

## Eat Safely, Eat Well: An Evaluation of Food Safety Educational Resources for Pregnant Women in British Columbia, Canada

### ABSTRACT

Certain foodborne pathogens cause infection more commonly in pregnant women than in the general population and can cause unusually severe maternal illness or adverse fetal outcomes. Previous work in British Columbia (BC) identified a need to develop food safety messaging for pregnant women, and targeted educational resources were developed and distributed. The purpose of this study was to evaluate the impact of the food safety educational resources for pregnant women in BC. The distribution and use of the resources were tracked through Web site analysis and key informant interviews. The impact on knowledge and behaviors was determined through self-administered, pre- and post-intervention surveys among pregnant women in health-care settings. A coordinated distribution of resources using multiple formats and to multiple audiences led to an over 300% increase in access to Web site resources. Knowledge of high risk foods and food safety practices among pregnant women improved significantly ( $P < 0.001$ ) following the availability of the resources. However, our evaluation was not able to

demonstrate a change in behavior that led to a decrease in the consumption of high risk foods. Key informants in BC now refer to the resources as their main source of food safety information in pregnancy. Future plans to distribute educational resources related to food safety should consider a coordinated and time-focussed distribution and the use of various formats and mechanisms of distribution targeted to their intended audience.

### INTRODUCTION

Certain foodborne pathogens cause infection more commonly in pregnant women than in the general population and can cause unusually severe maternal illness or adverse fetal outcomes. The risk of infection with intracellular pathogens, specifically *Listeria monocytogenes* and *Toxoplasma gondii*, increases because of the decline in cell-mediated immunity in pregnancy (15). Pregnant women are 18 times more likely than the general population to be infected with *Listeria* (10). Other foodborne infections (e.g., *Salmonella*, *E. coli*, *Campylobacter*, etc.) do not occur more commonly in pregnancy but have been associated with more severe illness

and spontaneous abortion or neonatal sepsis (10, 13, 15). In Canada, listeriosis outbreaks associated with soft pasteurized cheeses, other dairy products, imitation crab meat and deli meat have occurred, and some have been associated with maternal and/or fetal illnesses (6, 8).

In British Columbia (BC), 150 cases of invasive listeriosis were reported between 2003 and 2012 (3). Of those, 13 (8.7%) were pregnancy-related. Ninety percent reported consuming high risk foods and over 60% of these women had adverse outcomes.

Because of the potential serious outcomes of foodborne illnesses and the lack of appropriate food safety resources for pregnant women in BC, a study was conducted to examine the awareness, practices and needs of pregnant women regarding food safety (16). The study identified a need to develop food safety messaging to improve the knowledge of high risk foods and safe food practices among pregnant women. As a result, targeted educational resources were developed and packaged into Eat Safely, Eat Well printed and electronic resources. The printed resources included a booklet and two posters that describe general food safety practices and safer food alternatives to reduce listeriosis. The electronic resources included the BC Centre for Disease Control (BCCDC) Pregnancy and Food Safety Web site ([www.bccdc.ca/foodsafetyinpregnancy](http://www.bccdc.ca/foodsafetyinpregnancy)), which was made available starting in June 2012. All of the printed resources were also made accessible through the Web site.

During the month of February 2013, BCCDC coordinated the release of information about the resources by publishing a follow-up article, conducting an official media release (including releasing through twitter) and communicating with health professionals at various levels of the health-care system (17).

The purpose of this study was to evaluate the newly developed and targeted Eat Safely, Eat Well resources by determining the distribution and use of the resources, and their impact on food safety knowledge and behaviors of pregnant women in BC.

## MATERIAL AND METHODS

Unique visits to and downloads of resources from the BCCDC Pregnancy and Food Safety Web site from June 1, 2012 to June 30, 2013 were measured. The impact of the coordinated release in February 2013 was assessed by comparing the monthly average of unique visits and downloads in the four months before (October 2012–January 2013) and the four months after the release (March–June 2013).

Health professionals who received Eat Safely, Eat Well resources were interviewed in May and June 2013, using a standardized, open-ended questionnaire through phone or self-administration to get feedback on the use of the resources.

A self-administered paper-based quantitative survey was conducted with pregnant women in BC between March

and June, 2013. The questionnaire included questions on: (1) access to food safety information during pregnancy; (2) food safety knowledge and behaviors; and (3) demographic factors. The survey was pre-tested prior to use in this study.

Pregnant women age 19 years and above with proficient English skills were recruited from five clinical care and two prenatal class settings through convenience sampling in three health authorities in BC. The same survey was used pre and post-intervention. The printed resources (booklets and both posters) were used as the intervention.

In prenatal class settings, the resources were available immediately after the pre-intervention surveys were completed. The post-intervention surveys were conducted 3–4 weeks after the intervention. In clinical care settings, pre-intervention surveys were distributed for the first 3 weeks, the printed resources were introduced, and post-intervention surveys were made available for 3 weeks after the intervention was started. In both settings, the resources were displayed and made available similarly in common areas (e.g., waiting room, examination room, classroom, etc.) throughout both the intervention and post-intervention periods. Participants were not linked between the pre- and the post-intervention surveys.

The survey data was analyzed using EpiData Analysis (version 2.2; EpiData Association; Odense, Denmark; 2013), and missing data were excluded from the analysis. The Chi-square test, with a significance level of  $< 0.05$ , was used to compare changes in proportions. The thresholds for knowing high risk foods or having safe food practices were defined as identification of  $\geq 6$  (out of 8) high-risk foods or following  $\geq 5$  (out of 8) safe food practices, respectively.

Approval was obtained through the Research Ethics Board at the University of British Columbia.

## RESULTS AND DISCUSSION

Between July 2012 and June 30, 2013, 1,816 booklets and 321 each of the Eat Safely Eat Well food safety and *Listeria*-specific posters were distributed to health professionals and pregnant women throughout BC.

Between October 1, 2012 and January 31, 2013, there were, on average, 47.5 unique visits per month to the Web site and 38.3 downloads per month for the booklets, 4.8 downloads per month for the food safety practice poster and 8.5 download per month for the *Listeria*-specific poster (Fig. 1). Following the coordinated release, between March 1 and June 30, 2013, the monthly average of unique visits was 192.5 (405.3% increase), number of downloads of booklets was 119.8 (313.1% increase), number of downloads of the food safety practice poster was 18.0 (378.9% increase), and number of downloads of the *Listeria*-specific poster was 29.0 (341.2% increase). The increase in unique access and downloads was sustained over a period of four months (Fig. 1).

Ten health professionals representing various professions and geographical regions in BC were interviewed. All had

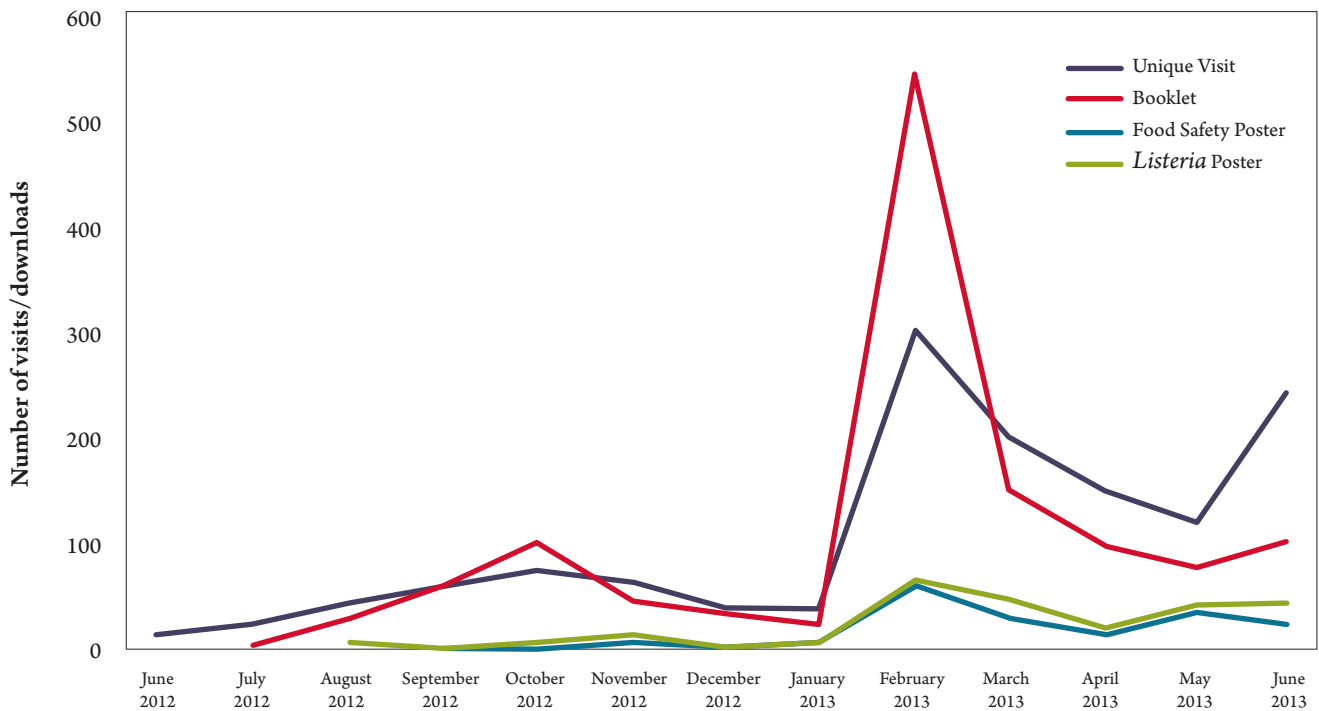


Figure 1. Monthly visits to the BCCDC Food Safety and Pregnancy Web site and downloads of resources, June 2012–June 2013

distributed resources to their clients. The interviewees provided positive feedback on the resources, and they all now refer to Eat Safely, Eat Well as their main source of food safety information for their pregnant clients. They reported an increase in food safety knowledge among themselves and their clients and would recommend the resources to colleagues. Health care providers preferred the printed, as opposed to electronic, resources especially for distribution in rural regions.

A total of 268 women participated in the survey. Overall, participants in the pre-intervention (n = 167) and the post-intervention (n = 101) groups were similar, with no significant difference in demographic factors or in the proportion of pregnant women receiving food safety information during pregnancy (Table 1). Of the participants, 14 were recruited from prenatal settings and 254 from clinical care settings.

After the printed resources were made available in their clinic or prenatal class, a significantly higher proportion of respondents correctly identified  $\geq 6$  high risk foods ( $P$ -value  $< 0.001$ ) and reported practicing  $\geq 5$  safe food practices ( $P$ -value = 0.001) (Table 2). There was no decrease in the consumption of high risk foods following the intervention, and consumption of *Listeria*-specific high-risk foods remained relatively high (Table 2).

Participants were asked to identify food safety resources that they used during pregnancy. The only resource that was

used significantly more often following the intervention was printed health brochures and posters (35.9% in pre-intervention and 52.6% in post-intervention;  $P$ -value = 0.003). Use of printed health resources resulted in a significant increase in the proportion of participants identifying a higher number of high risk foods post-intervention (86.7% of those who used vs. 68.1% in those who did not,  $P$ -value = 0.008). No significant improvement in behaviors or consumption of high risk foods was found among those using the printed health resources.

Our study employed a multi-method approach to evaluate the Eat Safely, Eat Well resources by assessing their distribution, use and impact on food safety knowledge and behaviors of pregnant women in BC.

Both the printed and the electronic resources were widely distributed and accessed by health professionals, organizations and pregnant women in BC. Although the resources were available earlier, a coordinated, time-focussed approach in February 2013 led to a large distribution of printed resources and the messages incorporated into a variety of formats. This coordinated release of information significantly increased visits to the BCCDC Web site and downloads of electronic resources by between 300–400%, which was sustained over a period of at least four months. Our messages were repeated over a short time period, using multiple formats during the coordinated release. In addition, we targeted the distribution to the most likely users of the

**TABLE 1. Characteristics of survey participants**

Characteristics	Pre-Intervention (n = 162)*, n (%)	Post-Intervention (n = 101)*, n (%)	P-value
≥ 30 years of age	101 (63.5)	57 (58.2)	0.391
3rd Trimester	86 (54.8)	54 (55.1)	0.960
<b>Ethnicity</b>			
White	102 (64.6)	56 (57.1)	P-value statistic is for comparison for all 3 groups
Asian (including S. Asian)	39 (24.7)	24 (24.5)	
Others (including First Nations)	17 (10.8)	18 (18.4)	
Post-high school education	114 (72.2)	76 (77.6)	0.337
Annual household income (≥ \$50,000)	86 (53.1)	57 (67.1)	0.268
Previous pregnancy	77 (49.0)	39 (40.2)	0.170
Planned pregnancy	111 (72.5)	70 (74.5)	0.741
Received food safety information during pregnancy	131 (83.4)	82 (85.4)	0.676

\*Not all participants answered all questions.

resources. These features may have increased the success of our distribution. Repeated, multi-pronged and targeted messages have been associated with success of education campaigns for food safety (7, 9, 14).

The Internet was an important method of accessing our materials. Other studies that have identified web-based resources for food safety are popular among women and young adults (11). However, as shown by the responses of our key informants, printed resources are often used and preferred by certain populations that may not have access to the Internet. Therefore, using both traditional and web-based resources and mechanisms of distribution is important.

Our evaluation demonstrated that the resource formats and the content were liked and used by health professionals in BC. Eat Safely, Eat Well resources were developed using evidence-based research to take the needs of pregnant women in BC into account and may have led to the high use and acceptance of our resources. Understanding the needs, perceptions and barriers of the target population can help develop effective messages and formats in order to improve success and acceptance (9, 12, 14).

Knowledge of high risk foods and food safety practices among pregnant women were significantly improved

following the availability of the printed booklets and posters in health settings. Practices that were not significantly improved were either already practiced at a high frequency (e.g., washing hands with soap) or have previously been shown to be harder to change (e.g., measuring temperature of cooked meat) (11). Knowledge of *Listeria*-specific high risk foods (e.g., soft cheese, pate, cold deli meat) and some *Listeria*-specific food safety practices (e.g., heating foods to steaming hot) showed the largest improvements post-intervention, suggesting that the targeted messages and focus on *Listeria* were effective.

Our resources did not have an impact on the consumption of high risk foods. Overall, the proportion of women who reported frequently consuming high-risk foods was low, which may have limited our ability to detect a behavior change in our study population. However, changes in knowledge, which we did demonstrate, are often required prior to change in behavior and practices (1, 11). Other studies have indicated that some women are unwilling to change their consumption habits during pregnancy because of preferences, convenience, or lack of awareness (2). Cold deli meats were the high-risk food most frequently consumed, followed by soft cheese, in both the pre and post-

**TABLE 2. Food safety knowledge and behaviors prior to and following availability of *Eat Safely, Eat Well* resources**

Responses of the Participants	Pre-Intervention (n = 162)*, n (%)	Post-Intervention (n = 101)*, n (%)	P-value
Know what <i>Listeria</i> is	89 (55.6)	73 (72.3)	0.007
<b>Believe foodborne illness is a risk to ...</b>			
You	36 (22.6)	22 (22.0)	0.904
Your baby	32 (20.0)	25 (25.0)	0.343
<b>Identify the following as high-risk food</b>			
Raw sprout (e.g., alfafa)	76 (50.0)	69 (71.9)	< 0.001
Soft cheese (e.g., brie)	105 (69.1)	81 (84.4)	0.007
Pate (meat spread)	86 (56.6)	73 (76.0)	0.002
Refrigerated smoked fish	68 (44.7)	65 (67.7)	< 0.001
Raw or lightly cooked eggs	124 (81.6)	83 (86.5)	0.314
Raw seafood (e.g., sushi)	127 (83.6)	90 (93.8)	0.018
Cold deli meat (e.g., ham)	109 (71.7)	84 (87.5)	0.004
Unpasteurized dairy products	123 (80.9)	82 (85.4)	0.362
Identified ≥ 6 high risk food (total out of 8)	85 (55.9)	74 (77.1)	< 0.001
<b>Always follow safe food practices<sup>§</sup></b>			
Heating leftover to steaming hot	57 (37.7)	58 (61.7)	0.003
Heating deli meat to steaming hot	24 (18.5)	31 (43.7)	0.001
Thawing frozen food safely	44 (29.5)	29 (34.9)	0.395
Cooking shellfish thoroughly	32 (34.4)	28 (57.1)	0.009
Measuring temperature of cooked meat	19 (13.6)	19 (22.1)	.096
Cooking eggs until yolk is solid	87 (57.6)	59 (67.8)	0.120
Washing hands with soap for ≥ 20 sec	122 (77.7)	80 (81.6)	0.452
Heating soft cheese to steaming hot	17 (15.7)	19 (31.7)	0.016
Follow ≥ 5 safe food practices (total out of 8)	16 (9.9)	25 (24.8)	0.001
<b>Frequently<sup>†</sup> consume the following high-risk food</b>			
Cold hot dog	0 (0.0)	0 (0.0)	N/A
Raw seafood	1 (0.6)	3 (3.1)	0.156
Pate	4 (2.5)	2 (2.0)	1.000
Refrigerated smoked fish	4 (2.5)	2 (2.0)	1.000
Unpasteurized milk	1 (0.6)	0 (0.0)	1.000
Raw or lightly cooked eggs	8 (5.1)	10 (10.2)	0.118
Soft cheeses	16 (10.1)	9 (9.3)	0.825
Raw sprout	4 (2.5)	2 (2.0)	1.000
Cold deli meat	33 (20.9)	17 (17.3)	0.488

\*Not all participants answered all questions.

<sup>§</sup>Practice options included: Never, Sometimes and Always.

<sup>†</sup>Frequently is defined as consumption at least once every two weeks.



intervention stages. Changing these consumption practices is important, listeriosis outbreaks have been associated with these products (6, 8). Improved messaging (2), using additional mechanisms to change behaviors (e.g., in-person training, more active engagement), a longer period of time for the intervention, or changing the time when resources are provided may be required to bring about this change. Earlier work indicated pregnant women wanted information on food safety early in pregnancy (16). Targeting all women of child-bearing age to inform and influence knowledge, practices and behaviors prior to pregnancy and the use of alternative methods of distribution to pregnant women (e.g., maternity stores, Web sites and blogs, pharmacies) in addition to traditional forms of communication may also be effective.

We chose to use a pre- and post-intervention design instead of a control design to minimize selection bias and to maximize comparability and internal validity. Although we were not able to control external factors that may have influenced food safety knowledge and behaviors, we were not aware of any external factors or new food safety materials that may have influenced our study participants. Two different settings (prenatal classes and clinical care settings) were used to distribute materials and conduct evaluation. It is possible that the setting or individual clinician/instructor may have impacted our findings. However, we believe that the small number of participants from the prenatal setting would have had minimal impact on our results and impact both pre and post intervention equally. While analysis of the Web site indicated an increase in access to the materials, we were unable to comment on the geographic locations or

obtain information about the people accessing the Web site to further support broad distribution and access by targeted population. Our study participants covered a wide spectrum of demographic factors and were similar in age and ethnicities distributions but were of slightly higher socioeconomic status than the BC population (4, 5). The characteristics and food safety knowledge and behaviors of the participants in our pre-intervention surveys were also similar to those from a previously published BC survey (16). This suggests that our findings may be generalizable to a broad segment of the BC population. Practice and behavior changes were self-reported, which may lead to over-reporting compared to what is done in practice (12); however, this would have impacted the pre and post-intervention surveys equally. At this time we are not able to comment on the long-term impacts of our resources on disease rates but plan to monitor this through public health surveillance data.

Future design and delivery of food safety resources should take into account the successful components of the coordinated release, the feedback provided by health professionals using traditional and electronic resources, and use of an evaluation in order to effectively improve food safety knowledge and behaviors. This work done in BC will, it is hoped, lead to decreased illness and fewer serious outcomes among the population.

#### ACKNOWLEDGMENTS

We thank the staff from the evaluation sites, the health professionals who participated in the interviews, and Ian Roe for assisting with the Web site analysis.

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