was a risk of self-selection bias, with more motivated physicians choosing to attend. The physicians who attended the workshop demonstrated a lack of baseline knowledge regarding physical activity guidelines, but most were physically active themselves. It may be that the workshop attracted those who were in need of further education, but were personally invested in the area of physical activity.

Future directions.

Dissemination investigations with increased sample size and comparison designs are needed. It is recommended that more objective measurements be used to assess clinician behaviour, such as direct observation or audio recordings of consultations.[40] Ideally, long-term (>2 year) trials should investigate whether clinician-targeted interventions lead to patient behaviour and health outcome change, in addition to physician behaviour change. This would allow for all parameters of the RE-AIM framework to be evaluated, and the public health impact of such interventions to be effectively quantified.

The results of this study indicate that providing family physicians with training and tools may be an important component in effectively implementing physical activity prescription into routine clinical practice, and should be considered in future dissemination trials.

We conclude that physician training workshops combined with practical tools provide a promising method of encouraging physical activity prescriptions in this type of setting.

Contributions: All authors were responsible for study concept and design. AW and JW were primarily responsible for designing the educational workshop. JCD and JW were responsible for the analysis of the study data. All authors contributed to writing and critical revision of the manuscript.

Acknowledgements: We would like to acknowledge the support of the BC Ministry of Health for physical activity promotion work in the Province of British Columbia.

Funding: JW is funded by a graduate award by the Canadian Institutes of Health Research. AW is funded by the Clinician Scholar Program scholarship through the University of British Columbia. JCD is funded by the Michael Smith Foundation for Health Research Postdoctoral Fellowship Award and the Canadian Institute for Health Research Postdoctoral Fellowship Award.

Competing interests: None

Provenance and peer review: Not commissioned, externally peer reviewed.

Data sharing statement: All of the data for the study are housed at the Centre for Hip Health and Mobility, in Vancouver BC. Only team members have access to the raw data for the sole purpose of dissemination of the results. Data analysis is ongoing.

Ethics approval: Approval was sought and subsequently granted from the Behavioural Research Ethics Board at the University of British Columbia (H13-01977) and by the Fraser Health Authority Research Ethics Board (2014-013).

References:

1 Hippocrates. *Regimen I*. Translated by W.H.S Jones. Cambridge: Harvard University Press; 1953. p. 229.

2 Hallal PC, Andersen LB, Bull FC, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. *The Lancet* 2012;380(9838):247–57.

3 Kohl 3rd HW, Craig CL, Lambert EV, et al. The pandemic of physical inactivity: global action for public health. *The Lancet.* 2012;380(9838):294–305.

4 Warburton DE, Charlesworth S, Ivey A, et al. A systematic review of the evidence for Canada's Physical Activity Guidelines for adults. *Int. J. Behav. Nutr. Phys. Act.* 2010;7(1):39.

5 Warburton DE, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. *Can. Med. Assoc. J.* 2006;174(6):801–9.

6 Investments that work for physical activity. *Br. J. Sports Med*. 2012;46(10):709–12.

7 Orrow G, Kinmonth AL, Sanderson S, et al. Effectiveness of physical activity promotion based in primary care: systematic review and meta-analysis of randomised controlled trials. *Br. Med. J*. 2012;344(mar26 1):e1389–e1389.

8 Kallings LV, Leijon M, Hellénius M-L, et al. Physical activity on prescription in primary health care: a follow-up of physical activity level and quality of life. *Scand. J. Med. Sci. Sports*. 2008;18(2):154–61.

9 Petrella RJ, Koval JJ, Cunningham DA, et al. Can primary care doctors prescribe exercise to improve fitness?: The step test exercise prescription (STEP) project. *Am. J. Prev. Med*. 2003;24(4):316–22.

10 Eakin EG, Glasgow RE, Riley KM. Review of primary care-based physical activity intervention studies: effectiveness and implications for practice and future research. *J. Fam. Pract.* 2000;49(2):158–68

11 Petrella RJ, Lattanzio CN. Does counseling help patients get active? Systematic review of the literature. *Can. Fam. Physician* 2002;48:72–80.

12 Swinburn BA, Walter LG, Arroll B, et al. Green prescriptions: attitudes and perceptions of general practitioners towards prescribing exercise. *Br. J. Gen. Pract.* 1997;47(422):567–9.

13 Petrella RJ, Lattanzio CN. Physical activity counseling and prescription among canadian primary care physicians. *Arch. Intern. Med*. 2007;167(16):1774–81.

14 Barnes PM, Schoenborg CA. Trends in adults receiving a recommendation for exercise or other physical activity from a physician or other health professional. Hyattsville, MD:

National Center for Health Statistics [Internet]; 2012 [cited 2014 October 8]; no. 86. 7 p. Available from: http://www.cdc.gov/nchs/data/databriefs/db86.pdf

15 Douglas F, Torrance N, van Teijlingen E, et al. Primary care staff's views and experiences related to routinely advising patients about physical activity. A questionnaire survey. *BMC Pub. Health.* 2006;6:138

16 Hébert ET, Caughy MO, Shuval K. Primary care providers' perceptions of physical activity counselling in a clinical setting: a systematic review. *Br. J. Sports Med*. 2012;46(9):625–31.

17 Kennedy MF, Meeuwisse W. Exercise counselling by family physicians in Canada. *Prev. Med.* 2003;37(3):226–32.

18 McKenna J, Naylor PJ, McDowell N. Barriers to physical activity promotion by general practitioners and practice nurses. *Br. J. Sports Med.* 1998;32(3):242–7.

19 Howe M, Leidel A, Krishnan SM, et al. Patient-related diet and exercise counseling: do providers' own lifestyle habits matter? *Prev. Cardiol.* 2010;13(4):180–5.

20 Jorgensen TK, Nordentoft M, Krogh J. How do general practitioners in Denmark promote physical activity? *Scand. J. Prim. Health Care.* 2012;30(3):141–6.

21 Frank E, Segura C. Health practices of Canadian physicians. *Can. Fam. Physician* 2009;55(8):810–1.e7.

22 Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am. J. Public Health* 1999;89(9):1322–7.

23 Canadian Society for Exercise Physiology. CSEP - Get the Guidelines [Internet] 2014; [cited 2014 Oct 15] Available from: http://www.csep.ca/english/view.asp?x=804

24 Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med. Sci. Sports Exerc*. 2003;35(8):1381–95.

25 Guidelines for data processing and analysis of the international physical activity questionnaire [Internet] 2005; [cited 2014 Oct 13] Available from: http://www.ipaq.ki.se/scoring.pdf

26 Rollnick S, Miller WR, Butler C. *Motivational Interviewing in Health Care: Helping Patients Change Behaviour*. Guilford Press; 2008. 225 p.

27 Bredin SD, Gledhill N, Jamnik VK, et al. PAR-Q+ and ePARmed-X+. *Can. Fam. Physician.* 2013;59(3):273–7.

28 Coleman KJ, Ngor E, Reynolds K, et al. Initial validation of an exercise "vital sign" in electronic medical records. *Med. Sci. Sports Exerc*. 2012;44(11):2071–6.

29 Sallis R. Developing healthcare systems to support exercise: exercise as the fifth vital sign. *Br. J. Sports Med.* 2011;45(6):473–4.

30 Exercise is Medicine Canadian Taskforce. Exercise Prescription & Referral Tool [Internet]. *Exercise is Medicine Canada*. [cited 2014 Oct 15] Available from: http://www.exerciseismedicine.ca/professional-resources/exercise-prescription-referral-tool

31 Gunn J, Southern D, Chondros P, et al. Guidelines for assessing postnatal problems: introducing evidence-based guidelines in Australian general practice. *Fam. Pract.* 2003;20(4):382–9.

32 Pagano M, Gauvreau K. *Principles of Biostatistics*. 2nd ed. Pacific Grove, CA: Duxbury Press; 2000. 592 p.

33 The College of Family Physicians of Canada, Canadian Medical Association, The Royal College of Physicians and Surgeons of Canada. 2014 National Physician Survey. [Internet] 2014. [cited 2015, May 1] Available from: http://nationalphysiciansurvey.ca/wp-content/uploads/2014/11/2014-National-EN.pdf

34 Eakin EG, Glasgow RE, Riley KM. Review of primary care-based physical activity intervention studies: effectiveness and implications for practice and future research. *J. Fam. Pract.* 2000;49(2):158–68

35 Carroll JK, Winters PC, Sanders MR, et al. Clinician-targeted intervention and patient-reported counseling on physical activity.. *Prev. Chronic. Dis*. [Internet] 2014 [cited 2014 Sep 7];11:130302. Available from: http://www.cdc.gov/pcd/issues/2014/13_0302.htm. doi:10.5888/pcd11.130302

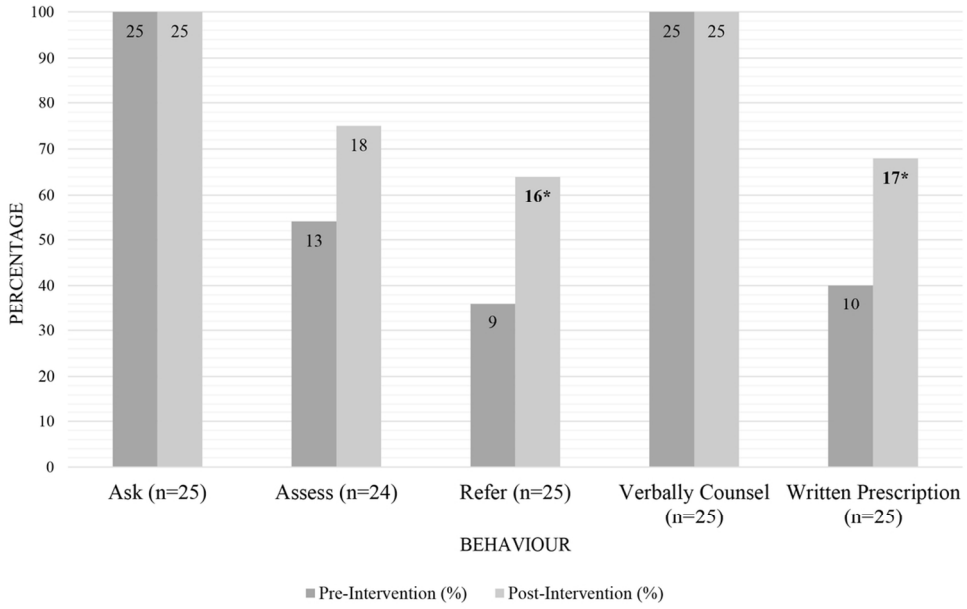
36 Williford HN, Barfield BR, Lazenby RB, et al. A survey of physicians' attitudes and practices related to exercise promotion. *Prev. Med*. 1992;21(5):630–6.

37 Holtz KA, Kokotilo KJ, Fitzgerald BE, et al. Exercise behaviour and attitudes among fourth-year medical students at the University of British Columbia. *Can. Fam. Physician* 2013;59(1):e26–32.

38 Frank E, Segura C, Shen H, Oberg E. Predictors of Canadian physicians' prevention counseling practices. C*an. J. Public Health Rev. Can. Santee Publique* 2010;101(5):390–5.

39 Smith WR. Evidence for the effectiveness of techniques to change physician behaviour. *Chest*. 2000;118(2 Supplement):8S – 17S.

40 Carroll JK, Antognoli E, Flocke SA. Evaluation of physical activity counseling in primary care using direct observation of the 5As. *Ann. Fam. Med*. 2011;9(5):416–22.



108x68mm (300 x 300 DPI)