Effectiveness of Mandatory Food Handler Training
A Rapid Review

Gagan Babra, Research and Policy Analyst
Louise Aubin, Manager

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Key Messages

1. Peel Public Health currently operates a voluntary food handler training program targeted to individuals who work in food service establishments in Peel Region.

2. In 2015, while revising the Food Premises Regulation (Ontario Regulation 562) under the *Ontario Health Protection and Promotion Act*, the Ministry of Health and Long-Term Care proposed making food handler training mandatory across Ontario.

3. A review of the research revealed limited and inconclusive evidence regarding the effectiveness of mandatory food handler training. The appraised studies concluded that mandatory food handler training alone was not responsible for changes in rates of food handler violations or incidences of foodborne illness cases and outbreaks. Additional factors that were not captured in the analyses may have confounded the outcomes observed.

4. Further high-quality research on the effectiveness of mandatory food handler training is needed.

5. Considering the lack of high-quality, peer reviewed evidence, and the cost of implementing mandatory food handler training, it is recommended that mandatory food handler training not be implemented at this time.

6. Other recommendations include;
   - Develop a knowledge translation plan to disseminate research findings to relevant stakeholders
   - Continue to monitor the research, and
Consider participating in further research as appropriate.

Executive Summary

Overview and Purpose

Peel Public Health offers food handler training to individuals who work or would like to work in a food premises. The goal of the service is to increase awareness of foodborne illnesses and safe food handling practices. While Peel does not require food handlers to attend training, provincially, there is discussion about making training mandatory for food handlers in Ontario. This rapid review describes the evidence on the effectiveness of mandatory food handler training and provides recommendations.

In 2011, Peel Public Health conducted a rapid review of the literature on the effectiveness of mandatory food handler training and found that there was insufficient research evidence on whether training improves safe food handling practices in commercial premises. (1). As a result, Peel did not proceed with mandatory food handler training. In 2015, when the discussion of mandatory food handler training re-emerged, Peel Public Health decided it was timely to review the research evidence published since the first rapid review.

Research question
The research question addressed in this review was: “Is the provision of mandatory food safety training effective at improving food safety practices of food handlers working in commercial food establishments?”

**Results**

Two moderate quality articles revealed that mandatory food handler training alone was not responsible for changes in behaviour or rates of illness. Averett et al. (2) found a statistically significant decrease in the rates of both critical and total food handler-related violations after the implementation of mandatory food handler training. However, they found an even greater decrease in the rates of the control violations¹. Hammond et al. (3) found that while the overall number of foodborne disease outbreaks and cases in restaurants decreased after the implementation of mandatory food handler training, there were more outbreaks and cases associated with one or more of the 17 identified factors related to food employee behaviours and food preparation practices. In each study, authors acknowledged that additional factors not captured in their analysis may have contributed to the outcomes observed.

**Recommendations**

As a result of the findings of this review, we recommend that Peel Public Health:

- Not implement mandatory food handler training at this time,

¹ Control violations are those unrelated to food handler behaviours, not covered in the food handler training program and generally considered outside of the control of a food service establishment employee (e.g., placement of hand washing sink or adequacy of plumbing).
● Develop a knowledge translation plan to disseminate research findings to relevant stakeholders, including the Ministry of Health and Long-Term Care and Public Health Ontario,

● Continue to monitor the research, and

● Consider participating in further research as appropriate.

1. Issue

Food handler training is intended to improve food safety practices and thereby reduce the incidence of foodborne illness associated with commercial food premises. While Peel Public Health currently offers a voluntary food handler training program, discussions are underway at the provincial level about making training mandatory across Ontario.

2. Context

Foodborne illness, also known as food poisoning, is caused by pathogens in food such as bacteria, parasites, and viruses. While most people with a foodborne illness recover, there can be long-term complications and even death. Seniors, young children, pregnant women and people who are immune-compromised are the most likely to become very sick.

Peel Public Health currently offers a voluntary food handler training program for individuals interested in working in a food premises, currently working in a food premise and those who own or manage a food premises. Food handler training is outlined in the
Ontario Public Health Standards as one component in a comprehensive approach to preventing and reducing of food-borne illness.

In 2011, a rapid review entitled *Does food handler training improve food safety: A Critical Appraisal of the Literature* (1) was conducted to inform whether Peel Public Health should implement a mandatory food handler training program. The research question was; “Is the provision of food safety training effective at improving food safety practices of food handlers working in commercial food establishments?”

The authors found insufficient research evidence and recommended that Peel Public Health not adopt a mandatory food handler training program in Peel Region at the time. Additionally, they recommended continued monitoring of food safety training activities of surrounding public health units and the Ministry of Health and Long-Term Care (MOHLTC), and revisiting the literature at a later date.

Under the Ontario Public Health Standards (4), public health units are responsible for ensuring food handlers have access to food safety training. A number of public health units in Ontario currently require mandatory food handler training, including Toronto, York Region, Hamilton, and Middlesex-London.

In 2015, the MOHLTC invited Peel Public Health to provide input into the revisions of the Food Premises Regulation (Ontario Regulation 562) under the *Ontario Health Protection and Promotion Act*. Consequently, it was timely for Peel Public Health to review the research on the effectiveness of mandatory food handler training once again.
This rapid review examines the research on the effectiveness of mandatory food handler training and is an update to the Peel Public Health’s 2011 rapid review.

Challenges to evaluating the effectiveness of mandatory food handler training include difficulties linking mandatory food handler training with violations, foodborne illness cases and outbreaks. Firstly, training alone does not lead to behavioural change. It is generally accepted that, “Imparting factual information alone often does not result in the maintenance of long-term behavior change (5) “ Secondly, there can be other ways that food can become contaminated, such as contamination during manufacturer processing, which are unrelated to the knowledge and/or use of safe food handling practices.

3. Literature Review Question

The research question addressed in this review was: “Is the provision of mandatory food safety training effective at improving food safety practices of food handlers working in commercial food establishments?”

In PICO format:

Population - food handlers employed in commercial food establishments

Intervention - mandatory food safety education or training

Comparison - none, or voluntary food safety education/training

Outcome - enhanced knowledge, behaviour change, inspection infractions, foodborne illness cases, foodborne illness outbreaks
4. Literature Search

The search strategy was developed from the PICO question and consultation with two Peel Public Health librarians and one knowledge broker. Published literature was searched in January 2016. The databases searched included Guelph University Primo, Global Health and Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations. Grey literature was searched in December 2015 and January 2016. Sources included the World Health Organization, U.S. Centers for Disease Control, National Collaborating Centre for Environmental Health and Trip Database.

Searches were limited to studies published in English between 2011-2015. Study designs included were originally limited to synthesized literature or studies with control groups. This was later expanded to include other types of study designs to capture additional relevant results. After searching the published literature databases, grey literature sources, and reference lists, it was decided that articles excluded in the 2011 rapid review would be re-assessed for relevancy based on the expanded study design criteria. See Appendix A for the detailed search strategy.

5. Relevance Assessment

Two reviewers independently examined the titles and abstracts for relevance. Discrepancies were resolved through discussion and mutual agreement or discussions with a third reviewer. Articles selected for critical appraisal had to meet the following
criteria: 1) include a mandatory food handler training intervention 2) have a control or comparison group, 3) written in English, and 4) published since 2011.

6. Results of the Search

The search yielded 759 articles. Eleven articles were excluded as duplicates, leaving 721 articles for primary relevance assessment. The titles and abstracts were examined by two reviewers and 27 articles were retrieved for full text review. After reviewing full text documents, four articles were found to be relevant to the research question. See Appendix B for the Literature Search Results Flowchart.

7. Critical Appraisal

Four relevant articles; one review and three single studies were critically appraised by four reviewers.

The review article A Review of Food Safety Interventions and Evaluation in Food Service Establishments (6), published by the National Collaborating Centre for Environmental Health was independently critically appraised by four reviewers using the Health Evidence Tool (7), and was assessed as weak quality. The publishers were contacted for more information about methods; however, no additional information was available. Accordingly, this review was excluded.

Three single studies were appraised by four individuals using the Critical Appraisal Skills Programme (CASP) Cohort Study Checklist (8). One study was assessed as weak quality
and excluded. The remaining two studies, Averett et al., (2) and Hammond et al., (3), were assessed as moderate quality, and were included.

8. Description of Included Studies

The highest quality evidence available included two cohort studies which are described below. Additional details of these studies can be found in Appendix C: Data Extraction Tables.

**Evaluation of Local Health Department’s Food Handler Training Program (2)**

This study assessed the impact of a mandatory food handler training program in Kansas City, Missouri. In 2005, the Kansas City, Missouri Health Department began implementing a mandatory food handler training program for all food handlers in food service establishments.

The authors compared rates of total and critical food handler related violations to rates of control or non-food handler related violations from routine inspections of food service establishments before (2001-2004) and after (2005-2007) the program’s implementation. Total violations included both food handler-related critical violations (that must either be remedied immediately or within ten days or the establishment will be closed) and food handler-related non-critical violations (less immediate threats to public health and only required to be corrected by the next inspection). Control violations are those unrelated to food handler behaviours, not covered in the food handler training program and generally
considered outside of the control of a food service establishment employee (e.g., placement of hand washing sink or adequacy of plumbing).

The food handler training program consisted of a two-hour lecture with slides on hygiene, handwashing, employee health, hazardous materials, food storage and temperature requirements, date marking, reheating, dishwashing and ways to keep the establishment safe and clean. The training was usually provided in English at a high school literacy level but was also available in Spanish, Chinese and Vietnamese.

Assessing the Effectiveness of Food Worker Training in Florida: Opportunities and Challenges (3)

This study identified 17 contributing factors for foodborne illness outbreaks and then compared the rate of outbreaks and cases associated with these factors before and after mandatory food worker training was implemented in Florida. These contributing factors were:

- Poisonous substance accidentally added
- Liquid/semi-solid mix of potentially hazardous food
- Raw/lightly cooked food
- Raw product contaminated by animal/environment
- Cross-contamination from raw ingredient of animal origin
- Advance preparation
- Bare-hand contact
- Slow cooking
- Insufficient time/temperature cooking
- Insufficient time/temperature during reheating
- Infected food handler
- Toxic tissue
- Storage in contaminated environment
- Toxic container
- Polluted source

The intervention, which was prompted by legislation, required all public food workers in Florida to receive training from an approved certification program that covered food safety criteria, major risk factors considered in foodborne illness outbreaks and the Food and Drug Administration Food Code’s five intervention strategies\(^2\) (9). The legislation targeted over 40,000 restaurants and other licenced food establishments, such as catering facilities.

The numbers of foodborne outbreaks and cases associated with each of the 17 contributing factors were assessed and summarized into two categories: the four years (1997-2000) before implementation of food worker training and the three years (2001-2003) after implementation of training to assess the effectiveness of the intervention.

\(^2\) The five Food and Drug Administration Food Code interventions were introduced in 1993 and include: demonstration of knowledge, implementation of employee health policies, hands as a vehicle of contamination, time/temperature relationships, and consumer advisory.
9. Synthesis of Findings

Though food handler violations as well as food-borne illness cases and outbreaks decreased, they could not be directly attributed to mandatory food handler training.

1. Total food handler related violations (critical and non-critical combined) decreased after the implementation of mandatory food handler training, and the control violations decreased more (2). All results described below were statistically significant (p-value of 0.05).

- Rates of total food handler-related violations significantly decreased by 12.2% while control violations significantly decreased by 29.0% after the implementation of the mandatory food handler training program.

- For the premises that were in existence for the entire seven-year duration of the study, food handler-related violations decreased 20.2% while control violations decreased 32.8%. Both decreases were statistically significant.

- Food handler-related critical violations decreased by 4.9% and control violations decreased by 24.7%. Both decreases were statistically significant.

- For the premises that were in existence for the entire seven-year duration of the study, food handler-related critical violations decreased by 13.1% while control violations decreased by 47.7%. Both decreases were statistically significant.

\[ \text{Control violations are those unrelated to food handler behaviours, not covered in the food handler training program and generally considered outside of the control of a food service establishment employee.}\]
2. Overall foodborne illness outbreaks decreased following the implementation of mandatory food handler training. However, authors do not attribute the decrease of outbreaks to food handling due the many other potential contributing factors which were not considered in their analysis (3).

- The total number of foodborne-disease outbreaks in restaurants associated with one or more of the 17 contributing factors decreased from 1,001 before implementation of mandatory training (1997-2000) to 581 after implementation of mandatory training (2001-2003).

- The authors also reported the number of foodborne outbreaks that could be attributed to each contributing factor before and after implementation of mandatory food worker training.

  - There was a statistically significant increase in the number of outbreaks attributable to at least one of following 8 contributing factors: liquid/semi-solid mix of potentially hazardous food, raw or lightly cooked food, raw product contaminated by animal or environment, bare-hand contact, slow cooking, inadequate cold-holding temperature, infected food handler, and storage in a contaminated environment.

  - There was a statistically significant decrease in the number of outbreaks attributable to at least one of the following three contributing factors: insufficient
time or temperature during cooking, insufficient time or temperature during hot-holding, and polluted source.

- There was no significant change in the number of outbreaks attributable to the remaining six contributing factors after mandatory food handler training. These six factors included: poisonous substance accidentally added, cross-contamination from raw ingredient of animal origin, advance preparation, insufficient time/temperature during reheating, toxic tissue, and toxic container.

3. Overall foodborne-disease cases decreased following mandatory food handler training. However, authors do not attribute the decrease of cases to food handler training due the many other potential contributing factors which were not considered in their analysis (3).

- The total number of foodborne-disease cases in restaurants associated with one or more of the 17 contributing factors decreased from 5,651 before implementation of mandatory training (1997-2000) to 3582 after implementation of mandatory training (2001-2003).

- The authors reported the number of foodborne-disease cases that could be attributed to each contributing factor before and after implementation of mandatory food worker training.

- There was a statistically significant increase in the number of foodborne-disease cases attributable to at least one of the following 10 contributing-factors: liquid/semi-solid mix of potentially hazardous food, raw or lightly
cooked, advance preparation, bare-hand contact, slow cooking, inadequate cold-holding temperature, insufficient time/temperature during reheating, toxic tissue, storage in a contaminated environment and toxic container.

- There was a statistically significant decrease in the number of foodborne-disease cases attributable to at least one of the following six contributing-factors: poisonous substance accidentally added, cross-contamination from raw ingredient of animal origin, insufficient time/temperature cooking, insufficient time/temperature during hot-holding, infected food handler and polluted source.

- There was no significant change in the number of foodborne-disease cases related to raw product contaminated by animal or environment.

The two included studies share several major limitations. Firstly, examining mandatory training limits study design and quality. It excludes experimental study designs that are high quality, like randomized control trials, and makes us rely on observational studies.

Secondly, authors of both papers acknowledged that food handler behaviour, foodborne cases and outbreaks have a variety of causes and that there are potential factors not captured in their analysis. As a result, the changes in outcomes measured before and after the implementation of mandatory food handler training may not be directly attributable to the mandatory food handler training alone. Not taking into account confounding factors like differences in public health inspectors, and other environmental
changes going on at the same time (education or legislative changes) weakens the reliability of the study.

Thirdly, measuring illnesses and outbreaks as outcomes is challenging because linking outbreaks and illness to a specific restaurant or source (food, water, person to person spread) is difficult and gastrointestinal illness is under-reported.

10. Applicability and Transferability

A meeting was held on February 14, 2017 to discuss the applicability and transferability of the research findings. The facilitated sessions included staff and management from the Office of the Medical Officer of Health and the Environmental Health Division. Highlights from the discussion are provided below. For more information, refer to Appendix D.

**Applicability (feasibility)**

*Political Acceptability or Leverage*

- The Ministry of Health and Long-Term Care is considering mandatory training.
- Current political climate supports fiscal restraint. Based on estimates, a mandatory program would cost approximately $300,000. However, in the absence of compelling evidence, Regional Council is unlikely to approve implementing mandatory food handler certification.
- Not initiating mandatory food handler training shows wise stewardship and would strengthen Peel’s image as an evidence-driven organization.
• Peel may encounter conflicting opinions on their stance to not implement mandatory food handler training from other public health units as some have recently implemented mandatory training for their jurisdiction (Toronto and Hamilton)
• The target group, namely food handlers, are likely to support maintaining the current program and decision not to mandate due to the financial and time burden

*Social Acceptability*

• Food handlers are likely to support the current voluntary training program and decision to not mandate
• There are ethical concerns around requiring mandatory food handler training when some individuals have limited financial resources and time to attend the training
• Mandatory food handler training would be socially acceptable and ethical to the target population if it is provided in an accessible format (i.e. cost, language, literacy level)

*Available Essential Resources (personnel and financial)*

• Voluntary training is currently offered by PPH and others, and the evidence does not support a change to mandatory training
• If Peel implemented a mandatory food handler training program, there would be significant personnel and financial implications
• Without mandating food handler training administered by the Region, funds can be used in other programs

*Organizational expertise and capacity*

• This intervention overlaps with our existing voluntary training program
• Currently, the *Food Premises Regulation* and *Health Protection and Promotion Act* do not require food handlers in food establishments to be certified.

**Transferability (generalizability)**

*Magnitude of Health Issue in Local Setting*

• Magnitude of foodborne illness has not been measured adequately due to lack of reporting/food history recall of cases.

**Target Population Characteristics**

• Studies looked at mandatory training for food handlers in North American settings, so there would be some generalizability.

• The similarities and differences between the populations is hard to determine without a more detailed description of the demographic characteristics of each study population and analysis of how different characteristics might influence the outcomes measured.

• As Peel has a diverse population, tailoring and adapting training to the different languages would be important.

• Also may consider incorporating cultural foods that are encountered during inspections into the training.

**11. Recommendations**

As a result of the findings of this review, we recommend that Peel Public Health:

• Not implement a mandatory food handler training at this time,
• Develop a knowledge translation plan to disseminate research findings to relevant stakeholders including the Ministry of Health and Long-Term Care and Public Health Ontario,

• Continue to monitor the research, and

• Consider participating in further research as appropriate.
References

(1)  Pajot M, Aubin L. Does food handler training improve food safety? A critical appraisal of the literature Mississauga, ON: Region of Peel; 2011


(8) Critical Appraisal Skills Programme (CASP) tool for Cohort Study Checklist [Internet]. 2013. Available from: http://media.wix.com/ugd/dded87_e37a4ab637fe46a0869f9f977dacf134.pdf [Accessed 22\(^{nd}\) February 2016].

Appendices

Appendix A: Search Strategy

Appendix B: Literature Search Results Flowchart

Appendix C: Data Extraction Tables

Appendix D: Applicability & Transferability Worksheet
Appendix A: Search Strategy

Literature Search Summary

<table>
<thead>
<tr>
<th>Search Question</th>
<th>Is the provision of food safety training effective at improving food safety practices of food handlers working in commercial food establishments?</th>
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<tr>
<td>Published and Grey Literature databases/sources</td>
<td>Published - Guelph University Primo, Global Health and Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations Grey- WHO, CDC, NCCEH, Trip Database</td>
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<th>Search Strategy/ MESH, text words</th>
<th>Total Number of Results Reviewed</th>
<th>Comments</th>
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<tr>
<td>Google</td>
<td>Dec 10, 2015</td>
<td>“Food safety training” “Food safety training effective” “Mandatory food safety training”</td>
<td>40/millions</td>
<td>6 articles screened for relevancy</td>
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<td>Trip Data Base</td>
<td>Dec 10, 2015</td>
<td>“Food safe* training OR education”</td>
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<td></td>
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<td>Trip Data Base</td>
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<td></td>
<td></td>
<td>“Mandatory food training effective NOT hormones”</td>
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<td></td>
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| University of Guelph | Jan 6, 2016 | “Food safety training”
| | | “Food safety training effective”
| | | “Mandatory food safety training”
| | | 40/1000s
<p>| | | 1 article screened for relevancy |
| Ovid MEDLINE(R) &lt;1946 to November Week 3 2015&gt; | Jan 7, 2016 | Search Strategy: 1 exp food handling 2 food work*.tw. 3 restaurant work*.tw. 4 (food adj (handl* or prepar* or process* or serving)).tw. 5 1 or 2 or 3 or 4 6 train*.tw. 7 educ*.tw. 8 exp education/ 9 6 or 7 or 8 10 5 and 9 11 (mandatory or obligatory).tw. 12 exp certification/ 13 11 or 12 14 10 and 13 | 29 | 4 articles screened for relevancy - all were duplicates of studies found in original RR |
| Database: Global Health &lt;1973 to 2016 Week 01&gt;, Ovid MEDLINE(R) &lt;1946 to January Week 1 2016&gt;, Ovid MEDLINE(R) In-Process &amp; Other Non-Indexed Citations | January 18, 2016 | Search Strategy: 1 exp foodborne diseases/pc 2 exp food handling/st 3 1 or 2 4 train*.ti,ab. 5 educ*.ti,ab 6 certif*.ti,ab. 7 exp education/ 8 intervention*.ti,ab. 9 4 or 5 or 6 or 7 or 8 10 3 and 9 11 mandat*.tw. 12 requir*.tw. 13 11 or 12 14 10 and 13 15 limit 10 to english language 16 limit 15 to yr=&quot;2005 - Current&quot; 17 limit 14 to english language 18 limit 17 to yr=&quot;2005 - Current&quot; 19 remove duplicates from 16 | 63 | 1 articles screened for relevancy and it was included in the original Rapid Review |</p>
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<th>Source</th>
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<th>Articles Screened</th>
<th>Relevant Articles</th>
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<td>Global Health</td>
<td>exp foodborne diseases/pc exp food handling/st 1 or 2 train*.ti,ab. educ*.ti,ab. certif*.ti,ab. exp education/ intervention*.ti,ab. 4 or 5 or 6 or 7 or 8 10 3 and 9 mandat*.tw. requir*.tw. 4 or 5 or 6 or 7 or 8 10 3 and 9 11 and 9 limit 10 to english language limit 15 to yr=&quot;2005 -Current&quot; limit 14 to english language limit 17 to yr=&quot;2005 -Current&quot; remove duplicates from 16 remove duplicates from 18</td>
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<tr>
<td>“Food safety training”</td>
<td>“Food safety education”</td>
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</tbody>
</table>

- All potentially relevant articles from these searches can be found in Published Literature Relevance Review Table and the Grey Literature Relevance Review Table
Appendix B: Literature Search Results Flowchart

Is the provision of mandatory food safety training effective at improving food safety practices of food handlers working in commercial food establishments?

**Published Literature**
(Global Health, Ovid MEDLINE(R), & Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations, Reference lists)
- Database Search 1 on Jan 7, 2016 (29)
- Database Search 2 on Jan 18, 2016 (63)
- Database Search 3 on Jan 18, 2016 (427)

**Grey literature (245)**
(Google, Trip Database, University of Guelph, NCCEH, CDC & WHO)

Total identified articles (759)

Removal of Duplicates (11)

Non-relevant (721)
(based on title and abstract screening)

Relevance assessment of full document versions (27)

Non-relevant articles (23)
(based on reading full article)

Total Relevant Articles (4)

Synthesized (1)

Non-synthesized (3)

Quality assessment of relevant articles (4)

Weak articles (2)
(1 review and 1 single study)

Moderate articles (2)
(2 single studies)
### Appendix C: Data Extraction Tables

<table>
<thead>
<tr>
<th>Item reviewed</th>
<th>Review #1 of 2: Evaluation of Local Health Department's Food Handler Training Program</th>
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<td><strong>General Information &amp; Quality Rating</strong></td>
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<tr>
<td>Author(s)</td>
<td>Averett E, Nazir N &amp; Neuberger JS.</td>
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<tr>
<td>Date</td>
<td>January 2011</td>
</tr>
<tr>
<td>Country</td>
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<tr>
<td>Quality rating</td>
<td>Moderate using Critical Appraisal Skills Programme (CASP) Cohort Study Checklist</td>
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<tr>
<td>Objective(s)</td>
<td>Assess impact of implementation of mandatory food handler training program in Kansas City</td>
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<td><strong>Details on methodology</strong></td>
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<td>Study design and analysis</td>
<td>Quasi-experimental design as reported by the authors. Although they studied the same population before and after the intervention without assigning participants to intervention or control group, we chose to critically appraise it with the CASP Cohort Study Checklist. Analyses compared the overall rates of food handler–related violations and control violations found during routine inspections before the implementation of the mandatory food handler training program (2001–2004) and after (2005–2007). Overall total and critical violation rates were calculated by dividing the number of relevant violations by the total number of routine inspections in each of the two time periods. Before implementation of food handler training, 10,184 inspections occurred, while after implementation 7,014 inspections occurred. Analyses were also done using a subset of data of those food establishments in existence during the entire seven-year study period (2001–2007). Before the implementation of food handler training, 5,283 inspections occurred, and due to decreased inspection frequency, 4,107 occurred after implementation of food handler training. Differences in rates before and after the implementation of mandatory food handler training were calculated using Odds ratios (OR) with 95% confidence intervals (CI). Chi-square tests using two-tailed p-values were performed.</td>
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<tr>
<td>Setting</td>
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<td>Population</td>
<td>Food service establishment employees in Kansas City</td>
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<td>Exposure</td>
<td>Mandatory food handler training program (delivered usually in English) which consisted of a two-hour lecture with slides conducted at the health department offices</td>
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</tbody>
</table>
| Primary outcome | • Rates of food handler-related **total** and **critical** violations were compared to **control** violations per routine inspection of food service establishments.  
  • **Total** violations included both food handler-related **critical** violations (that must either be remedied immediately or within ten days or the establishment will be closed) and food handler-related non critical violations (less immediate threats to public health and only required to be corrected by the next inspection).  
  • **Control** violations are those unrelated to food handler behaviours, not covered in the food handler training program and generally considered outside of the control of a good service establishment employee (e.g., placement of hand washing sink or adequacy of plumbing). |
| Results & Limitations | Relevant results of review | • Rates of **total food handler–related violations** were significantly less than the rates of **control violations** both before and after the implementation of the mandatory food handler training program: $OR = 0.78$, 95% $CI = 0.76$ to 0.80, $p = .000$; and $OR = 0.96$, 95% $CI = 0.93$ to 1.00, $p = .042$, respectively.  
  • **Food handler–related violations** decreased 12.2% after the implementation of the mandatory food handler training program, while control violations decreased 29.0% after the initiation of the mandatory food handler training program. Both decreases were statistically significant.  
  • For the data subset of premises that were in existence for the entire duration of the study, **food handler-related violations** decreased 20.2% while control violations decreased 32.8%  
  • Rates of **food handler–related critical violations** were significantly higher than the rates of **control violations** both before and after the implementation of the mandatory food handler training program: $OR = 2.58$, 95% $CI = 2.49$ to 2.67; and $OR = 3.26$, 95% $CI = 3.11$ to 3.41, respectively.  
  • After the implementation of food handler training, **food handler–related critical violations** decreased by 4.9% and control violations decreased by 24.7%. Both decreases were statistically significant.  
  • For the data subset being premises that were in existence for the entire duration of the study, rates of **food handler–related critical violations** }
were significantly greater than the rate of control violations both before and after the implementation of the mandatory food handler training program: OR = 2.56, 95% CI = 2.43 to 2.70; and OR = 3.31, 95% CI = 3.10 to 3.53, respectively.

- For the data subset, food handler–related critical violations decreased by 13.1% while control violations decreased by 47.7%. Both decreases were statistically significant.

<table>
<thead>
<tr>
<th>Author’s conclusions</th>
<th>Comments/limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>- No measureable benefit was seen from the mandatory food handler training program</td>
<td>- The control violations decreased more than food handler related violations after implementation of the mandatory food handler training program which suggests that factors other than the mandatory food handler training affected the results.</td>
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<tr>
<td>- More evaluation is recommended as well as improvements of the training program through multiple teaching methods</td>
<td>- The authors felt that it was difficult to say how much of the reduction in food handler violations was because of the mandatory food handler training program or due to other factors not captured in their analysis</td>
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<td>- Lack of consistency among inspectors (no data on intra- or inter-inspector reliability)</td>
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<td>- The high turnover rate of inspectors and subjective nature of inspections could have influenced the reliability of the data collected on violations.</td>
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<td>- Mandatory food handler training was phased in over two years. This could influence how many food handlers were trained at the time of inspection, perhaps resulting in an underestimation of the impact the mandatory training has on violations.</td>
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<tr>
<td>General Information &amp; Quality Rating</td>
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<tr>
<td>-------------------------------------</td>
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</tr>
<tr>
<td><strong>Author(s)</strong></td>
<td>Hammond RM, Brooks RG, Schlottmann J, Johnson D, Johnson RJ.</td>
</tr>
<tr>
<td><strong>Date</strong></td>
<td>October 2005</td>
</tr>
<tr>
<td><strong>Country</strong></td>
<td>United States</td>
</tr>
<tr>
<td><strong>Quality rating</strong></td>
<td>Moderate using Critical Appraisal Skills Programme (CASP) Cohort Study Checklist</td>
</tr>
<tr>
<td><strong>Objective(s) of review</strong></td>
<td>Assess food worker training effectiveness in Florida</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Details on methodology</th>
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<tbody>
<tr>
<td><strong>Study design and analysis</strong></td>
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</table>
● Toxic container
● Polluted source

- The numbers of foodborne outbreaks and cases associated with each of the 17 contributing factors were summarized into two categories: the four years (1997-2000) before implementation of food worker training and the three years (2001-2003) after implementation of training.

- Using the rate of total number of foodborne-disease outbreaks or cases associated with each contributing factor per 1,000 outbreaks or cases, the authors performed a Z-test. This test for difference of proportions was applied to each contributing factor to determine whether a significant change in the rate of outbreaks or cases associated with that contributing factor occurred after training was implemented.

### Setting
Florida

### Population
Florida Food Handlers

### Exposure
Mandatory food worker training by an approved certification program. (Specifics of training requirements can be obtained from Florida Department of Business and Professional Regulation)

### Primary outcome
Foodborne outbreaks and cases.

## Results & Limitations

### Relevant results of review
- The total number of foodborne-disease outbreaks in restaurants associated with one or more of the 17 contributing factors decreased from 1,001 before implementation of mandatory training (1997-2000) to 581 after implementation of mandatory training (2001-2003).

- The average annual occurrence of foodborne-disease outbreaks associated with one or more of the contributing factors was 250 before mandatory training (in 1997-2000) and 194 per year after mandatory training (2001-2003).

- The authors also calculated the proportion of foodborne outbreaks by each contributing factor before and after implementation of mandatory food worker training. Using p-values, they found a statistically significant increase in the proportion of foodborne outbreaks among 8 of the 17 contributing factors. These eight factors were as follows: liquid/semi-solid mix of potentially hazardous food, raw or lightly cooked food, raw product contaminated by animal or environment, bare-hand contact, slow cooking, inadequate cold-holding temperature, infected food handler, and storage in a contaminated environment.

- The authors found a statistically significant decrease in the proportion of...
outbreaks among 3 of the 17 contributing factors. The three factors were as follows: insufficient time or temperature during cooking, insufficient time or temperature during hot-holding, and polluted source.

- There was no significant change in outbreaks related to the remaining six contributing factors. These six factors included: poisonous substance accidentally added, cross-contamination from raw ingredient of animal origin, advance preparation, insufficient time/temperature during reheating, toxic tissue, and toxic container.

- The total number of foodborne-disease cases in restaurants associated with one or more of the contributing factors decreased from 5,651 cases before mandatory training (1997-2000) to 3,582 cases after mandatory training (2001-2003).

- The annual occurrence of foodborne-disease cases associated with one or more of the contributing factors was 1,413 per year before mandatory training (1997-2000) and 1,194 per year after mandatory training (2001-2003).

- Using p-values, the authors found a statistically significant increase in the proportion of cases among 10 of the 17 contributing factors. The ten factors were as follows: liquid/semi-solid mix of potentially hazardous food, raw or lightly cooked, advance preparation, bare-hand contact, slow cooking, inadequate cold-holding temperature, insufficient time/temperature during reheating, toxic tissue, storage in a contaminated environment and toxic container.

- A statistically significant decrease was found among 6 of the contributing factors, and no change occurred in cases associated with one category. The six factors were as follows: poisonous substance accidentally added, cross-contamination from raw ingredient of animal origin, insufficient time/temperature cooking, insufficient time/temperature during hot-holding, infected food handler and polluted source.

- There was no significant change in outbreaks related to the remaining contributing factor of raw product contaminated by animal or environment.

Author’s conclusions

- While the overall rate of foodborne outbreaks associated with the contributing factors deceased after the implementation of mandatory training, there were more outbreaks and cases involving multiple contributing factors which suggests that there may have been other confounding factors which were not considered.

- The authors recommended that further research is needed to establish the most useful methods and approaches for assessing effectiveness in order to assess the health impact of food worker training. Additionally, they recommended that the increases and decreases of foodborne outbreaks related to particular contributing factors could be used to focus future training material.
<table>
<thead>
<tr>
<th>Comments/limitations</th>
<th>Authors suggest that epidemiologists may have been more accurate in identifying and documenting contributing factors in the later years of the study.</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>There were no confidence intervals reported.</td>
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</table>
## Appendix D: Applicability and Transferability Worksheet

### Applicability and Transferability Worksheet

<table>
<thead>
<tr>
<th>Factors</th>
<th>Questions</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Political acceptability or leverage | • Will the intervention be allowed or supported in current political climate?  
  • What will the public relations impact be for local government?  
  • Will this program enhance the stature of the organization?  
    o For example, are there reasons to do the program that relate to increasing the profile and/or creative a positive image of public health?  
  • Will the public and target groups accept and support the intervention in its current format? | • Mandatory food handler training will not be supported in the region, due to the lack of supporting research evidence  
  • Current political climate is encouraging fiscal restraint, so recommendations to not initiate mandatory food handler training on the basis of unclear evidence shows wise stewardship of resources and would serve to strengthen Peel's image as an evidence-driven organization  
  • Peel may encounter some conflicting opinions on their stance of not implementing mandatory food handler training from other jurisdictions.  
  • The Ontario Ministry of Health and Long-Term Care is considering implementing mandatory training  
  • There is also general consensus amongst other public health units that food handler training should be mandatory and some have already implemented it (Toronto and Hamilton)  
  • Many Peel Public Health Public Health Inspectors believe in mandatory certification based on either working in other health units or anecdotal feedback from colleagues working in other health units about the benefits of mandatory food handler certification.  
  • Many industries would like the province to make a final decision on mandatory food handler certification.  
  • Many employers already require their staff to be certified (i.e. daycares and long term care facilities)  
  • The target group, namely food handlers, are likely to support the
| Social acceptability | • Will the target population find the intervention socially acceptable? Is it ethical?  
  o Consider how the program would be perceived by the population.  
  o Consider the language and tone of the key messages.  
  o Consider any assumptions you might have made about the population. Are they supported by the literature?  
  o Consider the impact of your program and key messages on non-target groups. | • Mandatory food handler training is both socially acceptable and ethical to the target population if it is provided in an accessible format [i.e. language, literacy level]  
• Food handlers are likely to support current voluntary training program and decision to not mandate.  
• Typical food handlers in Peel may not be able to afford a mandatory food handler training program  
• There are concerns over the equity of mandatory food handler training causing undue hardship to individuals with lower socio-economic backgrounds, and there is no means test  
• Public may have concerns about food safety without mandatory training.  
• The public assumes that there is a requirement for certification and training for food handlers and therefore might find it unethical to not provide mandatory food handler training  
• Avoiding a mandate can also be ethically justified as it would prevent placing a burden of on a newcomer/immigrant and transient population |
<table>
<thead>
<tr>
<th>resources (personnel and financial)</th>
<th>the local implementation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Are they adequately trained? If not, is training available and affordable?</td>
<td></td>
</tr>
<tr>
<td>• What is needed to tailor the intervention locally?</td>
<td></td>
</tr>
<tr>
<td>• What are the full costs?</td>
<td></td>
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<tr>
<td>o Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative supports.</td>
<td></td>
</tr>
<tr>
<td>• Are the incremental health benefits worth the costs of the intervention?</td>
<td></td>
</tr>
<tr>
<td>o Consider any available cost-benefit analyses that could help gauge the health benefits of the intervention.</td>
<td></td>
</tr>
<tr>
<td>o Consider the cost of the program relative to the number of people that benefit/receive the intervention.</td>
<td></td>
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</tbody>
</table>

| being delivered by PPH and this review does not propose a change to this practice or its associated costs |
| • If we were to implement a mandatory food handler training program, there would be significant resource implications. Peel would need more PHIs to implement the training and potentially more classroom space. Currently, 5 call centre staff teach the course in the building 2-4 times a month. There are many staff who could teach; however, they would need orientation and time away from their regular duties |
| • Peel has outdated infrastructure. For example, there are no online registration and payment options. Individuals have to physically visit Access Peel in order to register and pay for the course. |
| • Might require additional translated courses to deal with needs of population |
| • PHIs are educated but training for presentations is minimal |
| • We might consider allowing individuals to receive training from other training companies as long as they meet the curriculum requirements. |
| • The costs of the training materials have been covered and have been supplemented by individuals who sign up for the course |
| • This may require exams outside work hours/offsite to accommodate businesses. |
| • Based on estimates, a mandatory program would cost ~$300,000. However, in the absence of compelling evidence, the Board of Health and Regional Council are unlikely to approve implementing mandatory food handler certification |
| • Without mandating food handler training administered by the Region, funds can be used in other programs |
There may be a benefit of less critical violations in restaurants – less time for PHI to be spent issuing charges/ court time (more than 8 hours per PHI per premises/ charge)

Unable to measure impact on food-borne illness rates due to underreporting

Is the intervention to be offered in line with Peel Public Health’s 10-Year Strategic Plan (i.e., 2009-2019, ‘Staying Ahead of the Curve’)?

Does the intervention conform to existing legislation or regulations (either local or provincial)?

Does the intervention overlap with existing programs or is it symbiotic (i.e., both internally and externally)?

Does the intervention lend itself to cross-departmental/divisional collaboration?

Any organizational barriers/structural issues or approval processes to be addressed?

Is the organization motivated (learning organization)?
  - Consider organizational capacity/readiness and internal supports for staff learning.

This intervention overlaps with our existing food handler training program with no cross-departmental collaboration

Currently the Food Premises regulation and Health Protection and Promotion Act do not require food handlers in food establishments to be certified.

The intervention of mandatory food handler training is currently not being recommended; however, there are proposed changes to mandate food handlers to obtain training. If this is the case, Peel may need to consider providing more opportunities.

If provincial legislation goes ahead, there may be implications for inspection protocols that would require PHIs to inspect training credentials as part of their food premises inspection.

Barriers to implementing mandatory training:
- the physical environment to accommodate extra staff
- costs of extra staff (teaching, admin, prosecutors)
- redistribution of work in EI team to not include inspections if more courses needed
- lack of infrastructure to automate registrations
- Equity issues for the food handlers accessing the course (SES, language, literacy)
- Lack of adult education experts for creation of alternate format for the functionally illiterate.

Lack of adult education experts for creation of alternate format for the functionally illiterate.

<table>
<thead>
<tr>
<th>Transferability (generalizability)</th>
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<tbody>
<tr>
<td>Magnitude of health</td>
</tr>
<tr>
<td>- What is the baseline prevalence of the health issue locally?</td>
</tr>
<tr>
<td>- Foodborne illness is a significant multi-factorial disease in our</td>
</tr>
</tbody>
</table>
### issue in local setting

- What is the difference in prevalence of the health issue (risk status) between study and local settings?
  - Consider the Comprehensive Health Status Report, and related epidemiological reports.

- Region that is also notably underreported.
  - It has been estimated that only one out of every 313 cases of enteric illnesses are reported to a health unit. Thus, in 2006, there would have been an estimated 369,600 cases in Peel region if all cases were reported. ~ Kawachi I, Kennedy BP, Glass R. Social (as cited in Comprehensive Health Status Report, 2008)

### Magnitude of the “reach” and cost effectiveness of the intervention above

- Will the intervention appropriately reach the priority population(s)?
  - What will be the coverage of the priority population(s)?

- This review correctly identified that present evidence suggests mandatory food handler training will not be successful in protecting health broadly, which includes priority populations.

### Target population characteristics

- Are they comparable to the study population?
- Will any difference in characteristics (e.g., ethnicity, socio-demographic variables, number of persons affected) impact intervention effectiveness locally?
  - Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors).

- Studies looked at mandatory training for food handlers in North American settings, so there would be some generalizability, though the multicultural nature of Peel’s community might unique differences
- The similarities and differences between the populations is hard to determine without a more detailed description of the demographic characteristics of each study population and analysis on how different characteristics might influence the outcomes measured
- As Peel has a diverse population, Peel needs to consider tailoring and adapting training to the necessary languages.
- Also may need to consider incorporating cultural foods that are encountered during inspections into the training

### Proposed Direction (after considering the above factors):

Continue to offer food handler training on a voluntary basis and monitor evidence around the effectiveness of mandatory food handler training, revisiting the appropriateness of a mandate at such time that the evidence is clear that it has broader population health benefit.

**Form Completed by:** Lawrence Loh, Paul Callanan, Louise Aubin, Gagan Babra, Stephanie Martins, Beata Hilliard, Andrea Chiefari