



Colorectal Cancer Prevention in New Immigrant Women: A Pilot Study of an Educational Program to Fortify Food Literacy and Physical Activity

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Authors' contributions

This work was carried out in collaboration between all authors. Author TYL designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author GH collected the data and managed the educational program. Author BFP designed the study and edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Purposes: (a) to educate new immigrant women (NIW) about Colorectal cancer (CRC) screening services provided by the Canadian health care system, and (b) to advance NIW's knowledge on CRC prevention strategies, focusing on food literacy, eating habits, and physical activity.

Methods: A pretest-posttest design was used to examine the efficacy of an educational program. Four instruments were used to collect data. Fifty participants filled out the questionnaires before and after the program. Statistical analysis of Repeated Measures ANOVA was performed.

Results: The Repeated Measures ANOVA indicated that participants' knowledge significantly improved following the food safety educational program. Repeated Measures ANOVA also showed that the educational program had an effect on participants' perceived behavioral control subscale on feeling about cancer and cancer screening and this effect lasted two months after the program.

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Furthermore, participants' physical activity during their leisure time was gradually increasing from week 1 to 2 months after the educational program.

Conclusion: An educational program on food safety resulted in improved food safety knowledge for Chinese immigrants. Participants also have a better understanding of information related to healthy eating habits and colorectal cancer prevention and screening.

Keywords: Colorectal cancer; screening; education; physical activity; Chinese women.

1. INTRODUCTION

Colorectal cancer (CRC) has been identified by Canadian Cancer Society (CCS) as the third most commonly diagnosed cancer in Canada and the third leading cause of death from cancer in women in Canada [1]. Risk factors include family history, polyps in the colon and rectum, rare genetic conditions, physical inactivity, being overweight or obese, eating a diet high in red meat, eating processed meats, alcohol, diet low in fibre, and cooking meat at high temperatures [1-3]. Early prevention and detection are crucial in order to reduce mortality. Although recommended CRC screening begins at age 50, the incidence of CRC is reduced if diet and physical activity can be appropriately controlled [4-7]. So, it is very important to educate the public regarding the relationships among healthy diet, physical activity, and CRC risk factors at an earlier age.

Data released by Statistics Canada [8] indicate that nearly half (48.6%) of the GTA's population is born abroad. Immigrants face many challenges and barriers to becoming fully self-sufficient, not to mention the cultural differences and language barrier. Chinese is one of the fastest-growing immigrant groups in Canada [9]. In Chinese families, it is mostly women who do the food preparation. While mainstream resources (e.g. printed materials) exist, these typically fail to meet the cultural and linguistic needs of Chinese women. Chinese women, therefore, may not be aware of Canada's guidelines for healthy eating [10]. Many of them may not meet the minimum recommendations for dietary intake or physical activity. In addition, the Chinese tend to cook meat at high temperatures (such as well done, fried, broiled or barbecued) and preserve meat by smoking, curing, salting or adding preservatives such as nitrates or nitrites. Eating such meats increases the risk of developing colorectal cancer, and the more people eat the higher risk they face [1,11]. Furthermore, immigrants report lower cancer screening utilization compared with the general population [12]. Chinese immigrants may not be aware of

CRC screening opportunities provided by the healthcare system. Thus, many Chinese are at increased risk for CRC morbidity and mortality [11]. In addition, a US study reported that Asians have a 10–30 % higher risk of being found with late-stage CRC at time of diagnosis. Reasons for this disparity may include lack of knowledge, language barriers, limited access to healthcare, and cultural beliefs that do not promote screening [13]. Therefore, it is critical to initiate a culturally appropriate and language friendly educational program in order to effectively serve the Chinese immigrants in GTA through the provision of informational and psychosocial support.

The goal of this research was to initiate a culturally appropriate and language friendly educational program related to CRC risk prevention for Chinese immigrant women. The objectives are: (a) to educate new immigrant women (NIW) about CRC screening services provided by the Canadian health care system, and (b) to advance NIW's knowledge on CRC prevention strategies, focusing on food literacy, eating habits, and physical activity.

2. THEORETICAL FRAMEWORK

This research was guided by the Theory of Planned Behavior (TPB) developed by Ajzen [14]. Ajzen proposed the TPB to explain how people change their behaviors based on the notion that behavior can be predicted and planned [14]. TPB has been widely used by other researchers [15-18]. There are three kinds of consideration when predicting human action in an intervention program: behavioral beliefs, normative beliefs, and control beliefs. Behavioral beliefs are beliefs about likely consequences of behavior, normative beliefs are beliefs about normative expectations of others, and control beliefs are beliefs about the presence of factors that may facilitate or impede the performance of behavior. Ajzen [19] concluded that increasing knowledge alone does not help to change people's behavior; however, a program aimed at influencing people's intention to change by giving lots of

attention to attitudes, subjective norms and perceived behavior control may induce better results. Therefore, the focus of this research was to try to assess and change women's knowledge, beliefs and attitudes associated with CRC and CRC screening.

3. METHODS

A pretest-posttest design was used to examine the efficacy of an educational program for improving participants' knowledge on healthy diet and CRC risk prevention over time. The program was offered 2 hours per week for six weeks. Fifty participants attended. Lessons covered in the program were as follows: Week 1: Introduction to Ontario Healthcare System, Canada's Food Guide and food safety strategies; Week 2: unhealthy eating behaviors and CRC risk; Week 3: Exercise demonstrations; Week 4: CRC prevention and screening; Week 5: cooking demonstrations; and Week 6: Focus group discussion and course evaluation. In addition, participants did a 15-minute stretch exercise in the beginning of each lesson.

3.1 Participants

The program was held at South Riverdale Community Health Centre (SRCHC), which is a community-based organization located in Toronto east. An outreach social worker was in charge of advertising the program and recruiting participants. The target population in this program was recent Chinese immigrants. Inclusion criteria were Chinese women, who immigrated to Canada within the last five years, resided within the GTA, spoke Chinese Cantonese/Mandarin, and were more than 40 years old.

3.2 Measures

Four instruments were used to collect data: a demographic data questionnaire, a Food Safety Questionnaire [FSQ, 20-22], Feeling about Cancer and Cancer Screening (FCCS) [23], and the International Physical Activity Questionnaire (IPAQ) short form [24].

The 20-item FSQ was developed by Medeiros and colleagues [20] to measure participants' knowledge of food shopping, preparation, cooking, storage, and preservation. Five subscales were in the FSQ: Practice personal hygiene (2 questions), Cook foods adequately (3 questions), Prevent cross-contamination (3 questions), Keep foods at safe temperatures (6

questions), and Avoid foods from unsafe sources (6 questions) [22]. Each question is scored as correct (1) or incorrect (0), with "not sure" responses scored as incorrect. The possible total scores range from 0 to 20, with 20 being a perfect score. The validity of the FSQ has been well-established [22, 25]. The internal reliability of this scale was $>.75$ and test-retest reliability without intervention was $.81$ [22]. The internal reliabilities of the FSQ and subscales in this study were high (Cronbach's alpha > 0.80).

There were 42 questions on the Feeling about Cancer and Cancer Screening instrument [23]. Those questions were further grouped into five subscales to assess behavioral beliefs (11 questions), attitudes toward a behavior (14 questions), control beliefs (7 questions), perceived behavioral controls (6 questions) and behavioral intentions (4 questions). The five subscales accounted 60% of the total variance in beliefs and attitudes. A 5-point Likert scale was used, with 5 representing strongly agree and 1, strongly disagree. The questionnaire was tested with three Asian subgroups and the original internal consistencies ranged from $.17$ to $.90$. The authors explained that some low values were due to the insensitivity of using three subgroups [23]. However, the Cronbach's alpha coefficients of the scale and subscales in this study were between $.65$ and $.77$.

The 14-item International Physical Activity Questionnaire short form (IPAQ-SF) [24] was used to assess participants' physical activity on four specific domains of activities: job-related activity, transportation activity, housework, house maintenance, and caring for family activity, and recreation, sport, and leisure time activity. Participants need to answer how much time they spent in the past 7 days doing each activity and the average time spent doing that activity during such period. The IPAQ-SF has been tested by many researchers [26,27] and was reported as having reasonable measurement properties for monitoring population levels of physical activity among adults. The data collected from the IPAQ-SF were summed within each physical activity domain to estimate the total time spent in work, transport, household, and leisure-related physical activity [24]. The Metabolic equivalent (MET)-minutes/week was used.

3.3 Data Collection

The study was approved by the Ethics Review Board of York University. Participants who

agreed to participate in the study were asked to sign a consent form and fill out demographic data in week 1. The rest of the three instruments were administered in week 1, week 6 and two-month follow-up after the educational program. The first author, fluent in English and Mandarin, was available to provide assistance and answer participants' questions. All aspects of the study were described in full and all participants were informed of their right to withdraw from the study at any time without risk. To protect privacy of the participants, all personal information such as the participants' name, address, and phone number were removed from the questionnaires. The questionnaires were accessible to only the research team.

3.4 Analysis

Descriptive statistics (mean, SD, and frequency) were used to describe the characteristics of the participants. Repeated Measures ANOVA (RM-ANOVA) or Chi-square tests were used to analyze the change in study variables (knowledge, feeling and physical activity) over time (week 1, week 6 and two months later). All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 24.0. The level of significance was set at $\alpha = 0.05$.

4. RESULTS

4.1 Participants' Demographic Characteristics

The mean age of the 50 participants was 54.58 ± 8.97 . The majority of them were permanent residents (58.8%) and married (66.7%). As regard to their education level, nine participants (18.0%) hold a master degree, seven (14.0%) had a bachelor degree, eighteen had a high school diploma (36.0%), and 32.0% did not finish high school. Their family income was mostly below \$35,000 (84.3%). Most of them (80.4%) were unemployed. Only few (7.8%) participants had family members with CRC, while 30% of participants had family members with cancer and 27.5% had family members who died from it. Most (55%) of the participants were worried that they might have cancer. However, 70% of them rated the chance for them having cancer as less than 4%. The majority (67.5%) of the participants had never done CRC screening and 60% of them indicated that their doctor had never recommended it to them. A positive relationship

existed between CRC screening and doctor's recommendation ($r = .63$, $p < .001$).

4.2 Food Safety Knowledge

Participants' overall correct answer rate on the 20-item food safety knowledge questionnaire was 49.30% before the educational program (week 1), 72.85% after the program (week 6), and 74.30% two months after the program. Repeated Measure ANOVA (RM-ANOVA) indicated that a significant difference existed among the three knowledge total scores ($F = 28.34$, $p < .001$). Post-hoc tests (Tukey's HSD tests) indicated that significant differences existed between scores in week 1 and week 6 ($t = 4.71$, $p < .001$) as well as between scores in week 1 and two months after ($t = 5.00$, $p < .001$). No significant difference existed between week 6 and two months after ($t = .29$, $p = .93$). These results showed that the educational program had an effect on improving participants' food safety knowledge and this effect lasted two months after the program.

4.3 Feeling about Cancer and Cancer Screening (FCCS)

There are 42 questions in the FCCS questionnaire which include five subscales. The mean scores of the scale and five subscales are listed in Table 1. In order to compare the differences among subscales, the average score on each subscale was divided by the number of questions; for example, there are 11 questions on the Behavioral Beliefs subscale, and the average score on the Behavioral Beliefs subscale in week 1 was 39.82 which was then divided by 11, so the mean score was 3.62 (Table 1). RM-ANOVA revealed that no significant difference existed among the total scores and four subscale scores at three different time periods. The only exception was the subscale, Perceived Behavioral Controls. RM-ANOVA indicated that a significant difference existed among the subscale scores over time ($F = 4.05$, $p < .05$); post-hoc tests indicated that significant differences existed between the subscale scores in week 1 and week 6 ($p < .05$) as well as between scores in week 1 and two months after ($p < .05$). No significant difference existed between week 6 and two months after ($p = .68$). These results showed that the educational program had an effect on participants' perceived behavioral control and this effect lasted two months after the program.

Table 1. Mean scores on the feeling about cancer and cancer screening subscales and total scale over time (n=50)

	Week 1	Week 6	2-month later
Behavioral beliefs	3.62	3.59	3.55
Attitudes toward behavior	3.28	3.24	3.17
Control beliefs	3.51	3.42	3.51
Perceived behavioral controls	3.42	3.71	3.72
Behavioral intentions	3.82	3.70	3.74
Total scale	3.53	3.53	3.54

4.4 Physical Activity

Since the unemployment rate was high (80.4%) in the study participants, physical activity (PA) during working was not included in the analysis. Only one of the physical activities (PA) on the IPAQ had significant differences over time; that is, participants' PA during their leisure time within the most recent seven days. Based on the MET energy expenditure estimate assigned to each category of activity, the MET estimated under leisure domain has three types of activities: vigorous (8 METs), moderate (4 METs) and walking (3.3 METs) [24]. The calculation for the MET-minutes/week was as follows: METs x minutes/day x days. Participants reported a mean (SD) of 718.6 (670.5) of walking activity, 287.1 (252.6) min/wk of moderate-intensity physical activity, and 384.3 (354.9) min/wk of vigorous-intensity activity during their leisure time at baseline. Table 2 presents the median (interquartile range, IQR) and mode for the three activities at the different time period. RM-ANOVA indicated that mean walking and moderate activities differed statistically significantly between time points ($F=8.07$, $p<.01$; & $F=13.47$, $p<.001$). However, no significant difference existed for Vigorous activity ($F=1.03$, $p>.05$); For

walking activity, post-hoc tests indicated that significant differences existed in MET scores between week 1 and two months later ($p<.01$), and between week 6 and two months after ($p<.05$). No significant difference existed between week 1 and week 6. In regard to Moderate activity, pairwise comparisons indicated that significant differences existed with MET gradually increasing from week 1, week 6 and 2 months after the educational program (Table 3).

In order to understand the relationships among food safety knowledge, Feeling about Cancer and Cancer Screening and physical activity, Pearson's correlation coefficients were performed. The results indicated that there was a significant relationship between knowledge and the Perceived Behavioral Controls subscale ($r=.38$, $p<.05$). Perceived Behavioral Controls also had a positive relationship with participants' physical activity ($r=.39$, $p<.05$). With regard to the relationships within the subscales on the Feeling about Cancer and Cancer Screening, Perceived Behavioral Controls was positively related to Attitudes toward Behavior, Behavioral Beliefs, Behavioral Intentions and Control Beliefs ($r=.39\sim.61$, $p<.05$).

Table 2. Median and mode scores on the IPAQ Leisure Domain within the most recent seven days (n=50)

	1-W	2- W	3-W	1-M	2-M	3-M	1-V	2-V	3-V
n	50	50	50	50	50	50	50	50	50
Median	528	891	1188	0	300	510	0	0	303
Mode	396	495	1188	0	240	240	0	0	200

*1: week 1, 2: week 6, 3: 2 months, W-walking, M-Moderate activity, V-Vigorous activity

Table 3. Mean scores on the IPAQ Leisure Domain within the most recent seven days (n=50)

	Week 1	Week 6	2-month after
Walking	718.6	1030.3	1385.4
Moderate activity	287.1	606.4	928.6
Vigorous activity	384.3	575.2	603.2

5. DISCUSSION

The results of this study demonstrated that an educational program can increase an individual's knowledge on food safety, attitude on cancer screening, and physical activity and that this is sustained over a 2-month period. It is not surprising that participants' knowledge on food safety increased over time. Other studies also had similar findings [21-22,25]. Using the same questionnaire, Lee and colleagues [25] found that an educational program on food safety resulted in improved food safety knowledge for Chinese senior immigrants. The correct answer rate for seniors on pre-test was 57.8 % and 76.2% on post-test. Although women in this study had lower knowledge scores (49.3%) than the seniors before the education, they had similar scores two months after education (74.30%). Most of the studies used pre and post design; however, our study not only tested the knowledge scores before and after the educational program but also tested the residual effect two months after the education program. It turns out that the educational program had an effect on improving participants' food safety knowledge and this effect lasted two months after the program.

Using a social cognitive theory to understand the utilization of colorectal cancer screening, an American study found that Chinese immigrants in the US report lower cancer screening utilization compared with the general population [12]. Similar to this finding, 67.5% of the participants in our study had never done CRC screening tests. A positive association was found between doing the CRC screening test and physician's recommendation, which demonstrates the proposition of the theory of planned behavior that people's behavior is guided by what their physicians and significant others expect them to do [15-16]. Our study found that participants had only a few family members who had CRC and the majority of the participants predicted that their chance to be diagnosed with cancer was rare. This might explain why their intention to comply with CRC screening tests was low.

Participants demonstrated that their walking and moderate physical activities at two months were higher than those at six weeks after the education program. This indicated a sustained increase in these two variables over the follow-up period. However, participants' walking activity from week 1 to week 6 has no change. One of the possible explanations might be that

participants' behavioral intervention was effective in eliciting a behavioral change toward a more active lifestyle after the intervention and participants spent more time in moderate activity instead of walking at week 6. This result again showed that the educational program is an effective method with which to bring about health behavior change-increasing participants' PA.

The positive relationship between perceived behavioral controls and behavioral intention in this study follows the theory of planned behavior which says, "the greater the perceived control is, the stronger the person's intention to perform the behavior" [19]. Perceived behavior controls suggest potential influence from doctors, family, and close friends; while intentions suggest motivation to comply with CRC screening tests. The positive association was also consistent with findings of several other studies using Ajzen's model [14-19]. According to the TPB [14], behavioral beliefs can change a person's attitudes toward a behavior and control beliefs can produce perceived behavioral controls. These beliefs and attitudes work together to form a behavioral intention.

6. CONCLUSION

Contrary to expectations, in our study perceived behavioral controls had positive associations with knowledge and physical activity but behavioral intention had no relationship with these two variables. This may indicate that perceived behavioral controls could be a relevant factor in predicting participants' knowledge toward food safety and their physical exercise during leisure time. A study used TPB to test women's intention to do exercise during pregnancy and found that most pregnant women had positive perceived behavioral control with regard to regular exercise during pregnancy [18]. The authors concluded that perceived behavioral control is the strongest determinant for women to do physical exercise regularly. In addition, most of the scores on the FCCS did not change over time in our study. The only exception was the scores on the Perceived Behavioral Control subscale which significantly increased over time. Perhaps, perceived behavior controls can be better used to predict participants' performance in knowledge and physical activity, not behavioral intention for those with low risk of CRC. However, several studies [15-16,19] revealed that the best predictor of human behavior is the intention. The use of TPB in predicting CRC knowledge and physical activity needs further investigation.

Because of the small sample size of this study, the study may have been underpowered, and a larger study is recommended to replicate the findings. Nevertheless, the pilot study demonstrated that the benefits accrued over the course of the education program were sustained for 2 months. A longer-term study is suggested for interested researchers.

CONSENT

Participants who agreed to participate in the study were asked to sign a consent form at the first workshop.

ETHICAL APPROVAL

Institutional ethics approval was received from York University, Toronto, ON, Canada.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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