

***Salmonella* Outbreak at the University of Western Ontario**

Middlesex-London Health Unit November to December 2007

June 2008

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Dedication

We would like to acknowledge the expertise, dedication and commitment of Dr. Tom MacFarlane, Director of Health Services at The University of Western Ontario (UWO), who passed away on December 14, 2007. During this outbreak and during his career at UWO, Dr. MacFarlane was always there to do the best for the students and staff members he served. He will be very much missed.

Table of Contents

Summary of Figures.....	5
Summary of Tables.....	6
Summary of Appendices.....	7
A. Executive Summary.....	8
B. Introduction.....	12
C. Background.....	14
C-1) Overview of <i>Salmonella</i>	15
C-2) Laboratory Testing for <i>Salmonella</i>	16
C-3) Reportable Diseases.....	16
C-4) Epidemiology of <i>Salmonella</i>	18
C-5) The University of Western Ontario, Centre Spot and the Pita Outlet.....	19
D. Chronology of the Outbreak.....	26
D-1) First Phase - The Pita Outlet.....	27
D-2) Second Phase - Other Centre Spot Prepared Foods.....	28
D-3) Outbreak Declared Over.....	29
E. Descriptive Epidemiology.....	32
E-1) Age and gender.....	33
E-2) Symptoms.....	33
E-3) Health Care Utilization.....	34
E-4) Food Handlers.....	35
E-5) Exposure Classifications.....	35
E-6) Onset Dates.....	36
E-7) Exposure Dates.....	36

F. Inspection of the Kitchen at Centre Spot.....	40
F-1) Understanding the Processes	41
F-2) Recommendations to Improve Food Handling Practices	43
G. Investigation of the Pita Outlet	46
G-1) Stool Cultures from Food Handlers.....	47
G-2) Food and Environmental Samples	47
G-3) Comparing the Cases to Available Computerized Information Related to Purchases from the Pita Outlet on November 2, 2007	47
G-4) Case-Control Epidemiologic Study Regarding the Pita Outlet	52
H. Case-Control Epidemiologic Study Regarding the Consumption of Centre Spot Prepared Food	58
I. Communications	62
J. Discussion and Conclusions	66
K. Acknowledgements	70
L. Appendices	74
M. References.....	119

Summary of Figures

Figure 1: Cases of <i>Salmonella</i> by Year, Middlesex-London, 1997–2006	21
Figure 2: Average Rates of <i>Salmonella</i> by Age and Gender, Middlesex-London, 1997-2006.....	22
Figure 3: Average Number of <i>Salmonella</i> Cases per Month, Middlesex-London, 1997-2006.....	23
Figure 4: Layout of the Centre Spot.....	24
Figure 5: Approximate Number of Laboratory-Confirmed Cases Reported per Day ...	30
Figure 6: Onset Dates of 90 Laboratory-Confirmed <i>Salmonella typhimurium</i> Cases ..	38
Figure 7: Exposure Dates Laboratory-Confirmed Cases Pita Outlet and Centre Spot.....	39
Figure 8: Exposure Dates for Pita Outlet, Laboratory-Confirmed and Non-Laboratory-Confirmed Cases	56
Figure 9: Exposure Dates for Pita Outlet, Laboratory-Confirmed and Non-Laboratory-Confirmed Cases with Meal Plans.....	57

Summary of Tables

Table 1: Number and Percentage of Laboratory-Confirmed Cases Reporting Specific Symptoms	33
Table 2: Number and Percentage of Laboratory-Confirmed Cases Seeking Medical Care	34
Table 3: Number and Percentage of Laboratory-Confirmed Cases by Exposure Classification	36
Table 4: November 2, 2007 Purchase Times for Cases with Meal Plans Compared to Non-Cases with Meal Plans	49
Table 5: November 2, 2007 Meals Purchased by Cases with Meal Plans Compared to Non-Cases with Meal Plans	50
Table 6: November 2, 2007 Meals Purchased by Cases Compared to Sales Records	51
Table 7: Age and Gender Distribution in the Pita Outlet Case-Control Study	54
Table 8: Time of Food Purchases from Pita Outlet Comparing Questionnaire Cases and Questionnaire Controls	54
Table 9: Counter Used to Prepare Pitas at the Pita Outlet	55
Table 10: Food Items that Were (or Almost Were) Statistically More Likely to be Eaten by Cases than Controls	55
Table 11: Age and Gender Distribution in Centre Spot Case-Control Study	60
Table 12: Comparison of Cases and Controls who Regularly Eat Centre Spot Prepared Food in Campus Case-Control Study	61
Table 13: Summary of Media Interactions by Date	64

Summary of Appendices

Appendix A: Detailed Chronology of the Outbreak	75
Appendix B: Media release “ <i>Salmonella</i> Cases linked to food outlet”	79
Appendix C: Questionnaire for Ill Individuals (Case Questionnaire) in Pita Outlet Case-Control Study	80
Appendix D: Questionnaire for Well Individuals (Control Questionnaire) in Pita Outlet Case-Control Study	88
Appendix E: Detailed Food Analysis from Pita Outlet Case-Control Study.....	93
Appendix F: Questionnaire for Ill Individuals (Case Questionnaire) for Campus Consumption Case-Control Study	102
Appendix G: Questionnaire for Well Individuals (Control Questionnaire) for Campus Consumption Case-Control Study	110
Appendix H: Detailed Food Outlet Analysis from Campus Consumption Case-Control Study	115

SECTION A

Executive Summary

A. Executive Summary

Salmonella is a bacterial infection that causes gastrointestinal illness characterized by diarrhea, which can sometimes be bloody, fever, headache, abdominal pain, nausea and occasionally vomiting. It is spread through the consumption of food or drinks that have been contaminated with the feces of animals, birds or reptiles and can be transmitted from one person to another. Illness usually lasts four to seven days and is more severe in the very young, very old and those with underlying medical conditions.

Salmonella is a reportable disease under the Ontario Health Protection and Promotion Act, which means that doctors, nurses, hospitals and other designated groups must report to public health when they know or suspect an individual has *Salmonella*. In Middlesex-London, an average of 71 laboratory-confirmed cases of *Salmonella* are reported per year. In most Novembers, the month when this outbreak occurred, an average of 3.1 *Salmonella* reports are received by the Middlesex-London Health Unit (MLHU).

On November 8, 2007, the MLHU received six laboratory-confirmed cases of *Salmonella* within one hour, followed by a report from a local hospital of 12 ill individuals who had presented to their emergency department with symptoms compatible with *Salmonella*. Investigation of this unusual cluster of cases revealed that all the laboratory-confirmed cases were University of Western Ontario (UWO) students and most had eaten at a pita outlet located in the University Community Centre (UCC) food court, referred to as Centre Spot. The date of exposure mentioned by most cases was November 2, 2007. Based on an inspection of the pita outlet on November 9, and the fact that no food from November 2 remained at the outlet, the outlet was allowed to continue to operate.

Following a media release on November 10, 2007, UWO students and staff who had symptoms compatible with *Salmonella* also began calling the MLHU to report their illness. Additional laboratory-confirmed cases were received from November 9-15, 2007, the vast majority of whom reported eating at the pita outlet on or around November 2, 2007.

On November 12, 2007, based on investigation of two ill individuals, the suspicion was raised that the outbreak extended beyond the pita outlet. These individuals had not eaten food from the pita outlet but instead had eaten food from Lifestyles Refrigerators. Lifestyles Refrigerators are located in buildings across campus and contain sandwiches and salads prepared during the night by an operation called the "Production Centre" using the Centre Spot kitchen.

On November 13, 2007, intensive inspection of the Centre Spot kitchen began. The suspicion of the broader outbreak was confirmed on November 16, 2007 when 10 laboratory-confirmed cases received by the MLHU did not report eating food from the pita outlet. Instead, these 10 cases reported eating food from Lifestyles Refrigerators or from the other food outlets located in the Centre Spot food court, mostly during the week of November 5-9, 2007. These other food outlets, along with the pita outlet and Production Centre, shared the common kitchen at Centre Spot.

Over the weekend of November 17 and 18, 2007, a thorough cleaning and disinfection of the Centre Spot kitchen took place, after which only one laboratory-confirmed case reported having eaten food prepared at Centre Spot.

The outbreak was declared over on December 11, 2007. A total of 90 laboratory-confirmed cases were received during the outbreak, seven of whom required hospitalization. All were determined to be *Salmonella typhimurium* PT 108, PFGE STXAI.0312. This was the same strain that had been causing an increase in *Salmonella typhimurium* cases in Ontario and for which chicken had been the most commonly reported food eaten by close to 200 laboratory-confirmed cases.

Of the 90 laboratory-confirmed cases of *Salmonella typhimurium* PT 108, PFGE STXAI.0312 associated with UWO, it was determined that 41 (45.6%) were related to exposure at the pita outlet, 35 (38.9%) were related to eating foods prepared at Centre Spot, but not at the pita outlet, and 14 (15.6%) were related to other types of exposures. Exposure at the pita outlet occurred mainly on November 2, 2007, while exposure from the other Centre Spot prepared food was concentrated in the following week of November 5-9, 2007.

Fifteen UWO food handlers developed symptomatic *Salmonella typhimurium* as part of the outbreak. The dates of onset of their symptoms occurred after the onset of the outbreak; thus it was determined that none of these individuals was the cause of the outbreak. The food handlers appeared to have acquired their illness from eating food from the pita outlet or Centre Spot or from working at Centre Spot. A few food handlers did work at the Production Centre while symptomatic for a short period of time.

The kitchen at Centre Spot was inspected on at least 13 days during the investigation of this outbreak. Inspections were conducted to understand the processes that took place at Centre Spot and to make recommendations to improve food handling practices. Recommendations were made to prevent cross-contamination in the kitchen and to enhance temperature control.

As chicken is a possible source of *Salmonella*, the chicken handling at the pita outlet and Centre Spot was reviewed. The chicken used at the pita outlet arrives precooked and frozen. It is then thawed, chopped and reheated in an oven and held hot. Sampling of this chicken on November 9, 2007, one week after the exposure date for most cases associated with the pita outlet, did not detect *Salmonella* but revealed the chicken was positive for *Bacillus cereus*, indicating that bacteria could be introduced into the chicken and grow during the processing. The outlet adjacent to the pita outlet used raw chicken to prepare their meals. The handling of this raw chicken may have resulted in contamination of the kitchen environment. A sample of this chicken taken two weeks after the outbreak was determined to have another strain of *Salmonella*, *Salmonella heidelberg*.

To further investigate the source of infection at the pita outlet, the 27 food handlers associated with the pita outlet on October 31, November 1 and November 2 were asked to submit stool samples. Of the 24 food handlers who submitted samples, two were found to be positive for the outbreak strain of *Salmonella*. As stated above, these individuals were determined to have acquired their infection as part of the outbreak, not to be the source of the outbreak. Five food samples from the pita outlet were taken on November 9, and 35 were taken on November 13, 2007. No *Salmonella* was identified,

however, the November 9 chicken sample from the pita outlet was positive for *Bacillus cereus*. Fourteen environmental swabs and samples from the pita outlet and other locations in the Centre Spot kitchen taken on November 13 were all negative for *Salmonella* and other pathogens.

An analysis using computerized information regarding time and type of food purchases was conducted for those who purchased food using their meal plans from the pita outlet on November 2, 2007, the date of exposure for most pita outlet-associated cases. Individuals who were ill were more likely to have purchased their food between 2:00 and 4:00 p.m. on that day, compared to those who did not develop illness. As well, ill people were somewhat more likely to purchase chicken-containing food than those who remained well.

An online case-control study was conducted to further assess exposures at the pita outlet on October 31, November 1, November 2 and November 5, 2007. This analysis revealed that cases (those who were ill) were more likely to consume chicken than controls (those who remained well). Also, cases were more likely to have been served from the left side counter of the two serving counters at the pita outlet, which is the only counter that is open after 1:00 p.m. in the afternoon.

A second online case-control study was conducted assessing on-campus purchasing patterns among those who ate food from outlets on campus. Cases were more likely than controls to regularly purchase food from several Centre Spot food outlets.

The exact source of this outbreak will likely never be definitively determined. It is possible that the handling of the raw chicken in areas adjacent to the pita outlet could have resulted in environmental contamination. This contamination could have initially spread to the pita outlet, and in the following week to other areas of the Centre Spot kitchen, possibly on the hands of staff members who worked at various food outlets during each shift.

Although there appears to be an association between eating chicken from the pita outlet and developing illness, it is important to note that 12 of 26 (46%) ill people who ate at the pita outlet on November 2 did not report eating the chicken. Possible explanations for the association with the pita outlet chicken include that the chicken was contaminated; the tongs used to serve the chicken were contaminated; the person likely to serve or handle the chicken was infected or had *Salmonella* on his/her hands; or the location where the chicken pitas were prepared on the elongated cutting board was contaminated. The clustering of cases from 2:00 to 4:00 p.m. on November 2, 2007 could have been explained by contamination of the elongated cutting board on the left serving counter or a food handler who worked at the left serving counter.

This outbreak illustrates the significant impact of a food borne outbreak when it affects a complex operation which serves a large number of people. It is hoped that the investigations related to this outbreak and subsequent changes that resulted will aid in the prevention of future outbreaks at UWO and other similar establishments.

SECTION B

Introduction

B. Introduction

On November 8, 2007, the Middlesex-London Health Unit (MLHU) became aware of an outbreak of *Salmonella* involving the University of Western Ontario (UWO). Over the next several weeks it became apparent that the outbreak consisted of two distinct, but related phases – the first involving a food outlet that primarily served pitas located in the University Community Centre (UCC) Centre Spot at UWO, and the second involving food prepared at Centre Spot and purchased both from this location and other food outlets around campus.

In total, 90 laboratory-confirmed cases of *Salmonella typhimurium* were reported to the MLHU, all of which were determined to be the same strain. Seven students were hospitalized. There were no deaths. This report will describe the investigation of this outbreak which involved:

- collection and analysis of detailed information on all laboratory-confirmed cases and the numerous people whose symptoms suggested they also had *Salmonella*, but for whom no laboratory tests were available (non-laboratory-confirmed cases);
- detailed inspections of the Centre Spot food preparation facilities and processes;
- laboratory testing of food and environmental samples from the pita outlet and Centre Spot kitchen;
- analysis of computerized records of meals purchased from the pita outlet; and
- two case-control studies.

SECTION C

Background

C-1) Overview of <i>Salmonella</i>	15
C-2) Laboratory Testing for <i>Salmonella</i>	16
C-3) Reportable Diseases.....	16
C-4) Epidemiology of <i>Salmonella</i> in Middlesex-London and Ontario.....	18
C-5) The University of Western Ontario, Centre Spot and the Pita Outlet.....	19

Figures

Figure 1	Cases of <i>Salmonella</i> by Year, Middlesex-London 1997-2006.....	21
Figure 2	Average Rates of <i>Salmonella</i> by Age and Gender, Middlesex-London 1997-2006	22
Figure 3	Average Number of <i>Salmonella</i> Cases per Month, Middlesex-London, 1997-2006	23
Figure 4	Layout of Centre Spot.....	24

C. Background

C- 1) Overview of *Salmonella*

Salmonella is a bacterial infection that causes gastrointestinal illness characterized by diarrhea, which can sometimes be bloody, fever, headache, abdominal pain, nausea and occasionally vomiting. In some cases, the diarrhea can be severe and require hospitalization. *Salmonella* can lead to complications in the very young, the very old and those who have certain underlying medical conditions. Complications can include dehydration, infection of the bloodstream, or infections outside the gastrointestinal tract.

Salmonella originates from feces of animals, birds and reptiles and is acquired by ingesting fecally contaminated foods, such as raw or undercooked eggs, meat, shellfish or poultry, as well as contaminated fruits or vegetables, including sprouts, or by drinking contaminated water or milk. The bacteria can be passed from one person to another if the hands of an infected person are not properly washed after having a bowel movement. *Salmonella* bacteria can also be carried by turtles, iguanas, snakes, chickens, dogs and cats and can spread to people who handle infected animals or their feces.

Symptoms begin 6 to 72 hours after exposure to the bacteria, with an average time to the onset of symptoms of 12 to 36 hours. This period of time is called the “incubation period”. The acute symptoms of salmonellosis (the disease caused by *Salmonella*) usually last between four and seven days. *Salmonella* can be spread from an infected person as long as the bacteria is present in the feces which ranges from several days to weeks, although it is more easily spread when diarrhea is present. Prolonged carriage of the bacteria can occur in some individuals. At 12 weeks from initial infection, 5% of older children and adults are still carrying the bacteria. Approximately 1% of infected individuals can still carry the organism one year or more after initial infection.

Treatment for salmonellosis is generally supportive and includes rehydration. Antibiotics are only recommended in the very young (less than 3 months of age), the very old and those with underlying medical conditions or complications. Antibiotics do not shorten the duration of illness, can prolong the length of time *Salmonella* is carried in the stool, and can promote the development of antibiotic resistant organisms.

Numerous types (called serotypes) of *Salmonella* can infect humans; *Salmonella typhimurium* and *Salmonella enteritidis* are the most common. Further molecular typing can be done by the laboratory to identify the specific strain and this information can be used to assist in determining if cases of the same serotype are related to the same exposure or outbreak.^{1 2}

The outbreak described in this report was caused by *Salmonella typhimurium*. Several notable outbreaks of *Salmonella typhimurium* have been reported in North America. In September 2003, health officials in Oregon reported 18 cases of *Salmonella typhimurium* linked to kits for making egg salad.³ In April 2005, 55 cases of *Salmonella typhimurium* identified in Ontario were linked to an uncommon strain. Deli meats from a single producer were identified as the most likely source, although results were not definitive.⁴ In 2005 in Ontario, a *Salmonella typhimurium* outbreak comprised of 155 cases was associated with a Mother’s Day buffet.⁵

C-2) Laboratory Testing for *Salmonella*

When a client presents to a health care provider with acute diarrhea, it is strongly recommended that a stool sample be collected. The stool sample is submitted to a local laboratory for culture. If the stool is found to be positive for *Salmonella* or other organisms, the result must be forwarded to the local public health unit, along with any available information about the client and the name and contact information for the health care provider who ordered the test (see Reportable Diseases section).

Specimens that are positive for *Salmonella* and other organisms are forwarded from the local laboratory to the Central Public Health Laboratory (CPHL) in Toronto for further testing. There the serotype is determined. As well, for outbreak related organisms and a sample of non-outbreak related organisms, molecular typing is conducted. The CPHL conducts one form of molecular typing called Pulsed-Field Gel Electrophoresis (PFGE). PFGE uses enzymes that cut in specific places along the genetic material (DNA) obtained from the organism being tested. These pieces of DNA are then separated according to their molecular size using a pulsed electrical charge to pull them through a gel. The pattern of bands produced with a particular enzyme determines the PFGE pattern of the bacteria. Bacteria with the same or a similar PFGE pattern can be considered to be the same strain indicating that they may have originated from the same source or exposure and be part of an outbreak.

For further molecular typing to determine the strain, the bacteria are sent to the National Microbiology Laboratory in Winnipeg. At this laboratory, phage typing, which relies on the susceptibility or resistance of the bacteria to selected viruses that infect them, is conducted. The pattern of reaction or non-reaction to a variety of viruses determines the phage type of the *Salmonella*. Bacteria of the same strain will have the same phage type (PT).

Conducting the molecular typing for all *Salmonella* isolates belonging to an outbreak will help to determine if they are all from a common source, in which case they would be expected to have identical phage types and identical or closely related PFGE types.

C-3) Reportable Diseases

The Health Protection and Promotion Act (HPPA) is the Ontario legislation that governs the work of public health.⁶ Regulation 559/91, Specification of Reportable Diseases, under the HPPA, designates over 70 diseases or conditions as reportable to public health.⁷ Under the HPPA, physicians, nurses, other regulated health professionals, laboratories, hospitals, school principals, and superintendents of institutions must report these diseases to the local health unit. Section 25 (1) of the HPPA states that physicians and other regulated health care practitioners are required to report when they form the opinion that the person has or may have a reportable disease. Regulation 569, entitled Reports, under the HPPA specifies the information that must be reported to public health units which includes demographic information, clinical presentation, risk factors, the results of diagnostic testing and current treatment.⁸ Disease caused by *Salmonella* is reportable under the HPPA.

Reporting to the public health serves three purposes:

1. **Prevention of transmission:** The ill person can be followed up to ensure that they understand their disease and how to prevent transmission to others. For some diseases (which do not include *Salmonella*) specific interventions such as vaccines or antibiotics can be offered to the contacts of the infected person to assist in preventing infections in these people.
2. **Outbreak identification:** Through investigation of where the ill person ate during the incubation period, the possible source of the infection can be identified. If more than one ill person with the same gastrointestinal disease reports the same source for their infection, an outbreak is suspected.
3. **Collection of surveillance information:** Information on all reportable diseases is entered into the Integrated Public Health Information System (iPHIS), which is the provincial electronic reporting system used by Ontario public health units and the Ministry of Health and Long-Term Care. Analysis of the information in iPHIS can determine the trends of infectious diseases over time and the demographics of the groups affected by these diseases. These analyses can help identify outbreaks, and assist with targeting public health programs and interventions.

When a person with laboratory-confirmed or suspected *Salmonella* is reported to the Health Unit, a Public Health Nurse (PHN) or Public Health Inspector (PHI) contacts the person as soon as possible to obtain the following information:

- Demographic information including occupation;
- Description of symptoms and when they began;
- A history of all foods consumed during the incubation period, including meals eaten at food premises outside of the home;
- The source of their drinking water;
- History of recent travel;
- History of animal contact during the incubation period;
- Anything out of the ordinary in the incubation period;
- Do they know of others who are ill with similar symptoms?

If possible, one PHN or PHI interviews all clients with *Salmonella* in order to facilitate the identification of common exposures that may indicate an outbreak is occurring.

Counseling is provided to the ill person about proper hand and washroom hygiene and the need to refrain from preparing food for others while symptomatic. Food handlers, childcare workers and health care providers with *Salmonella* are excluded from work until their symptoms have been resolved for 24 hours. During an outbreak, the health unit may decide to exclude these individuals until they demonstrate that they have cleared their *Salmonella* infection based on two stool cultures that are negative for *Salmonella*.

It should be noted that generally there is a delay of several days to more than a week between the date of exposure to an organism such as *Salmonella* and a positive report being received by public health. This is because of the time required for the client to develop their symptoms, feel ill enough to seek health care, submit a stool sample and for laboratory processing and reporting to public health to take place. In this outbreak,

further delays were encountered in contacting some students who had returned home to their parents when they were ill and whose illness may have been reported to other health units.

It should also be noted that there is significant under-reporting of diseases such as *Salmonella* in part, because not all clients with *Salmonella* seek medical attention. Even when the client does present for care, the health care provider may not always order a stool sample to diagnose the infection. It is estimated that in industrialized countries, as few as 1% of clinical cases of *Salmonella* are reported.¹ Therefore, it is reasonable to assume that for each reported case of *Salmonella* there are many other people with *Salmonella* who have not been reported to public health.

C-4) Epidemiology of Salmonella in Middlesex-London and Ontario

The MLHU serves a population of approximately 420,000 people, of whom 350,000 live in the City of London and 70,000 live in the more rural areas of Middlesex County. In Middlesex-London between the years 1997 and 2006, an average of 71 people with laboratory-confirmed *Salmonella* were reported per year.

Figure 1 provides a summary of the number of cases of *Salmonella* in Middlesex-London from 1997 to 2006. The peak in 2005 is due to local cases associated with a large Ontario outbreak of *Salmonella enteritidis*. This outbreak was linked to the consumption of bean sprouts from a common supplier.

Figure 2 indicates the average rates of laboratory-confirmed *Salmonella* by gender and age between 1997 and 2006. Infection is most common in children less than 1 year of age followed by children 1 – 9 years of age. Males and females have similar rates of infection.

Figure 3 indicates the average number of laboratory-confirmed cases per month. As with all bacterial infections that cause gastrointestinal symptoms, *Salmonella* is more common during the summer months, likely due to improper preparation, cooking, handling or storage of food during barbecues and picnics. In November, the month of this outbreak, an average of six cases of salmonellosis are reported based on the years 1997 to 2006. However, the *Salmonella enteritidis* bean sprout outbreak occurred in November and December 2005. Because of this, a total of 35 Middlesex-London cases of *Salmonella enteritidis* occurred in November 2005. Excluding that year, the average number of laboratory-confirmed cases of *Salmonella* in November was 3.1.

At the time of the *Salmonella* outbreak in Middlesex-London, Ontario had been experiencing increased rates of *Salmonella typhimurium* infections caused by a common phage type referred to as PT 108. Two different, but closely related PFGE patterns had been associated with this increase in infections. One PFGE pattern, STXAI.0344, was first noted in Ontario in February 2007 and was last reported in August 2007. A total of 107 cases of *Salmonella typhimurium* PT 108 STXAI.0344 were reported from 21 health units, with most cases occurring between March and June 2007. Seven cases with this PFGE pattern were reported from Middlesex-London including three cases that were related to a single common food outlet. The most commonly consumed food reported by the provincial cases was chicken.

The CPHL reported another PFGE pattern of *Salmonella typhimurium* PT 108 in May 2007. This PFGE pattern, STXAI.0312, was closely related in its banding pattern to STXAI.0344. As of October 9, 2007, 91 cases of this strain had been reported from 25 health units, including two from Middlesex-London. The most commonly consumed food related to this strain was also chicken.⁹ Recently, the laboratory has decided that STXAI.0344 and STXAI.0312 are so closely related that they can be considered the same strain and have all been renamed with the STXAI.0312 designation.

C-5) The University of Western Ontario, Centre Spot and the Pita Outlet

The University of Western Ontario (UWO), located in London, Ontario, has approximately 3,500 full-time faculty and staff members, and approximately 30,000 undergraduate and graduate students. UWO offers more than 400 different majors, minors and specializations through its 12 Faculties and three affiliated Colleges. A total of 3,830 students live in one of the nine residences scattered throughout the campus. Almost all these students receive a meal plan which entitles them to purchase lower cost foods in the residence cafeterias and tax-exempt foods from other locations on campus. The meal plan can also be used to purchase food from off-campus food outlets, but regular prices which are not tax exempt are paid for these purchases. Students who do not live in residence can also purchase one of three types of meal plans. The three types of plans vary with respect to the amount of money paid for the meal plan and the amount of money each type of meal plan allows the user to save for on-campus purchases. Approximately 15,250 students who do not live in residence access one of the three meal plan options.¹⁰

The main building on campus for non-academic student services is the University Community Centre (UCC). Within the UCC is a food court, called Centre Spot. Figure 4 provides a diagram of the layout of Centre Spot, which contains seven food outlets, most of which are franchises of popular fast food chains. In addition to these outlets, there is a cooler that serves salads and sandwiches called a Lifestyles Refrigerator or Lifestyles Grab and Go, an area to purchase soup and several vending machines. Food from most of the outlets at Centre Spot is brought to one of five cash registers and paid for using either a meal plan or cash / debit cards. The Centre Spot serves up to 7,000 customers per day when classes are in full session.

Behind the counters where food is ordered and served at Centre Spot, is a common kitchen where food is prepared and/or cooked for all seven food outlets. Food handlers at Centre Spot can work at any of the food outlets. At night, the kitchen and the area where food is ordered and served are used to produce baked goods, salads and sandwiches. This night time preparation is called "Production Centre" and foods prepared by this operation are distributed to numerous other food outlets in 14 buildings across campus. The salads and sandwiches are stored and offered for sale in Lifestyles Refrigerators in these locations. All food preparation occurring at Centre Spot takes place utilizing a Hazard Analysis and Critical Control Points (HACCP) based food safety system which is used to identify potential food safety hazards at critical points during the process of food preparation so that corrective action can be taken.

One of the seven food outlets in Centre Spot is a pita outlet. It abuts a wall on one side and a Chinese food outlet on the other. The pita outlet serves a large variety of pita

types along with several types of salads. There is a broad selection of ingredients that can be added to the pitas or salads including different types of vegetables, cheeses and sauces.

The pita outlet has two counters where the pitas or salads can be assembled. During busy times, both counters are open to serve customers. Later in the day when it is less busy, only one counter remains open (the counter on the customer's left). At each counter there can be three to four people preparing a single pita. Prior to the outbreak, the pita was placed on an elongated, white cutting board and pushed along from one food handler to the next to load the various items into the pita. Finally, the pita was wrapped in paper and handed to the customer who then paid for the pita at one of the five cashiers.

In addition to food outlets and other services, the UCC also has a health care clinic for students and employees. Student Health Services has an average of 60,000 visits per year and provides medical services, including assessment, limited diagnostics, treatment and follow-up; and counseling, health information and resources.

Figure 1

Cases of *Salmonella* by Year Middlesex-London, 1997–2006

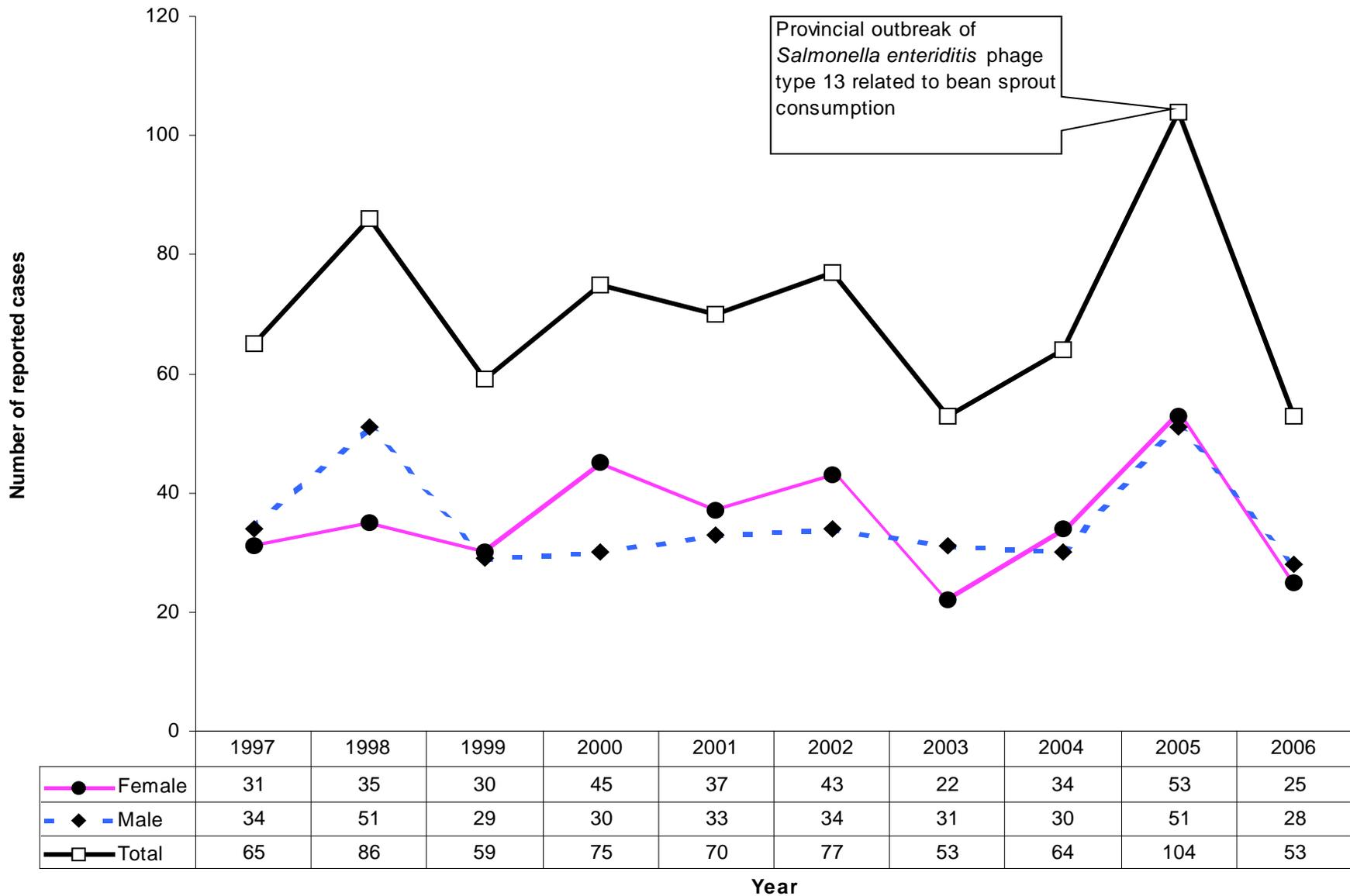


Figure 2

Average Rates of *Salmonella* by Age and Gender Middlesex-London, 1997-2006

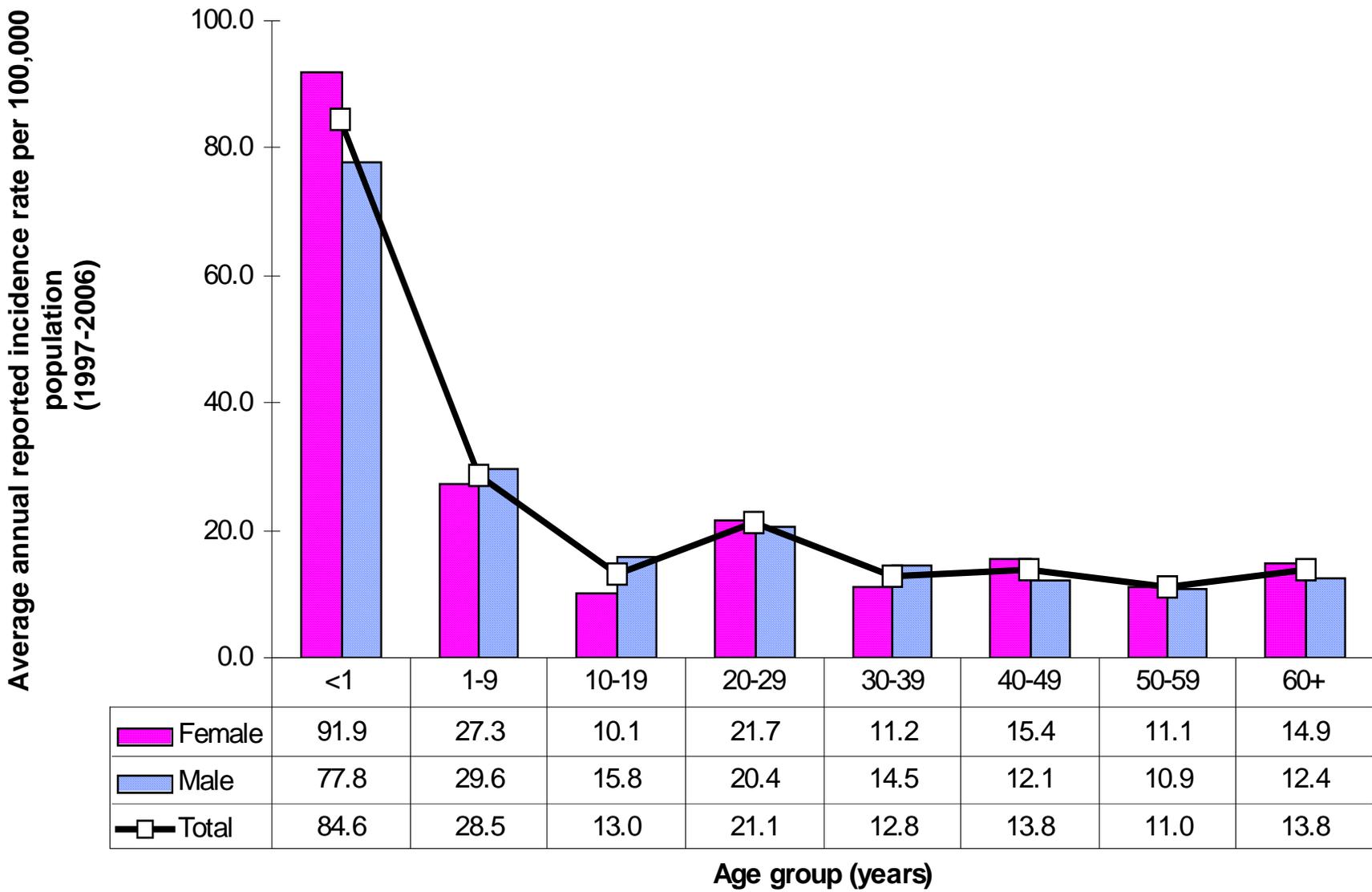


Figure 3

Average Number of *Salmonella* Cases per Month Middlesex-London, 1997-2006

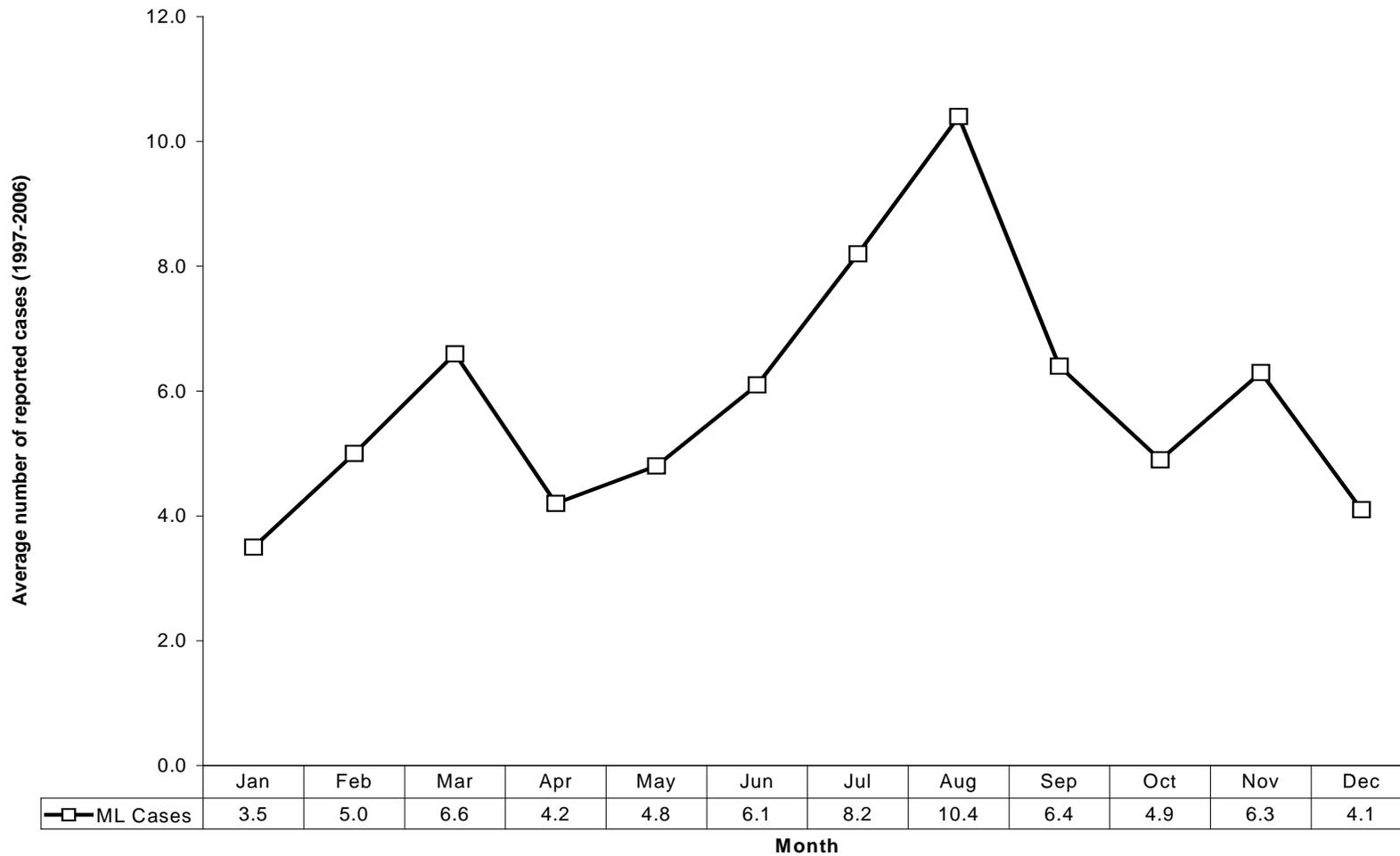
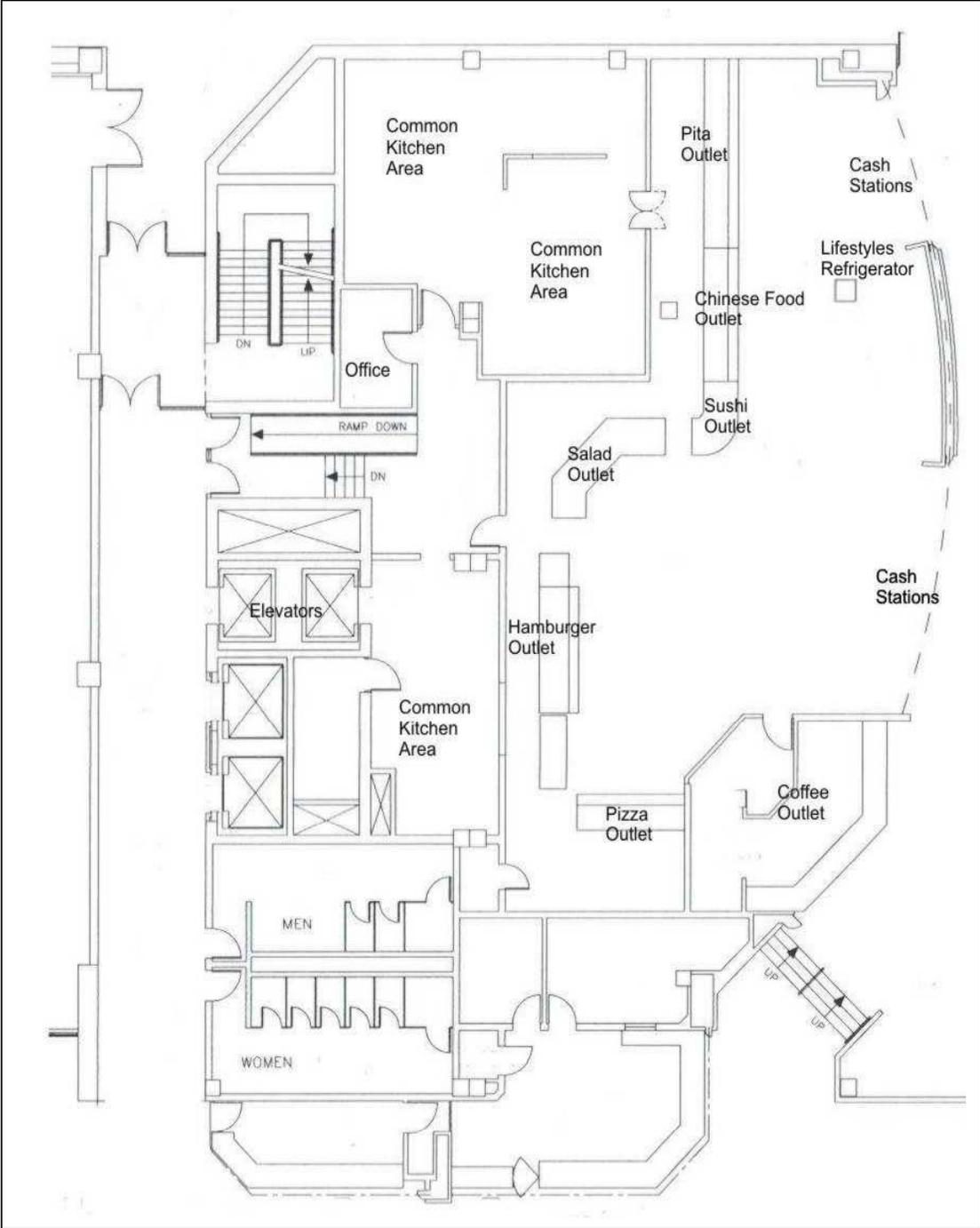


Figure 4

Layout of Centre Spot



SECTION D

Chronology of the Outbreak

D-1) First Phase – The Pita Outlet	27
D-2) Second Phase – Other Centre Spot Prepared Foods	28
D-3) Outbreak Declared Over	29

Figure

Figure 5	Approximate Number of Laboratory-Confirmed Cases Reported per Day	30
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D. Chronology of the Outbreak

Appendix A provides a detailed overview of the chronology of this outbreak. A brief overview of the key dates and events are provided in this section.

D-1) First Phase - The Pita Outlet

On the afternoon of Thursday, November 8, 2007, the MLHU received six reports of laboratory-confirmed *Salmonella* within one hour. As noted in Figure 3 (page 23), the average number of *Salmonella* reports in Middlesex-London from 1997 to 2006 in November (excluding 2005) was approximately three per month. All six ill people were females who, based on age and address, appeared to be UWO students. In addition, the hospital which reported some of the laboratory-confirmed cases informed the MLHU that, in the previous few days, they had seen another 12 individuals with gastrointestinal symptoms compatible with salmonellosis and possible connections to UWO.

During the remainder of that day and into the evening, calls were made by MLHU staff members to the laboratory-confirmed cases of *Salmonella* and the non-laboratory-confirmed cases with symptoms reported by the hospital. By early evening, three of the laboratory-confirmed cases had been reached. All were UWO students; two reported eating at the pita outlet at Centre Spot. The other had eaten food from several locations on campus including two Centre Spot outlets, but not from the pita outlet. Of the non-laboratory-confirmed cases, four were reached; two were UWO students and one reported eating at the pita outlet.

Based upon this preliminary information, the possibility was raised that the pita outlet may have been the source of an outbreak. The Public Health Inspector (PHI) on duty the evening of November 8 ascertained that the pita outlet in question had closed at 7:00 p.m. and was not scheduled to re-open until 10:00 a.m. on November 9. The PHI instructed the Hospitality Services Operations Manager not to re-open the pita outlet until approval to do so was granted by a PHI from the MLHU.

Later on the night of November 8 an additional laboratory-confirmed case of *Salmonella* was reached who also reported eating at the pita outlet. Therefore, a total of four of the individuals contacted on November 8 had eaten at the pita outlet. Of the four individuals, one had eaten a chicken salad, two had eaten chicken pitas and one had eaten a Philly steak pita. Their food had been purchased in the week ending November 2, 2007 and three mentioned purchasing food on November 2.

A PHI attended the pita outlet the following morning, conducted an inspection, interviewed food services staff and gathered five food samples, including a sample of the chicken. The inspection revealed no critical infractions. It was noted that food is delivered to the pita outlet almost daily and therefore no food from the previous week remained. Based on these findings, the pita outlet was allowed to re-open.

On November 9, 2007, an additional laboratory-confirmed case of *Salmonella* was reported to the MLHU and efforts continued to reach all the laboratory-confirmed and non-laboratory-confirmed cases. By the morning of November 10, six of the seven laboratory-confirmed cases had been reached and five reported eating at the pita outlet on or around November 2, 2007. In addition, two non-laboratory-confirmed cases with

clinically compatible symptoms reported eating at the pita outlet in the same time frame. Based on this information, a media release was issued in collaboration with UWO (see Appendix B). Information about the outbreak was also disseminated to local physicians, Ontario health units and posted on the UWO and MLHU web sites. It was decided to collect stool samples from the 27 food handlers who had handled food or had some connection to the pita outlet from October 31 to November 2, 2007. As well, on November 10, two PHIs met with UWO staff members to get complete information about the types and sources of food served at the pita outlet, and to review the process used to prepare pitas.

A detailed questionnaire was developed to capture as much information as possible from both laboratory-confirmed cases and people with clinically compatible symptoms who had not submitted stool specimens. The questionnaire asked about the nature of the client's symptoms, date and time of onset, and the health care the client had received. The client was then asked to recall the foods he/she had eaten in the three days before onset of illness, which is the maximum incubation period for *Salmonella* infection. For those who reported eating at the pita outlet, very specific information regarding the components of their pitas or salads was obtained.

Over the next week, laboratory-confirmed cases continued to be reported to the MLHU. In addition, people called the MLHU to self-report symptoms, and the hospitals and UWO Student Health Services continued to identify clients with symptoms compatible with *Salmonella* and report this information to the MLHU. The MLHU followed-up with these suspect cases to determine if they were likely to be part of this outbreak and to encourage them to submit stool samples.

D-2) Second Phase - Other Centre Spot Prepared Foods

From November 8 to November 15, almost all the laboratory-confirmed cases and most of the clinically compatible cases reported eating at the pita outlet. However, on November 12, one laboratory-confirmed case reported eating a pita on November 8 that had been purchased, not from the pita outlet, but from a Lifestyles Refrigerator at Centre Spot. On the evening of November 12, another UWO student, who called the MLHU to report gastrointestinal symptoms, reported that she had not eaten at the pita outlet, but had consumed a sandwich from a Lifestyles Refrigerator at the Engineering building on November 8.

These two cases led to a suspicion that perhaps this outbreak had a second phase that extended beyond the pita outlet to the other parts of the Centre Spot kitchen, including the overnight Production Centre which prepared the sandwiches, pitas and salads for the Lifestyles Refrigerators across campus. Because of this suspicion, on November 13, 2007, two PHIs began a very detailed inspection of the Centre Spot kitchen that spanned several days and included inspections of the nighttime Production Centre. The inspectors interviewed management and staff members and obtained 35 food samples and 14 environmental swabs and samples.

On Friday November 16, the Health Unit received 11 new laboratory-confirmed cases of *Salmonella*. As the cases were reached and interviewed, it became apparent that 10 of them had not eaten food from the pita outlet but rather had eaten food from various locations on campus. This brought to 12 the number of laboratory-confirmed cases of *Salmonella* with a UWO connection who had not eaten food from the pita outlet. With the

assistance of a staff member from UWO, it was determined that all 12 had eaten food prepared in the Centre Spot kitchen, either from one of the food outlets at Centre Spot (not including the pita outlet) or made by the Production Centre and distributed to food outlets across campus.

The discovery that the outbreak extended beyond the pita outlet to the whole Centre Spot kitchen led to the shut down of the kitchen over the weekend of November 17 and 18 so that a very thorough cleaning and disinfecting of the entire kitchen could be conducted. All previously prepared food and raw produce were discarded. This process was monitored by two PHIs.

Normally Centre Spot is closed on the weekend; however, on the weekend of November 17-18, the kitchen was slated for operation for the "Fall Preview", an event in which UWO plays host to approximately 7,000 potential students and their parents. After a thorough cleaning and disinfection of the area involved in baking, production of baked goods only was allowed for this event. No other food preparation was permitted. UWO arranged with a fast food outlet from the community to deliver food to Centre Spot for the visitors.

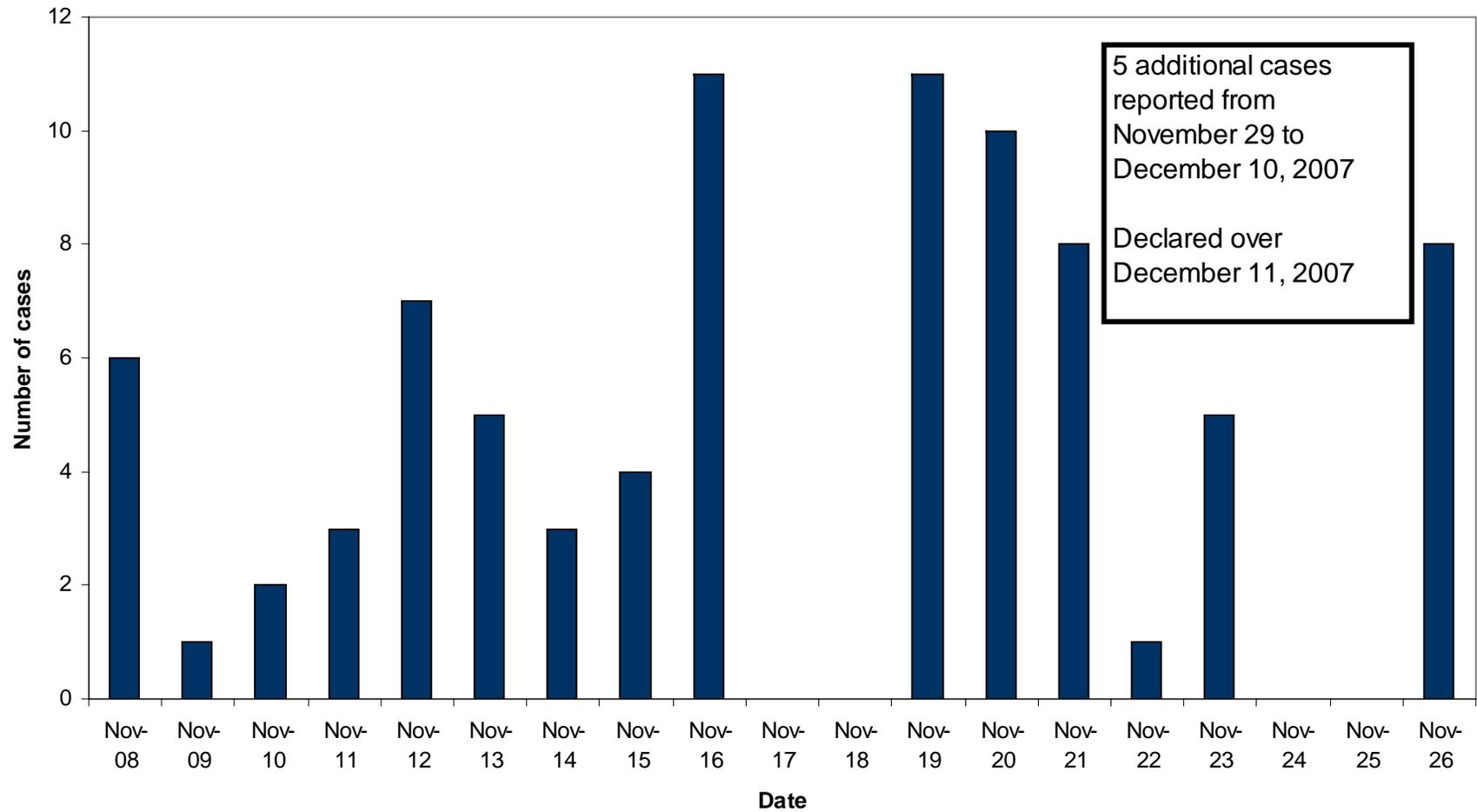
Laboratory-confirmed cases of *Salmonella* continued to be received up until December 10, 2007. Figure 5 provides the approximate number of laboratory-confirmed cases reported per day. Only one laboratory-confirmed case reported exposure after the intensive clean-up on the November 17-18 weekend.

D-3) Outbreak Declared Over

The outbreak was declared over on December 11, 2007. A total of 90 laboratory-confirmed cases were received during the outbreak. All were determined to be *Salmonella typhimurium* PT 108, PFGE STXAI.0312.

Figure 5

Approximate Number of Laboratory-Confirmed Cases Reported per Day



SECTION E

Descriptive Epidemiology

E-1) Age and Gender	33
E-2) Symptoms	33
E-3) Health Care Utilization.....	34
E-4) Food Handlers.....	35
E-5) Exposure Classifications	35
E-6) Onset Dates	36
E-7) Exposure Dates.....	36

Tables

Table 1	Number and Percentage of Laboratory-Confirmed Cases Reporting Specific Symptoms	33
Table 2	Number and Percentage of Laboratory-Confirmed Cases Seeking Medical Care	34
Table 3	Number and Percentage of Laboratory-Confirmed Cases by Exposure Classification	36

Figures

Figure 6	Onset Dates of 90 Laboratory-Confirmed <i>Salmonella typhimurim</i> Cases	38
Figure 7	Exposure Dates Laboratory-Confirmed Cases, Pita Outlet and Centre Spot.....	39

E. Descriptive Epidemiology

The following section will provide a description of the epidemiology of the 90 laboratory-confirmed cases of *Salmonella*. In some analyses, information on the non-laboratory-confirmed cases who ate at the pita outlet is also included to provide additional or confirmatory data.

E-1) Age and Gender

The mean and median ages of the laboratory-confirmed cases were 22 and 20 years respectively with a range of 17 to 51 years. There were 52 females (57.8%) and 38 males (42.2%).

E-2) Symptoms

Table 1 summarizes the symptoms for 89 of the 90 laboratory-confirmed cases. Symptom information is missing for one case. Virtually all laboratory-confirmed cases experienced diarrhea and 60% reported bloody diarrhea. There were 75 cases who provided details about the number of episodes of diarrhea they experienced on their worst day. The number of episodes ranged from 1 to 72 episodes in a 24-hour period; there were 16 (21.3%) cases who experienced 1 to 3 bowel movements per hour on their worst day. Overall, these 75 cases were characterized by a mean and median of 17 and 15 episodes of diarrhea respectively on their worst day.

At the time of interview by MLHU investigators, 42 (46.6%) of the 90 laboratory-confirmed cases indicated that they had recovered from their illness. Among these cases, five did not indicate the date that symptoms resolved. For the remaining 37 laboratory-confirmed cases, duration of illness ranged from 3 to 21 days, with a mean and median of 8 and 7 days, respectively.

Table 1: Number and Percentage of Laboratory-Confirmed Cases Reporting Specific Symptoms (n=89)

SYMPTOMS	Number (percent)
Diarrhea	88 (98.9%)
Bloody diarrhea	53 (59.6%)
Abdominal pain / cramps	88 (98.9%)
Chills	75 (84.3%)
Headache	72 (80.9%)
Fever	71 (79.8%)
Nausea	70 (78.7%)
Vomiting	35 (39.3%)
Other symptom(s) reported	54 (60.7%)

Note: Data is missing from one case. More than one symptom could be reported per client.

E-3) Health Care Utilization

Table 2 summarizes the health care utilization pattern of the 90 laboratory-confirmed cases. Seven of the laboratory-confirmed cases were hospitalized. The average duration of hospital stay is not known as some people were still in hospital at the time they were interviewed by the MLHU. One client developed a ruptured appendix that required surgery. There were no deaths associated with this outbreak.

Seventeen non-laboratory-confirmed cases were most likely to be part of this outbreak as they had clinically-compatible symptoms and ate at the pita outlet on November 2, the exposure date of most of the laboratory-confirmed cases. By definition, to be included in the analysis, non-laboratory-confirmed cases had to have had three or more bowel movements in a 24-hour period. Of these 17 non-laboratory-confirmed cases, 12 sought medical care. However, stool samples were collected from only two of these cases (for whom results came back negative) and were not collected on the other 10 cases. Five of the 10 cases for whom stool samples were not taken attended the same walk-in medical clinic.

Table 2: Number and Percentage of Laboratory-Confirmed Cases Seeking Medical Care (n=90)

TYPE OF MEDICAL CARE	Number (Percent)
Student Health Services	31 (34.4%)
Urgent Care / Emergency Department visit	30 (33.3%)
- LHSC – University	20
- LHSC – Victoria	2
- SJHC – Urgent Care	8
Hospitalization ¹	7 (6.7%)
- Hospitalized within MLHU jurisdiction	4
- Hospitalized outside MLHU jurisdiction	3
Emergency/clinic visit outside MLHU jurisdiction	6 (6.7%)
Family Physician	5 (5.6%)
Medical Walk In	4 (4.4%)
No medical care sought ²	1 (1.1%)
Medical care location not specified	6 (6.7%)

¹ One hospitalized case also attended Student Health Services; a second hospitalized case attended a medical clinic outside of the MLHU jurisdiction.

² This case self-identified to MLHU by telephone; stool collection kit was provided by MLHU.

LHSC - London Health Sciences Centre

SJHC – St. Joseph's Health Care London

MLHU – Middlesex-London Health Unit

E-4) Food Handlers

During the course of the outbreak, a total of 15 food handlers developed symptoms compatible with *Salmonella* and were found to be positive for the outbreak strain. In all cases, they were determined to have acquired their infection from eating food prepared at the pita outlet or Centre Spot or by working at Centre Spot. Based on the onset date of their illness, none of these food handlers could have been the source of infection at the pita outlet. However, a few of them had worked in the Production Centre at Centre Spot and may have worked while they were symptomatic. It is possible that these workers could have transmitted infection through the foods they prepared at Centre Spot.

E-5) Exposure Classifications

The most likely source of exposure for each of the 90 laboratory-confirmed cases was determined. This was done based on a careful review of where each case had eaten on campus during the incubation period. Table 3 summarizes this analysis. This table indicates that 41 (45.6%) of the 90 cases were most likely related to the pita outlet, and 35 (38.9%) of the cases were most likely related to consumption of food prepared at Centre Spot, but not by the pita outlet. The exact source of exposure for six cases could not be determined because they ate in many different locations on campus during the incubation period. Three cases were felt to be related to person-to-person spread from an ill individual to a close acquaintance. There were five laboratory-confirmed cases for whom no obvious source could be identified to explain their infection; however, they were felt to be part of this outbreak because they were UWO students and/or staff members and they had the outbreak strain of *Salmonella typhimurium*.

For 26 (63.4%) of the 41 laboratory-confirmed cases, the meal from the pita outlet was the only Centre Spot-prepared meal consumed during the incubation period. Fifteen (36.6%) of the 41 pita outlet-related cases had eaten at the pita outlet and also had eaten one or more foods prepared at Centre Spot, other than from the pita outlet. However, based on the average incubation period and the meals they consumed, the pita location was felt to be the most likely source of their exposure.

Of the 35 laboratory-confirmed cases related to consuming food from Centre Spot but not from the pita outlet, 15 (42.9%) appear to be related to food from a Lifestyles Refrigerator and 20 (57.1%) to food from other outlets at Centre Spot.

Table 3: Number and Percentage of Laboratory-Confirmed Cases by Exposure Classification (n=90)

EXPOSURE CLASSIFICATION	Number (Percent)
Pita outlet (Centre Spot)	41 (45.6%)
Pita outlet exclusively	26
Pita outlet plus other Center Spot exposures	15
Food prepared at Centre Spot (not pita outlet)	35 (38.9%)
Lifestyle Refrigerators	15
Other food outlets at Centre Spot	20
Other	14 (15.6%)
Cannot decide (multiple exposures)	6
No obvious source on campus	5
Person-to-person transmission	3

E-6) Onset Dates

Figure 6 graphically illustrates the onset dates of the 90 laboratory-confirmed cases, divided into the exposure classifications as follows: those related to the pita outlet; those related to eating foods prepared at Centre Spot, but not from the pita outlet; and the “other” group which includes those with multiple exposures, those who likely acquired their infection through person-to-person transmission and those whose source of infection is not clear since they did not eat food from either the pita outlet or prepared at Centre Spot. It should be recalled that the onset dates generally occurred one to three days after the exposure dates. Figure 6 clearly indicates the progression of the outbreak, with the cases related to the pita outlet developing illness first, followed by the cases related to eating food prepared in Centre Spot but not from the pita outlet, followed by the “other” group of cases occurring towards the end of the outbreak.

E-7) Exposure Dates

Figure 7 graphically illustrates the dates of exposure for the laboratory-confirmed cases related to the pita outlet and Centre Spot, where this could be determined. Exposure dates were based on the date the ill individual reported eating the food most likely to have caused their illness given the incubation period of *Salmonella*, or where available, the date the meal plan showed they purchased the food most likely to have caused their illness. The exposure date was difficult to ascertain for six of these cases so the graph represents the data from 70 laboratory-confirmed cases. Important landmarks related to the outbreak have been displayed on the graph.

From Figure 7, it can be determined that November 2, 2007 is the exposure date for 27 (65.8%) of the 41 laboratory-confirmed cases associated with the pita outlet. Most of the Centre Spot cases related to the Lifestyles Refrigerators and the food outlets at Centre Spot other than the pita outlet had exposure dates mainly in the following week (November 5-9).

Exposures resulting in illness appear to decrease with knowledge of the outbreak and as the MLHU increased its inspections of the Centre Spot kitchen. Only one laboratory-confirmed case reported an exposure date after the thorough kitchen clean-up that occurred on the weekend of November 17-18. It should be noted that there are very few exposures on November 3, 4, 10 and 11, since these were weekends when the Centre Spot was closed except for very select uses.

Figure 6

Onset Dates of 90 Laboratory-Confirmed *Salmonella typhimurium* Cases

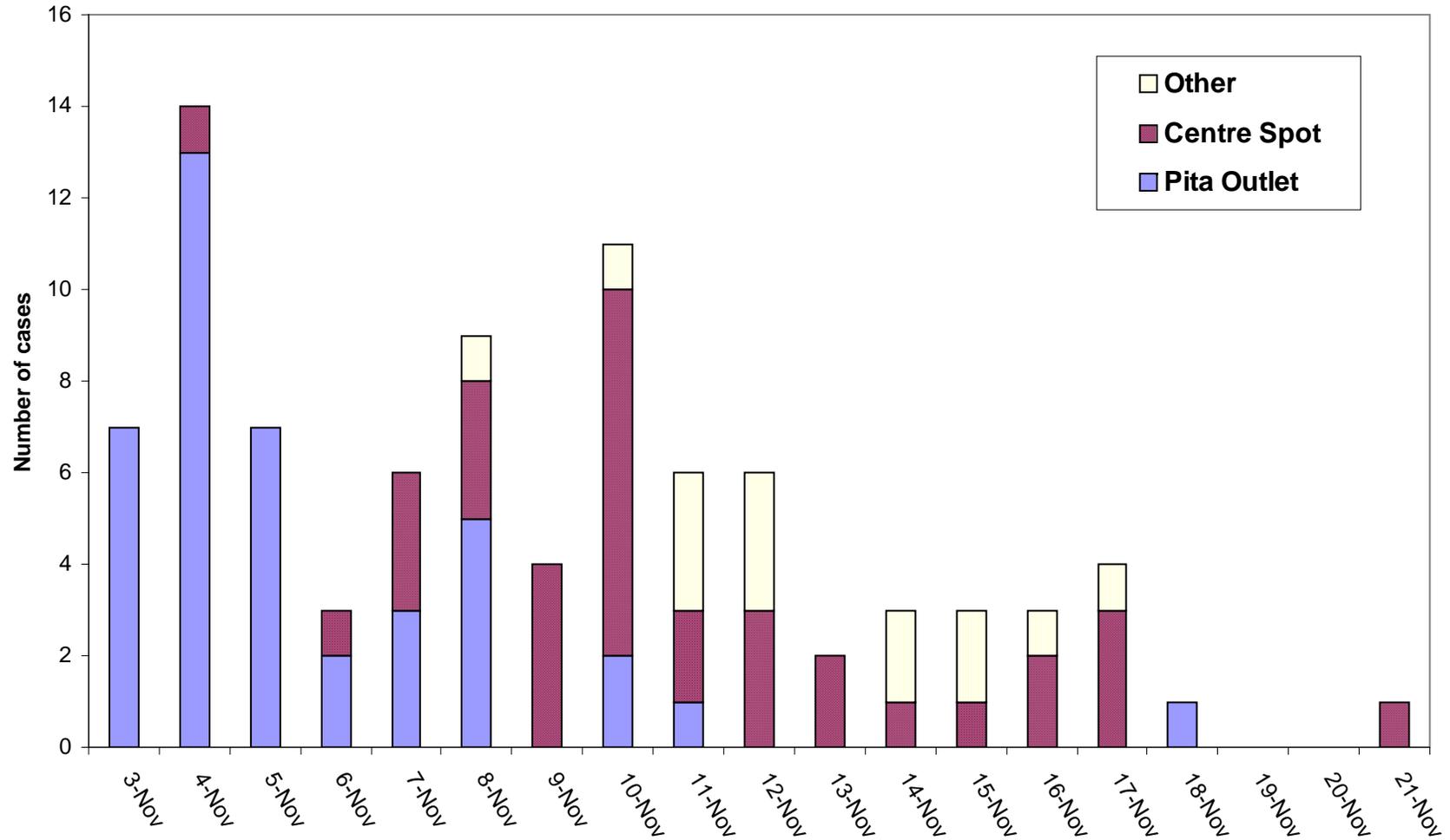
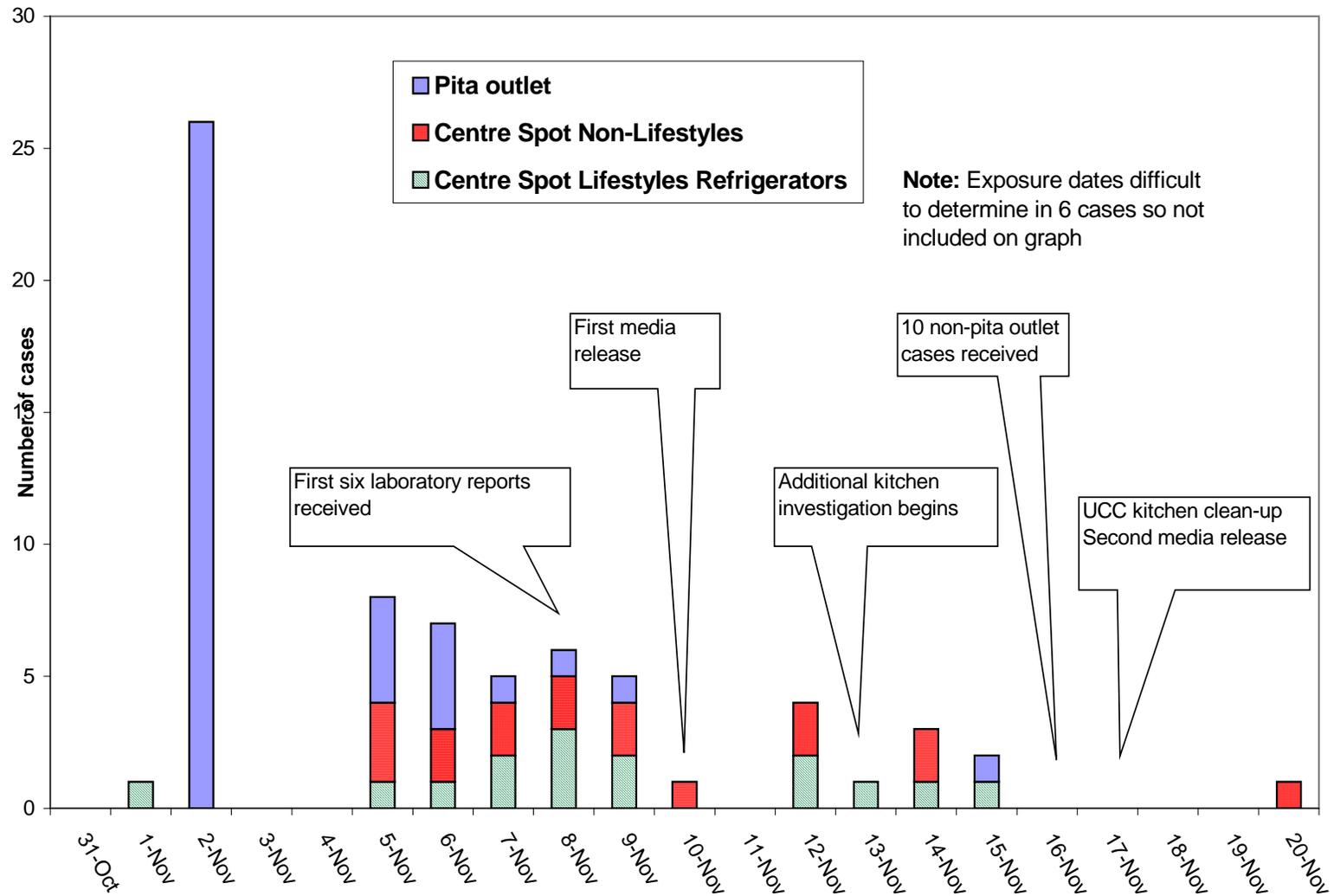


Figure 7

Exposure Dates Laboratory-Confirmed Cases Pita Outlet and Centre Spot



SECTION F

Inspection of the Kitchen at Centre Spot

F-1) Understanding the Processes	41
F-2) Recommendations to Improve Food Handling Practices	43

F. Inspection of the Kitchen at Centre Spot

Inspection activities at the Centre Spot kitchen evolved in stages as the epidemiology of the outbreak unfolded. Public Health Inspectors (PHIs) initially focused on food preparation at the pita outlet, but then broadened the scope of their inspection activities to include the remainder of the food outlets at Centre Spot and the Production Centre as the extent of the outbreak became apparent. At least 13 inspections were conducted from November 9 to November 23, most involving two PHIs. Inspections were conducted to understand the processes at Centre Spot and how these may have contributed to the outbreak, and to make recommendations to improve the food handling practices.

F-1) Understanding the Processes

The following processes were investigated during the inspections of Centre Spot:

Sources of food for the pita outlet: It was determined that all the fresh produce used at the pita outlet was also distributed to many other food premises both on and off campus. The meats for the pita outlet were produced specifically for the pita outlet and distributed to many other pita outlets belonging to the same franchise.

Chicken: Given that chicken from the pita outlet was eaten by several cases, the process related to its preparation was assessed. It was noted that the chicken served at the pita outlet arrived at the Centre Spot kitchen pre-cooked. It was then thawed, chopped, reheated in an oven and held hot until served. Samples of the chicken taken from the pita outlet on November 9 (one week after the exposure date for most cases) did not grow *Salmonella*; however, *Bacillus cereus* (a bacteria that can cause the rapid onset of vomiting and/or diarrhea if present in food in sufficient quantities) was identified, indicating that bacteria could be introduced into the chicken and grow during the processing.

Once it was determined that the outbreak extended beyond the pita outlet to involve other areas of the Centre Spot kitchen, investigations expanded to look at additional sources of chicken at Centre Spot. This was done both because chicken is a common cause of salmonellosis and because the Ministry of Health and Long-Term Care identified chicken as the most commonly consumed food in their investigation of the provincial increase in *Salmonella typhimurium* cases that was occurring in 2007 at the time of the UWO outbreak.

It was determined that, although other food outlets served chicken, most received their chicken precooked, as was the case with the pita outlet. However, it was noted that the food outlet adjacent to the pita outlet used raw chicken to prepare its dishes. The raw chicken was received frozen and then thawed in a large walk-in refrigerator in the basement below the main Centre Spot serving area and kitchen. This refrigerator was also used to store fresh produce. The chicken and fresh produce were physically and laterally separated in the refrigerator. However, there was a possibility of cross-contamination when thawing chicken was placed on carts alongside the produce for transport upstairs to the main kitchen. It was noted that the plastic bags containing the chicken were not sealed, and PHIs observed the chicken juices dripping onto the fresh produce in the refrigerator and off of the carts. This could have resulted in environmental contamination when chicken was transported to the Centre Spot kitchen. The hands of

food handlers who touched the chicken or the cart may also have contaminated the environment if they did not wash their hands adequately after touching those items. Once in the Centre Spot kitchen, the chicken was cooked in large woks located close to the pita outlet.

Two samples of raw, thawed chicken from the food outlet adjacent to the pita outlet were sent for testing on November 18, almost two weeks after the beginning of the outbreak. One sample was positive for *Salmonella heidelberg*, which is a another serotype of *Salmonella*, and the other was negative. This chicken was from a different batch than would have been present in the Centre Spot kitchen at the time of the outbreak.

Preparation of the pitas: The pitas at the pita outlet were prepared at one of two counters. At each counter, three to four food handlers loaded the meats, vegetables, cheeses and sauces onto the pita, then folded and wrapped the pita into a paper wrap. It was noted that the pitas were not placed onto paper until the very end of the process; rather during preparation they were pushed along the elongated, white cutting board from one handler to another. The white cutting board was wiped down with a dry cloth and not frequently sanitized.

Production Centre and Lifestyle Refrigerators: The Production Centre was a complex operation whereby a large variety of sandwiches, pitas and salads were made for Lifestyle Refrigerators across campus. As mentioned, the Production Centre used the serving counters and kitchen at Centre Spot each night. Two different teams of Production Centre staff worked each night; one produced regular sandwiches and salads while the other produced more elaborate “specialty” sandwiches. Some of the vegetables for the Production Centre and the food outlets at Centre Spot were cut up by the same staff member in the Centre Spot kitchen. Detailed records of the types of salads and sandwiches sent to each campus location are maintained by Production Centre staff members. The salads and sandwiches stayed in the Lifestyles Refrigerators for one to two days after which they were discarded if unsold. In addition to products for Lifestyles Refrigerators, baked goods for coffee and donut-style outlets across campus were made at Centre Spot each evening, using the covered pita outlet counters for cooling of the baked products as they came out of the oven.

The space and lay-out of the kitchen: Figure 4 (page 24) provides a diagram of the layout of Centre Spot. The physical space of the Centre Spot kitchen was noted to be very small given the large volume and complexity of the food preparation operations. This meant that many of the counters had multiple uses including the food preparation for the overnight Production Centre. This multiple use increased the potential and likelihood for cross-contamination (food becoming contaminated by other food via the environment, equipment or utensils). In addition, the areas designated for personal use by staff were small and were being used to store packaged food products.

Shipping and receiving: The baked goods, sandwiches and salads were shipped from the shipping / receiving area of Centre Spot to the 14 buildings across campus with food outlets and Lifestyles Refrigerators. In addition, some of the franchises delivered their goods to the shipping and receiving areas of Centre Spot and these were then transported from there to the various buildings across campus.

F-2) Recommendations to Improve Food Handling Practices

Given the large number of inspections that were conducted, and the complexity of the operations at Centre Spot, it was expected that several areas for improvement would be identified. The following describes the recommendations that were made based on the inspections at Centre Spot.

Recommendations to prevent cross-contamination: Food becoming contaminated from other food via the environment, equipment or utensils is referred to as cross-contamination. To prevent cross-contamination, the following recommendations were made:

- Remove all sources of raw chicken from Centre Spot and replace it with pre-cooked, frozen chicken that is reheated from the frozen state;
- Place the pitas on wax paper as they are being prepared so they do not come in contact with the preparation surface;
- Ensure utensils are not washed in the sink that is intended to wash raw produce;
- Discard permanently stained, worn plastic cutting boards that may be more difficult to clean including the white cutting boards at the pita outlet. Wash, rinse and sanitize cutting boards after each use;
- Ensure proper sanitation of serving utensils;
- Allow dishes to air dry and do not wipe with a dish towel;
- Regularly sanitize all surfaces with appropriate concentration of disinfectant;
- Regularly sanitize all bins used to transport food from one location to another;
- Install additional hand wash sinks / waterless hand wash stations as needed so that these are available in close proximity to where food is handled or prepared;
- Review at which steps hand washing is required in the process of handling / preparing food;
- Ensure dishwashers are reaching appropriate temperatures.

Recommendations with regard to temperature control: Storing hazardous foods at temperatures that are between 4 and 60^o C can increase the risk that pathogenic bacteria will grow in the food. Therefore, appropriate temperature control is required for refrigerators and hot holding units. To achieve appropriate temperature control, the following recommendations were made:

- Ensure all thermometers are properly calibrated;
- Ensure that staff accurately record temperatures of all refrigerators and respond as required when refrigerator temperature logs indicate elevated temperatures;
- Ensure maintenance or replacement of all refrigerator units that are not maintaining appropriate temperatures.

All of the recommendations made by the MLHU were quickly implemented by UWO. In addition, based on the above recommendations and the review of their operations, UWO proceeded with the following modifications:

- Simplification of the food preparation processes by moving the Production Centre operation from Centre Spot to a less busy kitchen on campus;
- Closing the Centre Spot area for 15 minutes each afternoon to allow extra time for cleaning and sanitization of work surfaces;

- Enhanced food handler training for all staff members and use of a checklist reminder system;
- Review and audit of Centre Spot and other campus food outlets by several groups including an external third party with expertise in this area as well as other UWO hospitality managers;
- Modifications to the dishwashing area, food storage areas and staff locker rooms;
- Installation of automatic cleaning dispensers for disinfecting solutions and alcohol-based hand sanitizer stations.

SECTION G

Investigation of the Pita Outlet

G-1) Stool Cultures from Food Handler	47
G-2) Food and Environmental Samples.....	47
G-3) Comparing the Cases to Available Computerized Information Related to Purchases from the Pita Outlet on November 2, 2007	47
G-4) Case Control Epidemiologic Study Regarding the Pita Outlet	52

Tables

Table 4	November 2, 2007 Purchase Times for Cases with Meal Plans Compared to Non-Cases with Meal Plans.....	49
Table 5	November 2, 2007 Meals Purchased by Cases with Meal Plans Compared to Non-Cases with Meal Plans.....	50
Table 6	November 2, 2007 Meals Purchased by Cases Compared to Sales Records	51
Table 7	Age and Gender Distribution in the Pita Outlet Case-Control Study	54
Table 8	Time of Food Purchases from Pita Outlet Comparing Questionnaire Cases and Questionnaire Controls	54
Table 9	Counter Used to Prepare Pitats at the Pita Outlet.....	55
Table 10	Food Items that Were (or Almost Were) Statistically More Likely to be Eaten by Cases than Controls.....	55

Figures

Figure 8	Exposure Dates for Pita Outlet, Laboratory-Confirmed and Non-Laboratory-Confirmed Cases.....	56
Figure 9	Exposure Dates for Pita Outlet, Laboratory-Confirmed and Non-Laboratory -Cases with Meal Plans	57

G. Investigation of the Pita Outlet

Aside from the inspections of the kitchen, several other investigations were undertaken to determine the cause of infections related to the pita outlet. These were as follow:

- Obtaining stool cultures from food handlers at the pita outlet;
- Obtaining food and environmental samples from the pita outlet;
- Comparing the cases to available computerized information related to purchases from the pita outlet on November 2, 2007;
- A case-control epidemiologic study.

Further details on these investigations are provided below.

G-1) Stool Cultures from Food Handlers

On November 10, 2007, a decision was made to test the stools of all the food handlers who had worked at or had some connection to the pita outlet on October 31, November 1 and November 2. These dates were felt to be the most likely dates of exposure based on the histories received as of November 10 from the laboratory-confirmed and non-laboratory-confirmed cases. This was done to determine if a food handler with *Salmonella* might have been the source of infection, which could have then spread during the preparation of food at the pita outlet. Twenty-four of 27 identified food handlers submitted stool samples. All were negative except for two. However, these two food handlers were not implicated as the source of this outbreak, as their symptoms developed on November 4 and 7, 2007, respectively, which was after November 2, the date of exposure for most of the pita outlet-related cases.

G-2) Food and Environmental Samples

Five food samples were taken from the pita outlet on November 9, 2007, during the first inspection. No *Salmonella* was identified in these five samples although the chicken was found to contain *Bacillus cereus*. There was also some evidence of bacteria on the tomatoes and lettuces. This is not an unexpected finding for raw produce. On November 13, 2007, an additional 35 food samples were taken from the pita outlet. All came back negative for *Salmonella* and other pathogens. It should be noted that all the food samples were collected a week or more after November 2, the date when most of the ill people ate at the pita outlet.

On November 13, 2007, a total of 14 swabs and samples were taken from environmental surfaces in the pita outlet and other areas of the Centre Spot kitchen. All of these were negative for *Salmonella* and other pathogens.

G-3) Comparing the Cases to Available Computerized Information Related to Purchases from the Pita Outlet on November 2, 2007

As can be seen from Figure 7 (page 39), November 2, 2007 is the date when most of the laboratory-confirmed cases ate at the pita outlet. An analysis of the laboratory-confirmed cases and non-laboratory-confirmed cases related to the pita outlet, as shown in Figure 8, further illustrates that November 2 is the most common date of exposure with a total

of 43 cases (26 laboratory-confirmed cases and 17 non-laboratory-confirmed cases) eating food from the pita outlet on that date.

It is also possible to look at the exposure dates based on the date of purchase using only meal plan data. Meal plan data from the pita outlet were available for October 31, November 1, November 2 and November 5. Meal plan data is a more reliable source of information than food histories, since it does not rely on the recall of the ill person. In total, 19 laboratory-confirmed and 8 non-laboratory-confirmed cases had a meal plan and purchased food from the pita outlet between October 31 and November 5. From Figure 9, it can be seen the vast majority of cases with a meal plan purchased their food from the pita outlet on November 2, 2007.

It should be noted that late in the afternoon on Fridays many of the food outlets in Centre Spot close, while the pita outlet and one or two other outlets remain open. The pita outlet represents approximately 24% of the total Centre Spot sales for Friday, November 2, 2007.

Since November 2 appears to be the date on which eating food from the pita outlet was associated with a large number of ill individuals, further analysis was done comparing the meal plan information for food purchased from the pita outlet on November 2 for those who got ill with those who did not report getting ill.

Table 4 compares the purchase times on November 2, 2007 between cases with meal plans compared to individuals with meal plans who did not report illness. From this table it can be seen that both laboratory-confirmed and non-laboratory-confirmed cases were more likely to purchase their meals between 2:00 and 4:00 p.m. on that day, compared to those who did not report illness. Almost 60% of the laboratory-confirmed cases purchased their food during this time period, compared to only 25.4% of the individuals who did not report illness (non-cases).

Table 5 compares the types of meals purchased by the cases with meal plans with those purchased by individuals with meal plans who did not report illness. From Table 5 it can be seen that the laboratory-confirmed cases (47%) and non-laboratory-confirmed cases (50%) were somewhat more likely to have purchased a pita containing chicken than the individuals who did not report illness (41.5%).

A similar analysis was done looking at the meals purchased by all cases who reported exposure on November 2, regardless of whether they had a meal plan or not (Table 6). This was compared with the total number of meal sales on November 2 according to the cash register data from Centre Spot. A total of 464 meals were sold from the pita outlet on November 2, 2007 – 444 pitas and 20 salads. This analysis illustrates that the laboratory-confirmed cases were somewhat more likely to purchase a pita containing chicken (52%) compared to the total percentage sales that were chicken pitas (40.7%), whereas 40% of the non-laboratory-confirmed cases purchased a chicken pita.

Tables 5 and 6 both illustrate that most of the cases purchased a pita, with only a few purchasing salads. This pattern reflects the general purchasing pattern based on both the analysis of the meal plan data (Table 5) and the analysis of sales records (Table 6).

Table 4: November 2, 2007 Purchase Times for Cases with Meal Plans Compared to Non-Cases with Meal Plans

Time	Laboratory-confirmed cases with meal plans Percent (Number) N = 17	Non-laboratory-confirmed cases with meal plan Percent (Number) N = 6	Non-cases with meal plans Percent (Number) N = 287
6:01 – 7:00 am	0	0	0.3% (1)
10:01 - 11:00 am	0	0	5.2% (15)
11:01 - 12:00	0	0	10.5% (30)
12:01 – 1:00 pm	11.8% (2)	0	11.8% (34)
1:01 – 2:00 pm	5.9% (1)	0	12.9% (37)
2:01 – 3:00 pm	29.4% (5)	50% (3)	12.9% (37)
3:01 – 4:00 pm	29.4% (5)	33.3 % (2)	12.5% (36)
4:01 – 5:00 pm	11.8% (2)	26.7 % (1)	9.8% (28)
5:01 – 6:00 pm	5.9% (1)	0	11.8% (34)
6:01 – 7:00 pm	5.9% (1)	0	10.8% (31)
7:01 – 8:00 pm	0	0	1.4% (4)

Note: One non-laboratory-confirmed case who purchased two meals on November 2 and meals on several other days was excluded from the analysis; one non-laboratory-confirmed case who purchased two of the same meal at the same time was counted only once; the other meal was excluded from the analysis.

Table 5: November 2, 2007 Meals Purchased by Cases with Meal Plans Compared to Non-Cases with Meal Plans

Type of pita / salad consumed by cases who had meal plans	Laboratory-confirmed cases with meal plans Percent (Number) N = 17	Non-laboratory-confirmed cases with meal plans Percent (Number) N = 6	Non-cases with meal plans Percent (Number) N = 287
Chicken pita	47% (8)	50% (3)	41.5% (119)
Souvlaki pita	11.8% (2)	16.7% (1)	12.2% (35)
Tuna pita	5.9% (1)	0% (0)	0.3% (1)
Turkey pita	5.9% (1)	0% (0)	3.5% (10)
Garden pita	5.9% (1)	0% (0)	1.0% (3)
Falafel pita	5.9% (1)	16.7% (1)	7.0% (20)
Black forest ham pita	5.9% (1)	0% (0)	0.7% (2)
Chicken Caesar salad	11.8% (2)	0% (0)	1.0% (3)
Garden salad	0% (0)	16.7% (1)	1.4% (4)
ALL SALADS	11.8% (2)	16.7% (1)	3.8% (11)
ALL PITAS	88.2% (15)	83.3% (5)	96.2% (276)

Note: Only for meals purchased by laboratory-confirmed and non-laboratory-confirmed cases with meal plans – other meals excluded from the table.

Note: One non-laboratory-confirmed case who purchased two meals on November 2 and meals on several other days was excluded from the analysis; one non-laboratory-confirmed case who purchased two of the same meal at the same time was counted only once; the other meal was excluded from the analysis.

Table 6: November 2, 2007 Meals Purchased by Cases Compared to Sales Records

Type of Pita / Salad Consumed by Cases	Laboratory-confirmed cases	Non-laboratory-confirmed cases	Sales records for Salads and Pitas
	Percent (Number)	Percent (Number)	Percent (Number)
	N = 25	N = 15	N = 464
Chicken pita	52% (13)	40% (6)	40.7% (189)
Souvlaki pita	12% (3)	6.7% (1)	11.4% (53)
Tuna pita	8% (2)	0% (0)	1.1% (5)
Turkey pita	8% (2)	6.7% (1)	4.1% (19)
Garden pita	8% (2)	6.7% (1)	2.2% (10)
Falafel pita	4% (1)	13.3% (2)	6.9% (32)
Black forest ham pita	0 % (0)	6.7% (1)	1.5% (7)
Chicken Caesar salad	4% (1)	0% (0)	1.5% (7)
BLT pita	4% (1)	0% (0)	2.8% (13)
Philly steak pita	0% (0)	6.7% (1)	3.9% (18)
Club pita	0% (0)	6.7% (1)	2.8% (13)
Garden salad	0% (0)	6.7% (1)	0.2% (1)
ALL SALADS	4% (1)	6.7% (1)	4.3 % (20)
ALL PITAS	96% (24)	93.3% (14)	95.7% (444)

Note: Only for meals purchased by laboratory-confirmed and non-laboratory-confirmed cases - other meals excluded from table.

Note: One laboratory-confirmed case who did not have a meal plan did not remember what they had purchased, so excluded from the analysis. On non-laboratory-confirmed case ate twice on that date as well as on several additional days, so excluded from the analysis. One non-laboratory-confirmed case without a meal plan was uncertain of type of pita purchased, so excluded from analysis. One non-laboratory-confirmed case who purchased two of the same meal at the same time was counted only once.

G-4) Case-Control Epidemiologic Study Regarding the Pita Outlet

To gain a better understanding of the cause of the outbreak at the pita outlet, a case-control study was conducted. This methodology involves comparing people who had *Salmonella* or symptoms compatible with *Salmonella* (cases) with people who did not develop *Salmonella* symptoms (controls). The cases are asked about their exposures during the incubation period, and the controls are asked about their exposures during the same time period.

The case-control study was conducted using a web-based questionnaire developed by the MLHU, which was adapted for online completion using technology developed by UWO. The questionnaire focused on individuals who ate food from the pita outlet on October 31, November 1, 2 and 5, as these were the dates originally implicated by most laboratory-confirmed cases related to the pita outlet. People who ate at the pita outlet on those dates were asked to complete the online questionnaire. These individuals were recruited using a mass email that was sent to all UWO students and staff; a posting on the UWO web site; information distributed to the media, including UWO-based newspapers, and signs posted at the pita outlet in Centre Spot.

Interested participants were directed from an introductory web page to two different questionnaires. One questionnaire was for those who had been ill (see Appendix C for the case questionnaire), and a second questionnaire contained questions for those who had not developed a diarrheal illness (see Appendix D for control questionnaire). In total, approximately 30,000 students and 3,500 staff members were sent information about the online questionnaire via the mass email. The questionnaire was launched on Thursday, November 22 at approximately 12:00 pm, and was available for completion until 11:55 pm on Monday, November 26.

During the period of time when the online questionnaire was “live”, there were 689 total hits to the introductory web page. For the case questionnaire, 240 individuals logged in, whereas 225 individuals logged in to the control questionnaire. Following data cleaning, including exclusion of cases not meeting the case definition, those who had logged into the questionnaire but did not enter any information, and people who had already been reported to the MLHU as either laboratory-confirmed or non-laboratory-confirmed cases, there were 86 questionnaire cases and 118 questionnaire controls.

Three types of comparisons were conducted using different groups of cases and comparing each to controls who completed the questionnaire (questionnaire controls).

- **Analysis 1 - Laboratory-confirmed cases.** The 32 laboratory-confirmed cases who ate at the pita outlet on October 31, November 1, November 2 or November 5 and became ill within 3 days of this exposure and developed 3 or more episodes of diarrhea in a 24-hour period were compared to 96 questionnaire controls.
- **Analysis 2 - Clinical cases.** The 22 non-laboratory-confirmed cases who ate at the pita outlet on October 31, November 1, November 2 or November 5 and became ill within 3 days of this exposure and developed 3 or more episodes of diarrhea in a 24-hour period were compared to 66 questionnaire controls.

- **Analysis 3 - Questionnaire cases.** The 86 cases identified from the online questionnaire who ate at the pita outlet on October 31, November 1, November 2 or November 5, became ill within 3 days of this exposure and developed 3 or more episodes of diarrhea in a 24-hour period were compared to 118 questionnaire controls.

For some questions, particularly those about the meals eaten from the pita outlet, analysis 1, 2 and 3 were conducted. However, some questions were only asked in the case-control study and so only information from analysis 3 is available.

Table 7 illustrates the age and gender distribution of the three types of cases and the controls from the case-control study. The age distribution is similar for all types of cases and for controls due to the fact that the outbreak and study mainly involved students. For each group of cases, there were more females than males, possibly because women are more likely to choose pita and salad meals than men. However, significantly more questionnaire controls were female, indicating women may be more likely to complete an online questionnaire.

For questionnaire cases, 39.5% of cases (30/76) had their most likely date of exposure on November 2, followed by November 1 (25%), November 5 (22.4%) and October 31 (13.1%). The most likely date of exposure could not be determined or was unavailable for 10 questionnaire cases.

Table 8 compares questionnaire cases to questionnaire controls with regard to the time of purchasing food from the pita outlet. From this analysis, there appears to be no difference between cases and controls in the time of food purchase. Contrary to the analysis of Table 4, questionnaire cases do not appear to have been more likely to have purchased their meals between 2:00 and 4:00 p.m.; however, the purchase times for the questionnaire cases relate to purchases from October 31, November 1, 2 and 5 and not exclusively from November 2, which is the analysis conducted in Table 4.

The questionnaire asked participants if they could recall which counter at the pita outlet was used to prepare their pita. Table 9 summarizes the results. Although 23% of both questionnaire cases and controls could not recall at which counter their pita had been prepared, cases were more likely to be served at the left counter (66% of cases compared to 54% of controls). Relatively few questionnaire cases recalled receiving their pita from the right counter (11% of questionnaire cases were served from the right counter compared to 66% from the left counter).

The analysis also showed that between October 31 and November 5, questionnaire cases were more likely to eat two or more meals from the pita outlet (29 of 86 questionnaire cases, 34%) compared to questionnaire controls (15 of 118 questionnaire controls, 13%).

Analysis 1, 2 and 3 all compare the foods eaten by the various groups of cases compared to controls. Appendix E provides details of these analyses. Table 10 summarizes the food items that were statistically more likely (or very close to being statistically more likely) to be eaten by the ill people (cases) than the people who did not develop symptoms (controls). The “unmatched odds ratio” in the table indicates how many times more likely the cases were to have eaten each food compared to the

controls. The 95% confidence interval is a statistical concept that indicates that there is 95% certainty that the odds ratio falls within that range.

It should be noted that there were several ways to purchase chicken from the pita outlet. The chicken breast pita, chicken Caesar pita (chicken breast and bacon) and chicken Caesar salad all contained the same type of chicken prepared in the same manner and at the same time. In analysis 1 and 2 involving the laboratory-confirmed and non-laboratory-confirmed cases, the chicken breast pita and chicken Caesar pita are combined into a category called “Chicken, any pita”, whereas the types of chicken pitas are separated out for the questionnaire cases and controls. Table 10 indicates that in several analyses the chicken used in the chicken breast pita, chicken Caesar pita and chicken Caesar salad was more likely to have been eaten by the cases than the controls.

Table 7: Age and Gender Distribution in the Pita Outlet Case-Control Study

	Lab-Confirmed Cases	Clinical Cases	Questionnaire Cases	Questionnaire Controls
AGE (years)	n= 32	n=19	n=82	n=116
Mean	20.7	19.8	21.2	22.2
Range	18-25	17-23	17-57	17-60
GENDER	n=32	n=22	n=86	n=116
Males	13 (40.6%)	7 (31.8%)	39 (45.3%)	35 (30%)
Females	19 (59.4%)	15 (68.2%)	47 (54.7%)	81 (70%)

Table 8: Time of Food Purchases from Pita Outlet Comparing Questionnaire Cases and Questionnaire Controls

	Cases n=86 Number (Percent)	Controls n=118 Number (Percent)
10:01-11:00 am	1 (1.2%)	6 (5.1%)
11:01-12:00	20 (23.2%)	23 (19.5%)
12:01-13:00 pm	17 (19.8%)	27 (22.9%)
13:01-14:00 pm	9 (10.4%)	21 (17.8%)
14:01-15:00 pm	8 (9.3%)	12 (10.2%)
15:01-16:00 pm	4 (4.6%)	3 (2.5%)
16:01-17:00 pm	11 (12.8%)	9 (7.6%)
17:01-18:00 pm	8 (9.3%)	10 (8.5%)
18:01-19:00 pm	4 (4.7%)	4 (3.4%)
Missing	4 (4.7%)	3 (2.5%)

Table 9: Counter Used to Prepare Pitas at the Pita Outlet

	Cases n=86 Number (Percent)	Controls n=118 Number (Percent)
Left counter	57 (66%)	64 (54%)
Right counter	9 (11%)	27 (23%)
Do not remember	20 (23%)	27 (23%)

Table 10: Food Items that Were (or Almost Were) Statistically More Likely to be Eaten by Cases than Controls

Analysis	Individual Food Exposure	Cases	Controls	Unmatched odds ratio	95% Confidence Interval
Analysis 1 Clinical cases vs. controls	Chicken (any pita)	18	33	2.64	1.2-6.05
Analysis 1 Clinical cases vs. controls	Cheddar cheese	22	46	2.39	1.02-5.58
Analysis 1 Clinical cases vs. controls	Any Chicken exposure (salad or pita)	18	37	2.21	0.97-5.03
Analysis 3 Questionnaire cases vs. controls	Chicken (any pita)	45	42	1.99	1.13-3.50
Analysis 3 Questionnaire cases vs. controls	Chicken Breast	30	21	2.5	1.3-4.7
Analysis 3 Questionnaire cases vs. controls	Any Chicken (salad or pita)	50	46	2.17	1.23-3.83

Figure 8

Exposure Dates for Pita Outlet Laboratory Confirmed and Non-laboratory-Confirmed Cases

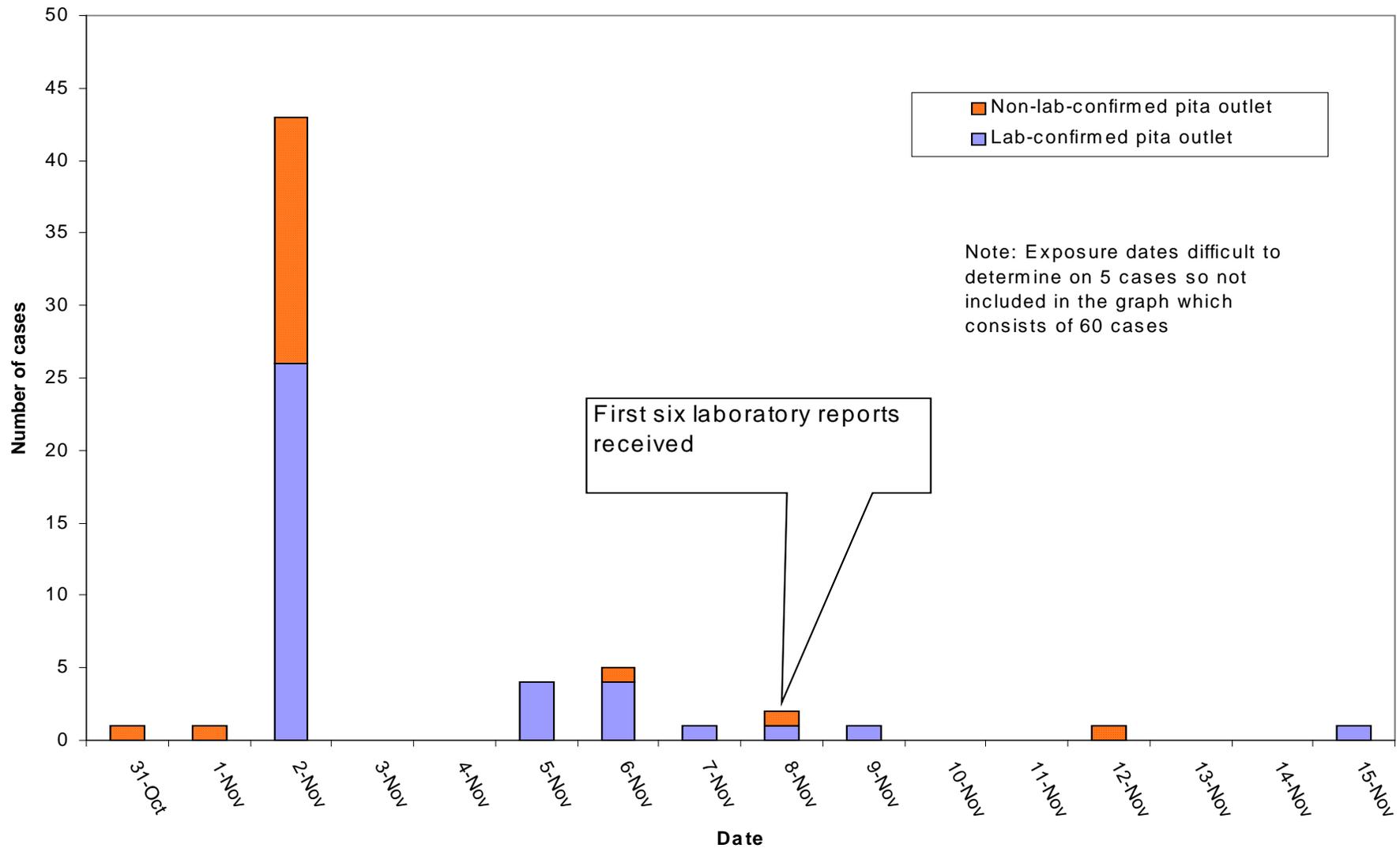
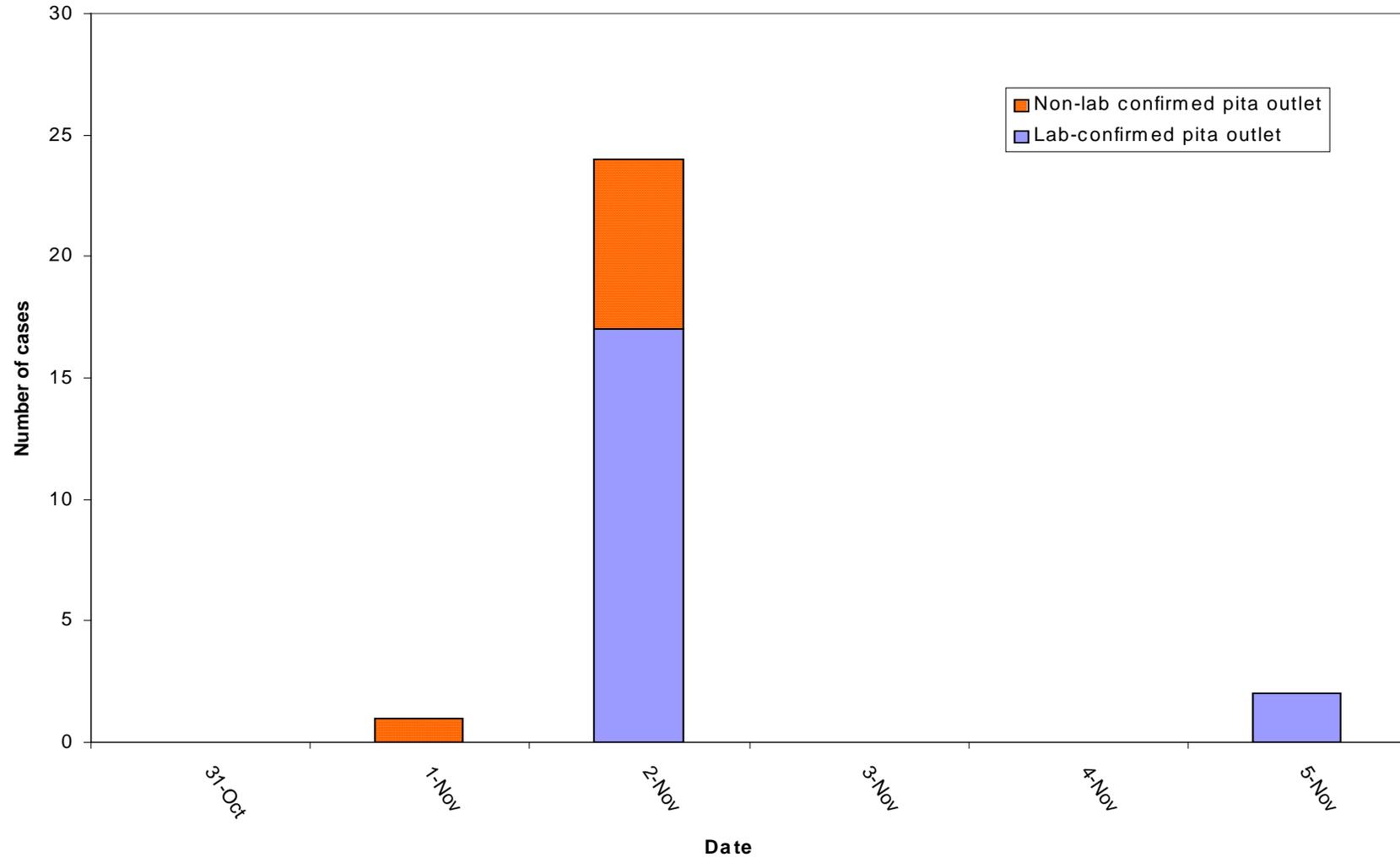


Figure 9

Exposure Dates for Pita Outlet Laboratory Confirmed and Non-Laboratory-Confirmed Cases with Meal Plans



SECTION H

Case-Control Epidemiologic Study Regarding the Consumption of Centre Spot Prepared Food

Tables

Table 11	Age and Gender Distribution in Centre Spot Case-Control Study	60
Table 12	Comparison of Cases and Controls who Regularly Eat Centre Spot Prepared Food in Campus Case-Control Study.....	61

H. Case-Control Epidemiologic Study Regarding the Consumption of Centre Spot Prepared Food

To gain a better understanding of the cause of the second phase of the outbreak, a case-control study was conducted to look at food consumption patterns in relation to food outlets on campus. Specifically, this study was designed to determine if people who developed illness compatible with *Salmonella* (cases) were more likely to eat foods prepared at Centre Spot than those who did not report illness (controls). Both the cases and controls were asked to indicate whether they regularly ate at each food outlet on campus.

This case-control study was conducted in a similar manner to the case-control study regarding the pita outlet. A web-based questionnaire was developed by the MLHU and adapted for online completion using technology developed by the UWO. Those who ate on campus were asked to complete the online questionnaire. These individuals were recruited using a mass email that was sent to all UWO students and staff, a posting on the UWO web site, and some information provided to the media. From the introductory web page, participants were directed to one questionnaire for those who had been ill (see Appendix F for the case questionnaire), and a second questionnaire contained questions for those who had not developed a diarrheal illness (see Appendix G for control questionnaire). In total, approximately 30,000 students and 3,500 staff members were sent information about the online questionnaire via the mass email. The questionnaire was launched in the evening of Wednesday, December 5, 2007, and was available for completion until 11:55 pm on Monday, December 10, 2007.

For the case questionnaire, 253 individuals logged in, whereas 1,053 individuals logged into the control questionnaire. Following data cleaning, including exclusion of cases not meeting the case definition, those who had logged into the questionnaire but had not entered any information or had not entered key pieces of information, there were 102 questionnaire cases and 878 questionnaire controls.

Table 11 illustrates the age and gender distribution of cases and controls in this study. The age distribution indicates the questionnaires were predominantly completed by students. For the cases and controls, 70% and 74% respectively of those completing the survey were women, indicating that women may be more likely to complete an online questionnaire than men.

Appendix H provides the detailed analysis comparing the food consumption patterns between cases and controls for all food outlets on campus. There were seven outlets where cases were statistically more likely to regularly eat than controls, and one outlet that almost reached statistical significance. Of these eight outlets, six had obvious connections to Centre Spot (two Lifestyles Refrigerators, one of which is located at Centre Spot; and four food outlets at Centre Spot). These are summarized in Table 12. It can be seen from this table that cases were statistically more likely to regularly eat food from Centre Spot locations than controls.

Of the other two outlets that were not located at Centre Spot and were not Lifestyles Refrigerators, one was a coffee outlet located in the Business School; however, baked goods for this outlet are produced at Centre Spot and cooled on the covered counter at the pita outlet. It should be noted that there are several outlets of the same chain across

campus, all of which receive baked goods from Centre Spot; only the Business School and Centre Spot outlets were statistically more likely to be locations where cases regularly ate. The remaining outlet was a coffee outlet from a different chain. Food from this outlet was not produced at Centre Spot.

Table 11: Age and Gender Distribution in Centre Spot Case-Control Study

	Questionnaire Cases	Questionnaire Controls
AGE (years)	n = 102	n = 878
Mean	21.9	20.7
Range	17–52	17–58
GENDER	n = 100	n = 846
Males	30 (30%)	212 (25.1%)
Females	70 (70%)	634 (74.0%)

Table 12: Comparison of Cases and Controls who Regularly Eat Centre Spot Prepared Food in Campus Case-Control Study

	Questionnaire Cases (n=102)	Questionnaire Controls (n=878)	Unmatched Odds Ratio	95% Confidence Interval
LIFESTYLES REFRIGERATORS				
Althouse	0	6 (0.7%)	--	--
Elborn	1 (1.0%)	1 (0.1%)	8.68	0.54–139.89
Engineering	0	3 (0.3%)	--	--
Law	2 (2.0%)	4 (0.5%)	4.37	0.79–24.16
Medical Science	0	10 (1.1%)	--	--
Natural Science – Einstein’s	2 (2.0%)	47 (5.4%)	0.35	0.09–1.48
Natural Science – Nucleus	6 (5.9%)	34 (3.9%)	1.55	0.64–3.79
North	1 (1.0%)	11 (1.3%)	0.78	0.10–6.11
Business	3 (2.9%)	4 (0.5%)	6.62	1.46–30.01
Social Science	5 (4.9%)	24 (2.7%)	1.83	0.68–4.92
Somerville	3 (2.9%)	25 (2.8%)	1.03	0.31–3.49
Talbot	2 (2.0%)	25 (2.8%)	0.68	0.16–2.92
Centre Spot	10 (9.8%)	32 (3.6%)	2.87	1.37–6.04
Weldon Library	1 (1.0%)	19 (2.2%)	0.45	0.06–3.38
Westminster	0	0	--	--
ANY LIFESTYLES	27 (26.5%)	177 (20.2%)	1.43	0.89–2.28
CENTRE SPOT				
Sushi outlet	4 (3.9%)	27 (3.1%)	1.29	0.44–3.75
Soup	3 (2.9%)	11 (1.3%)	2.39	0.66–8.71
Smoothie outlet	2 (2.0%)	21 (2.4%)	0.82	0.19–3.53
Hamburger outlet	17 (16.7%)	116 (13.2%)	1.31	0.75–2.29
Lifestyles	10 (9.8%)	32 (3.6%)	2.87	1.37–6.04
Chinese food outlet	14 (13.7%)	108 (12.3%)	1.13	0.62–2.06
Pita outlet	40 (39.2%)	113 (12.9%)	4.37	2.80–6.81
Pizza outlet	16 (15.7%)	86 (9.8%)	1.71	0.96–3.06
Salad outlet	20 (19.6%)	70 (8.0%)	2.82	1.63–4.86
Coffee and donut outlet Main level	40 (39.2%)	255 (29.0%)	1.58	1.03–2.41
Coffee and donut outlet Lower level	14 (13.7%)	145 (16.5%)	0.80	0.45–1.45
Coffee and donut outlet Another chain	9 (8.8%)	56 (6.4%)	1.42	0.68–2.97
ANY CENTRE SPOT	80 (78.4%)	499 (56.8%)	2.76	1.69 - 4.51

SECTION I

Communications

Table

Table 13	Summary of Media Interactions by Date	64
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I. Communications

Communication is a very important element of any outbreak response because the public and health care providers must be aware of the need to report illness and must be reassured that the outbreak is being appropriately managed. Audiences in this outbreak included the UWO community and the general public, local health care providers, and public health officials. Appendix A, which summarizes the chronology of the outbreak, includes the dates for many of the key communications. This information is summarized below. The frequent communications between the numerous organizations involved in the management of the outbreak will not be detailed in this report.

UWO Community and the General Public: A total of four media releases were issued by the MLHU over the course of the outbreak. The first media release was issued jointly with UWO (see Appendix B). All media releases were posted on the MLHU and UWO web sites. A total of 41 media interviews were conducted by MLHU staff; UWO staff participated in numerous other interviews. Table 13 provides a summary of the MLHU's media interactions by date.

Local Health Care Providers: Four email updates were provided to local health care providers via email listserves maintained by the MLHU and the Department of Family Medicine at UWO. Faxes to emergency departments and walk-in clinics were also sent on at least two occasions. Health care providers were advised of the progress of the outbreak, to collect stool samples on clients with compatible symptoms and to avoid treating clients with antibiotics in most cases. As well, frequent telephone communication occurred between the MLHU and Student Health Services at UWO, and MLHU and local hospitals where many of the ill students were being assessed in order to provide the MLHU with required information regarding these students.

Public Health Officials: At least three email updates were sent to all health units in Ontario. On November 14, 2007, the MLHU placed a posting on the Canadian Network for Public Health Intelligence, a confidential alerting system that advises public health officials across Canada of evolving outbreaks. On November 21, 2007, the outbreak was posted on ProMED, an electronic reporting system for outbreaks sponsored by the International Society for Infectious Diseases. ProMED postings go around the world to alert interested individuals of outbreaks and emerging infectious disease issues. To provide further details regarding the outbreak, the MLHU submitted information to ProMED that was posted on November 25, 2007. A further update was posted on November 27, 2007.

Table 13: Summary of Media Interactions by Date

Date	Print	Radio	TV	Total
11-Nov-07	1			1
12-Nov-07	1			1
13-Nov-07	1	2	1	4
14-Nov-07	1			1
16-Nov-07	1			1
17-Nov-07	1			1
19-Nov-07		1	1	2
20-Nov-07	1	4	5	10
21-Nov-07	1		2	3
22-Nov-07	2			2
23-Nov-07	2	3	1	6
24-Nov-07	1			1
27-Nov-07	2	1		3
28-Nov-07		1		1
07-Dec-07	2			2
11-Dec-07		1		1
12-Dec-07	1			1
Total	18	13	10	41

SECTION J

Discussion and Conclusions

J. Discussion and Conclusions

This outbreak resulted in 90 UWO students and staff members developing laboratory-confirmed *Salmonella*. All 90 laboratory-confirmed cases were the same strain, *Salmonella typhimurium* PT 108, PFGE STXAI.0312. Of note, this strain had been associated with an increase in provincial cases, which began in February 2007. Up to October 9, 2007, 198 laboratory-confirmed cases of *Salmonella typhimurium* PT 108, PFGE STXAI.0312 and PFGE STXAI.0344 (which were subsequently determined to be the same strain), had been identified in Ontario, including nine from Middlesex-London.

Of the 90 laboratory-confirmed cases at UWO, it was determined that 41 (45.6%) were related to exposure at the pita outlet, 35 (38.9%) were related to eating foods prepared at Centre Spot, but not at the pita outlet, and 14 (15.6%) were related to other types of exposures. Most of the initial cases were related to the pita outlet, with November 2, 2007 being the most commonly reported exposure date. In the following week from November 5-9, 2007, illness occurred mainly in relation to consumption of foods prepared at Centre Spot but not at the pita outlet. As awareness of the extent of the outbreak increased, the exposures resulting in illness decreased and only one laboratory-confirmed case reported an exposure that could have resulted in their illness after the thorough clean-up of the Centre Spot kitchen on the weekend of November 17-18, 2007.

It is estimated that in industrialized countries, as few as 1% of clinical cases come to the attention of public health as reported cases.¹ Based on this, it would be expected that significantly more than 90 individuals became ill as a result of this outbreak. Related to the pita outlet alone, the MLHU is aware of 22 non-laboratory-confirmed cases who developed symptoms compatible with *Salmonella* but either did not seek care or, if they sought care, in most instances, did not submit a stool culture. As well, another 86 individuals with illness compatible with *Salmonella* completed the online questionnaire related to the pita outlet.

Health care providers are key to outbreak recognition. In this outbreak, six laboratory-confirmed cases were received within one hour. This was clearly in excess of the average of three laboratory-confirmed cases the MLHU receives in most Novembers, and indicated from the start that an outbreak was occurring. However, groups of ill individuals were assessed at several health care facilities and the outbreak remained unreported until the laboratory confirmations began to arrive. As well, several individuals sought health care, and were not offered stool testing. Five of the 10 non-laboratory-confirmed cases who were not offered stool testing attended the same walk-in medical clinic.

The individuals affected by this outbreak were quite ill. There were seven laboratory-confirmed cases who required hospitalization. These individuals were hospitalized mainly for rehydration, although one individual developed appendicitis requiring urgent surgery. Sixty percent of the laboratory confirmed cases reported bloody diarrhea. For the 75 laboratory-confirmed cases where the frequency of bowel movements was reported, an average of 17 episodes of diarrhea was reported on their worst day. For the 37 laboratory-confirmed cases where duration of symptoms is known, the symptoms lasted from 3 to 21 days, with an average of 8 days. These numbers do not reflect the impact on students with regard to their academic work. Although UWO advisors worked

with students to accommodate their illness, students missed time from school and examinations, which in some cases needed to be caught up once they recovered.

In the investigation of this outbreak, the following working hypotheses were developed with regard to the source of this outbreak:

- The contaminated food was brought into the pita outlet from an outside supplier; or
- Food was contaminated at the pita outlet and subsequently the remainder of Centre Spot either through cross-contamination or from an infected food handler.

It appears unlikely that contaminated food from an outside supplier resulted in the cases attributed to the pita outlet as these foods were also distributed to many other food premises and/or pita outlets on and off campus which did not experience a similar outbreak. Furthermore, the detailed questioning of laboratory-confirmed and non-laboratory-confirmed cases and the case-control study related to the pita outlet did not identify a single food source that would explain all of the cases.

An infected food handler is not felt to be the likely source of this outbreak as testing of almost all the food handlers who worked at the pita outlet on October 31, November 1 and November 2 did not identify an obvious source. The two food handlers with connections to the pita outlet who had *Salmonella* got ill after the onset of the outbreak and appear to have acquired their infections as part of this outbreak. In total, there were 15 food handlers who developed salmonellosis as part of this outbreak from eating food from the pita outlet or other Centre Spot prepared food or from working in the Centre Spot environment. A few of these food handlers worked while they were ill for short periods of time, but it is difficult to determine if this resulted in spread of infection during the second phase of the outbreak from Centre Spot prepared food.

Given the extent of the outbreak related to Centre Spot, it appears more likely that the environment in the kitchen became contaminated from food within the Centre Spot kitchen. The handling of the raw chicken in areas adjacent to the pita outlet could have been a source of environmental contamination. Two weeks after the outbreak originated, a raw chicken from the Centre Spot kitchen was tested and found to have *Salmonella heidelberg*, highlighting that it is common for raw chicken to be contaminated with *Salmonella* strains.

The chicken from the pita outlet was implicated as a possible source of infection in several of the analyses (see Tables 5, 6 and 10). As well, there was evidence that bacteria could have been introduced and grown in the chicken because it was found to contain *Bacillus cereus* when tested on November 9, 2007. However, it should be noted that of the individuals with laboratory-confirmed illness who ate at the pita outlet on November 2, 12 of 26 (46%) did not report eating the chicken. Possible explanations for the association with the pita outlet chicken include that the chicken was contaminated; the tongs used to serve the chicken were contaminated; the person likely to serve or handle the chicken was infected or had *Salmonella* on his/her hands; or the location where the chicken pitas were prepared on the elongated cutting board was contaminated.

It was noted in the analysis of meal plan data related to November 2, 2007, that cases were more likely to have purchased their meals from 2:00 to 4:00 p.m. on that Friday afternoon, than those who were not reported to have been ill (see Table 4). At this time

of the afternoon only the left counter at the pita outlet was open. If the left pita counter had become contaminated, this would explain the clustering of illness in the 2:00 to 4:00 p.m. time period. A food handler with *Salmonella* on their hands working during this time frame at the left counter could also explain this finding. The case-control study did indicate that questionnaire cases who could recall which counter prepared their meal, were more likely to have been served from the left counter (see Table 9). Pitas were placed directly on these counters while being prepared and were slid from one food handler to another. Recommendations were made to UWO to replace these counters, to enhance sanitization of the pita preparation surfaces, to place the pitas on wax paper while being prepared and to increase hand washing.

It is uncertain why the contamination first appeared in relation to the pita outlet and subsequently in other Centre Spot prepared food. It is possible that a surface within Centre Spot became contaminated. This contamination then spread to the pita outlet, and in the following week to other areas of the Centre Spot kitchen, possibly on the hands of staff members who worked at various food outlets during each shift. The exact source of contamination and sequence of spread is unlikely to be fully understood, even with the investigations and analyses outlined in this report. It is quite possible that multiple events occurred to contribute to widespread contamination.

This outbreak illustrates the significant impact of a food borne outbreak when it affects a complex operation which serves a large number of people. The investigation of the kitchen at Centre Spot resulted in the recommendations outlined in Section F. In addition, it is recommended that health care providers be encouraged to obtain stool specimens whenever clients present with diarrhea. Clinicians should also be alert to clusters of clients presenting with similar symptoms and report suspicions of outbreaks to public health.

It is hoped that the investigations related to this outbreak and subsequent changes that resulted will aid in the prevention of future outbreaks at UWO and other similar establishments.

SECTION K

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K. Acknowledgements

We would like to acknowledge all the effort and invaluable assistance that went into the investigation of this outbreak by many individuals including:

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London Hospitals

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Thanks to all the individuals that conducted the stool cultures and determined the presence of *Salmonella* at the laboratories in London.

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National Microbiology Laboratory

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SECTION L

Appendices

Appendix A: Detailed Chronology of the Outbreak	75
Appendix B: Media release “ <i>Salmonella</i> Cases linked to food outlet”	79
Appendix C: Questionnaire for Ill individuals (Case Questionnaire) in Pita Outlet Case-Control Study	80
Appendix D: Questionnaire for Well Individuals (Control Questionnaire) in Pita Outlet Case-Control study	88
Appendix E: Detailed Food Analysis from Pita Outlet Case-Control Study.....	93
Appendix F: Questionnaire for Ill Individuals (Case Questionnaire) for Campus Consumption Case-Control Study.....	102
Appendix G: Questionnaire for Well Individuals (Control Questionnaire) for Campus Consumption Case-Control Study	110
Appendix H: Detailed Food Outlet Analysis from Campus Consumption Case-Control Study.....	115

Appendix A

Detailed Chronology of the Outbreak

Date	Event
Thursday November 8, 2007	<ul style="list-style-type: none"> • 6 laboratory-confirmed cases of <i>Salmonella</i> received within one hour. • Investigation by that evening revealed two of three clients contacted had eaten at pita outlet located at the University of Western Ontario (UWO), Centre Spot. Later that evening one additional laboratory-confirmed case was contacted who also reported eating at the pita outlet. • 12 people with gastrointestinal symptoms identified by emergency department; 4 were reached; 2 were UWO students and 1 ate at pita outlet. • Pita outlet not scheduled to reopen until 10:00 a.m. November 9, 2007; Advised not to reopen until cleared by Public Health Inspector.
Friday November 9, 2007	<ul style="list-style-type: none"> • 1 additional laboratory-confirmed case received for a total of 7 laboratory-confirmed cases. • Pita outlet inspected. No products on site from November 2, 2007. Cleared to re-open after inspection. • 5 food samples taken from pita outlet. • By the end of the day, 5 laboratory-confirmed cases of salmonella reached, 4 reported eating at pita outlet.
Saturday November 10, 2007	<ul style="list-style-type: none"> • First media release issued indicated 6 of 7 cases reached with 5 reporting eating at pita outlet, also 2 non-laboratory-confirmed cases reported eating at pita outlet. • Email and fax notices sent to Middlesex-London health care providers. • Posting on UWO and Middlesex-London Health Unit (MLHU) web site regarding outbreak. • Stool testing of food handlers associated with pita outlet on October 31, November 1 and November 2, 2007 requested. • Public Health Inspectors visit Centre Spot for further investigation. • By end of the day, aware of 2 additional laboratory-confirmed cases for a total 9 laboratory-confirmed cases. Had reached 8 of the cases of whom 7 report eating at pita outlet. Also aware of 6 non-laboratory-confirmed cases who reported eating at pita outlet. • Standardized questionnaire of all pita outlet menu items developed for interviewing cases.
Sunday November 11, 2007	<ul style="list-style-type: none"> • Received 3 additional laboratory-confirmed cases for a total of 12 laboratory-confirmed cases. Had reached 10 of these cases of whom 9 ate at pita outlet. • Received calls from 11 additional non-laboratory-confirmed cases with clinically compatible symptoms who ate at pita outlet, for a total 17 non-laboratory-confirmed cases who ate at pita outlet.

Date	Event
Monday November 12, 2007	<ul style="list-style-type: none"> ● Received at least 7 new laboratory-confirmed cases. ● Total of at least 19 laboratory-confirmed cases. 2 did not eat at the pita outlet and 2 were still under investigation. ● 1 of the laboratory-confirmed cases reported eating a pita from a Lifestyles Refrigerator at Centre Spot. ● 1 non-laboratory-confirmed case called the after-hours line and reported eating a chicken focaccia sandwich from a Lifestyles Refrigerator in the Engineering Building. ● Possibility that outbreak extends beyond pita outlet first suggested that evening. ● Email update sent to Middlesex-London health care providers.
Tuesday November 13, 2007	<ul style="list-style-type: none"> ● Received 5 new laboratory-confirmed cases. ● Total of 24 laboratory-confirmed cases; 20 ate at pita outlet, 2 did not eat at pita outlet and 2 still under investigation. ● Intensive investigation of Centre Spot food preparation areas begins. ● 35 food samples obtained from pita outlet and 14 environmental swabs and samples obtained from pita outlet and Centre Spot.
Wednesday November 14, 2007	<ul style="list-style-type: none"> ● Received 3 new laboratory-confirmed cases. ● Total of 27 laboratory-confirmed cases; 23 who ate at pita outlet, 2 did not eat at pita outlet and 2 still under investigation. ● Public Health Inspectors on site at Centre Spot food preparation area. ● Laboratory confirms that isolates are <i>Salmonella typhimurium</i>. ● Posting on Canadian Network for Public Health Intelligence web site to alert public health officials across Canada.
Thursday November 15, 2007	<ul style="list-style-type: none"> ● Received 4 new laboratory-confirmed cases. ● Total of 31 laboratory-confirmed cases; 25 who ate at pita outlet, 2 did not eat at pita outlet and 4 still under investigation. ● Public Health Inspectors on site at UCC food preparation area.
Friday November 16, 2007	<ul style="list-style-type: none"> ● 11 new laboratory-confirmed cases received / investigated – 10 did not eat at pita outlet. ● Investigation of common elements between the 10 new laboratory-confirmed cases revealed that all had eaten food prepared at Centre Spot (either purchased from Centre Spot or purchased from food outlets on campus that received food prepared at Centre Spot). ● Centre Spot closed and intensive clean-up commenced in collaboration with Public Health Inspectors. ● Total of 42 laboratory-confirmed cases; 29 reported eating at pita outlet, 12 reported eating food prepared from Centre Spot but did not eat food from pita outlet, 1 still under investigation.

Date	Event
Saturday November 17, 2007	<ul style="list-style-type: none"> ● Second media release issued reporting second phase to outbreak related to food prepared at Centre Spot. ● Email and fax notices sent to Middlesex-London health care providers. ● Fall Preview at UWO with 7,000 people expected. Alternate arrangement made to obtain food for visitors. ● Public Health Inspectors on site at Centre Spot food preparation area to monitor clean-up. ● No new laboratory-confirmed cases received.
Sunday November 18, 2007	<ul style="list-style-type: none"> ● Arrival of Federal Field Epidemiologist from Public Health Agency of Canada. ● Joint inspection of Centre Spot food preparation area by MLHU and UWO. ● Thawing chicken observed in the refrigerator next to produce. 2 chicken samples submitted for laboratory testing. ● No new laboratory-confirmed cases received.
Monday November 19, 2007	<ul style="list-style-type: none"> ● Received at least 11 new laboratory-confirmed cases.
Tuesday November 20, 2007	<ul style="list-style-type: none"> ● Received 10 new laboratory-confirmed cases. ● Total of 63 laboratory-confirmed cases; 30 reported eating at pita outlet, 20 reported eating food prepared at Centre Spot but did not eat food from pita outlet, 13 still under investigation. ● Exposure date of last laboratory-confirmed case. ● Third media release issued with updated numbers. ● Laboratory confirmed molecular typing as <i>Salmonella typhimurium</i> PT 108, PFGE Pattern STXAI.0312 ● Received results of food and environmental samples. Five food samples from pita outlet on November 9 all negative, except for <i>Bacillus cereus</i> in chicken. All 14 environmental samples from November 13 negative. Of the food sample results available from November 13, all negative.
Wednesday November 21, 2007	<ul style="list-style-type: none"> ● Received 8 new laboratory-confirmed cases. ● Total of 71 laboratory-confirmed cases; 33 reported eating at pita outlet, 25 reported eating food prepared at Centre Spot but did not eat food from pita outlet, 13 classified as other exposures or still under investigation. ● Email update sent to Middlesex-London health care providers. ● First ProMED posting
Thursday November 22, 2007	<ul style="list-style-type: none"> ● Received 1 new laboratory-confirmed case. ● Total of 72 laboratory-confirmed cases; 34 reported eating at pita outlet; 28 reported eating food prepared at Centre Spot but did not eat from pita outlet, 10 classified as other exposures or still under investigation. ● Online pita outlet study began.

Date	Event
Friday November 23, 2007	<ul style="list-style-type: none"> ● Received 5 new laboratory-confirmed cases. ● Total of 77 laboratory-confirmed cases; 35 reported eating at pita outlet; 31 reported eating food prepared at Centre Spot but did not eat from pita outlet, 11 classified as other exposures or still under investigation.
Sunday November 25, 2007	<ul style="list-style-type: none"> ● Second ProMED posting – submitted by MLHU.
Monday November 26, 2007	<ul style="list-style-type: none"> ● Received 8 new laboratory-confirmed cases. ● Total of 85 laboratory-confirmed cases. ● Online pita outlet study closes at 11:55 pm. After data cleaning, a total of 84 individuals to be included in analysis as cases from the questionnaire and 118 individuals to be included as controls from the questionnaire.
Tuesday November 27, 2007	<ul style="list-style-type: none"> ● Third ProMED posting.
Tuesday December 4, 2007	<ul style="list-style-type: none"> ● Federal field epidemiologist goes home.
Wednesday December 5, 2007	<ul style="list-style-type: none"> ● Online study of the second phase of the outbreak begins.
Monday December 10, 2007	<ul style="list-style-type: none"> ● Online study of the second phase of the outbreak closes at 11:55. After data cleaning, total of 102 individuals to be included in analysis as cases from the questionnaire and 878 individuals to be included as controls. ● 5 laboratory-confirmed cases received between November 29 and December 10, 2007. Last laboratory-confirmed case received December 10, 2007. ● Total of 90 laboratory-confirmed cases; 41 reported eating at pita outlet; 35 reported eating food prepared at Centre Spot but did not eat from pita outlet, 14 classified as other exposures.
Tuesday December 11, 2007	<ul style="list-style-type: none"> ● Outbreak officially declared over. ● Fourth media release issued.
Wednesday – Friday December 12 – 14, 2007	<ul style="list-style-type: none"> ● Ministry of Health and Long-Term Care Epidemiologist on site.

Note: The number of new cases received per day may vary slightly from the above chronology

SALMONELLA CASES LINKED TO FOOD OUTLET

November 10, 2007

For Immediate Release

LONDON, ON - The Middlesex-London Health Unit has received seven laboratory reports of salmonella between November 8th and 9th, 2007. In all seven cases, those who have become ill are students at The University of Western Ontario. The Health Unit has been in contact with six of the ill students; five of them report having eaten at the Pita Pit located in the University Community Centre (UCC) on campus, on or around November 1st or 2nd, 2007. The same outlet was also named by two other students who have salmonella-like symptoms, but who do not have a laboratory-confirmed infection. The Pita Pit at the UCC has been thoroughly inspected by Health Unit staff and continues to operate. No food from November 2nd remains at the outlet.

Salmonella is a bacterial infection characterized by the sudden onset of headache, fever, abdominal pain, diarrhea which can be bloody, nausea and sometimes vomiting. The diarrhea begins six to 72 hours after the consumption of contaminated food or beverage. The infection can also be transmitted from person-to-person. The symptoms of salmonella usually last between four and seven days, and most people recover without antibiotic treatment. In some cases, the diarrhea can be severe, requiring hospitalization. Salmonella can lead to medical complications in the very young, the very old and those who have certain underlying medical conditions.

The Health Unit is advising students and staff at The University of Western Ontario who currently have symptoms compatible with salmonella to contact a health care provider. Students and staff who have been ill with diarrhea since November 2nd, 2007 are also advised to contact the Middlesex-London Health Unit at 519-663-5317 ext. 2330; or 519-675-7523 on weekends and after hours.

Because salmonella can be passed from an ill person to others, individuals suspected of having salmonella are advised not to prepare food for others. They should also not work as a food-handler, health care provider or child care provider until they have been symptom-free for at least 24 hours. Careful hand washing after using the washroom is recommended.

Media contact:

Dan Flaherty, Communications Manager, Middlesex-London Health Unit
519-663-5317 extension 2469 or 519-617-0570 (cell)

Dr. Tom Macfarlane, Director of Health Services, The University of Western Ontario
Phone number:

Spokesperson:

Dr. Bryna Warshawsky, Associate Medical Officer of Health, Middlesex-London Health Unit

www.healthunit.com



Questionnaire for Ill Individuals (Case Questionnaire) in Pita Outlet Case-Control Study

November 2007

Thank you for agreeing to complete this questionnaire. This is for people who DID not DEVELOP diarrhea AND ate food from Pita Pit on one or more of the following dates:

- ◆ Wednesday - October 31 (Halloween), and/or
- ◆ Thursday - November 1, and/or
- ◆ Friday - November 2, and/or
- ◆ Monday - November 5, 2007.

This questionnaire should take about 10 minutes to complete. Even though there are a lot of pages it should go quickly.

- 1) ONCE YOU COMPLETE A PAGE AND PRESS SUBMIT, DO NOT GO BACK.
- 2) IF YOU DON'T REMEMBER AN ANSWER AND THERE IS NO "I DO NOT REMEMBER" OPTION, JUST LEAVE IT BLANK.

All information will be kept confidential and used only to investigate the outbreak. If you have any questions, please contact the Middlesex-London Health Unit at 519-663-5317 ext. 2330; after hours at 519-675-7523.

Notice of Collection: The personal information on this form is collected under the legislated authority of the Health Protection and Promotion Act, R.S.O., 1990, as amended. It is collected for the purposes of investigating a community outbreak of salmonella and helping to prevent further transmission of illness in the community. For further information about the collection of this information or this investigation, contact the Infectious Disease Control team at 519-663-5317 extension 2330.

Personal Information

1. First Name:
2. Last Name:
3. Gender: Male Female
4. Date of birth (D/M/Y)
5. Street address (if you live off-campus)
6. Name of Resident (if you live on-campus)
7. City
8. Postal Code
9. Phone Number
10. Email address
11. What program/faculty/department at UWO are you enrolled in?

12. What was your FIRST symptom?
- Vomiting
 - Diarrhea
 - Nausea
 - Abdominal pain/cramps
 - Headache
 - Fever
 - Chills
 - Other, please specify
13. What was the date that your FIRST symptom started? (D/M/Y)
14. On the day of your FIRST symptom, what was the time that your first symptom started? (e.g., 9:30 am, 4:00 pm)
15. Which of the following symptoms did you experience? (Check all that apply)
- Vomiting
 - Diarrhea
 - Nausea
 - Abdominal pain/cramps
 - Headache
 - Fever
 - Chills
 - Other, please specify
16. What date did you begin to have DIARRHEA? (D/M/Y)
17. What time did you begin to have diarrhea (Please specify am or pm, for example 9:30 pm)?
18. Please indicate the number of times you had diarrhea over the worst 24 hour period.
19. Was the diarrhea bloody?
- Yes
 - No
 - Uncertain
20. Did you seek medical attention as a result of your illness (e.g, TeleHealth, Emergency Care, Family Physicians...)?
- Yes
 - No
 - Uncertain
21. Did you miss any school as a result of your illness?
- Yes
 - No
22. If you missed any school, how many days did you miss (please enter a number and not a word)?
23. Are you still feeling ill?

- Yes
- No
- Uncertain

24. If you are no longer feeling ill, on what date did your symptoms completely resolve?
(D/M/Y)

25. Did you seek care from a Family Physician/Nurse Practitioner (if known)?
Yes
No

26. Name of Family Physician/Nurse Practitioner (if known).

27. Name of clinic of Family Physician/Nurse Practitioner (if known).

28. Date of visit to Family Physician/Nurse Practitioner (D/M/Y).

29. Did you seek care from a hospital Emergency Department or Urgent Care Centre?
Yes
No

30. Name of the Emergency Department or Urgent Care Centre.

31. Date of visit to the Emergency Department or Urgent Care Centre. (D/M/Y)

32. Did you seek care from a Walk-In Clinic?
Yes
No

33. Name of the Walk-In Clinic.

34. Date of visit to the Walk-In Clinic. (D/M/Y)

35. Were you admitted to hospital?
Yes
No

36. Name of the hospital to which you were admitted.

37. Date of admission to this hospital.

38. How many days were you in the hospital? (please enter numbers)

39. Did you seek any other type of care?
Yes, please specify:
No

40. Did you provide a stool sample for lab analysis?
Yes

No

If you answered "YES," please provide details in the two questions below.

41. Date you dropped off the stool sample. (D/M/Y)

42. Results of the stool sample analysis (if known).

- Positive for Salmonella
- Negative for Salmonella
- Other, please specify
- I do not know

43. Did you eat AT LEAST ONE meal from Pita Pit on any of October 31, November 1, November 2 and/or November 5?

- Yes
- No

44. On what date did you eat your FIRST MEAL at Pita Pit?

- Wednesday, October 31 (Halloween)
- Thursday, November 1
- Friday, November 2
- Monday, November 5

45. At what approximate time did you purchase (as opposed to eat) this meal at Pita Pit (please specify am or pm, for example, 10:15 am)?

46. At which station was your food prepared?

- At the station on the left (closest to Manchu Wok)
- At the station on the right (closest to wall)
- I do not remember

47. When did you then eat this meal?

- Within one hour of purchase
- Between one and two hours after purchase
- Between two and four hours after purchase
- More than four hours after purchase

48. Did your meal include a pita?

- Yes
- No (or I do not remember) (if checked, you will go to page Meal 1 Salad Y/N)

49. What type of pita did you order for this meal?

- The assorted
- Black Forest Ham

- BLT
- Chicken Breast
- Chicken Caesar
- Club
- Dagwood
- Falafel
- Gyro
- Philly Steak
- Rib Fest
- Roast Beef
- Seafood
- Souvlaki
- Tuna
- Turkey
- Vegetarian (Garden)
- Other, please specify
- I don't remember

50. What toppings did you order for your pita? (check all that apply)

- Baba Ganoush
- Cucumbers
- Hummus
- Lettuce-Iceberg
- Lettuce-Romaine
- Lettuce-I do not remember which type
- Mushrooms
- Olives-black
- Olives-green
- Onions
- Peppers-green
- Peppers-hot
- Pickles
- Pineapple
- Tomatoes
- Other topping, please specify
- I do not remember
- I did not have any toppings

51. What sauce did you order for your pita? (check all that apply)

- Ancho chipotle
- BBQ sauce
- Balsamic dressing

- Caesar dressing
- Dijon mustard
- Greek dressing
- Honey mustard
- Hot sauce
- Italian dressing
- Mango habanera
- Mayonnaise
- Mustard
- Ranch dressing
- Secret sauce
- Teriyaki sauce
- Tzatziki
- Other sauce, please specify
- I do not remember
- I did not have any sauce

52. What type of cheese did you order for your pita? (check all that apply)

- Cheddar
- Feta
- Swiss
- Other, please specify
- I do not remember
- I did not have any cheese

53. Did this meal at the Pita Pit include a salad?

- Yes
- No, or I do not remember (If checked, you will go to page Meal 2 Y/N)

54. What type of salad did you order?

- Caesar
- Chicken
- Garden
- Greek
- Julienne
- Seafood
- Tuna
- Other, please specify
- I do not remember

55. What type of lettuce was used for your salad? (check all that apply)

- Iceberg
- Romaine
- Other, please specify
- I do not remember
- I did not have any lettuce in my salad

56. What type of salad dressing was used for your salad? (check all that apply)

- Balsamic
- Caesar
- French

- Greek
- Italian
- Italian light
- Mango habanera
- Thousand Islands
- Other, please specify
- I do not remember
- I did not have any dressing on my salad

Note: Participants had the opportunity to respond to the same questions regarding seven additional meals they may have consumed at the Pita Pit on October 31, November 1, 2 and 5, 2007.

GENERAL FOOD CONSUMPTION HISTORY

G-1. Thinking back to the 3 days BEFORE you started feeling ill, did you eat food that you either used your meal plan for, or purchased from any OTHER on-or off campus eating establishments, such as restaurants, take-out, fast-food, or cafeterias?

- Yes
- No

G-2. If you answered "YES" to the previous question, please list the names of these OTHER eating establishments from which you either used your meal plan for, or purchased from any OTHER on or off-campus eating establishments. List each on a new line in the following format: "name and location of establishment, date, time".

- 1.
- 2.
- 3.

G-3. In the three days prior to the onset of your illness, were you in close contact with someone who had diarrhea?

- Yes
- No
- Uncertain

If you answered "YES", please ask them to contact the Health Unit if they have not already done so by calling 519-663-5317 ext. 2330 and after hours at 519-675-7523.

G-4. Is there anything you would like to add that might help us with this investigation?

If you are still symptomatic, please seek medical care if necessary. Even if you are no longer having diarrhea, we recommend that you provide a stool sample, if you have not yet done so, to Student Health Services.

If you are a food handler, child-care worker or health care worker, do not return to work until you have been cleared by the Health Unit. Please call 519-663-5317 ext. 2330 and after hours call 519-675-7523 for further information (Two negative stool cultures may be required).

Ensure you regularly wash your hands, especially after using the bathroom and before preparing/eating food.



Questionnaire for Well Individuals (Control Questionnaire) in Pita Outlet Case-Control Study

November 2007

Thank you for agreeing to complete this questionnaire. This is for people who did NOT develop diarrhea but did eat food from Pita Pit on one or more of the following dates:

- ◆ Wednesday - October 31 (Halloween), and/or
- ◆ Thursday - November 1, and/or
- ◆ Friday - November 2, and/or
- ◆ Monday - November 5, 2007.

This questionnaire should take 5 – 7 minutes to complete. Even though there are a lot of pages it should go quickly.

ONCE YOU COMPLETE A PAGE AND PRESS SUBMIT, DO NOT GO BACK.

IF YOU DON'T REMEMBER AN ANSWER AND THERE IS NO "I DO NOT REMEMBER" OPTION, JUST LEAVE IT BLANK.

All information will be kept confidential and used only to investigate the outbreak. If you have any questions, please contact the Middlesex-London Health Unit at 519-663-5317 ext. 2330; after hours at 519-675-7523.

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Personal Information

1. First Name:
2. Last Name:
3. Gender: Male Female
4. Date of birth (D/M/Y)
5. Street address (if you live off-campus)
6. Name of Resident (if you live on-campus)
7. City
8. Postal Code
9. Phone Number
10. Email address
11. What program/faculty/department at UWO are you enrolled in?

Food History

12. Did you eat AT LEAST ONE meal from Pita Pit on any of October 31, November 1, November 2 and/or November 5?
- Yes
 - No
13. On what date did you eat your FIRST MEAL at Pita Pit?
- Wednesday, October 31 (Halloween)
 - Thursday, November 1
 - Friday, November 2
 - Monday, November 5
14. At what approximate time did you purchase (as opposed to eat) this meal at Pita Pit (please specify am or pm, for example, 10:15 am)?
15. At which station was your food prepared?
- At the station on the left (closest to Manchu Wok)
 - At the station on the right (closest to wall)
 - I do not remember
16. When did you then eat this meal?
- Within one hour of purchase
 - Between one and two hours after purchase
 - Between two and four hours after purchase
 - More than four hours after purchase
17. Did your meal include a pita?
- Yes
 - No (or I do not remember) (if checked, you will go to page Meal 1 Salad Y/N)
18. What type of pita did you order for this meal?
- The assorted
 - Black Forest Ham
 - BLT
 - Chicken Breast
 - Chicken Caesar
 - Club
 - Dagwood
 - Falafel
 - Gyro
 - Philly Steak
 - Rib Fest
 - Roast Beef
 - Seafood
 - Souvlaki
 - Tuna
 - Turkey
 - Vegetarian (Garden)
 - Other, please specify
 - I don't remember

19. What toppings did you order for your pita? (check all that apply)

- Baba Ganoush
- Cucumbers
- Hummus
- Lettuce-Iceberg
- Lettuce-Romaine
- Lettuce-I do not remember which type
- Mushrooms
- Olives-black
- Olives-green
- Onions
- Peppers-green
- Peppers-hot
- Pickles
- Pineapple
- Tomatoes
- Other topping, please specify
- I do not remember
- I did not have any toppings

20. What sauce did you order for your pita? (check all that apply)

- Ancho chipotle
- BBQ sauce
- Balsamic dressing
- Caesar dressing
- Dijon mustard
- Greek dressing
- Honey mustard
- Hot sauce
- Italian dressing
- Mango habanera
- Mayonnaise
- Mustard
- Ranch dressing
- Secret sauce
- Teriyaki sauce
- Tzatziki
- Other sauce, please specify
- I do not remember
- I did not have any sauce

21. What type of cheese did you order for your pita? (check all that apply)

- Cheddar
- Feta
- Swiss
- Other, please specify
- I do not remember
- I did not have any cheese

22. Did this meal at the Pita Pit include a salad?
- Yes
 - No, or I do not remember (If checked, you will go to page Meal 2 Y/N)
23. What type of salad did you order?
- Caesar
 - Chicken
 - Garden
 - Greek
 - Julienne
 - Seafood
 - Tuna
 - Other, please specify
 - I do not remember
24. What type of lettuce was used for your salad? (check all that apply)
- Iceberg
 - Romaine
 - Other, please specify
 - I do not remember
 - I did not have any lettuce in my salad
25. What type of salad dressing was used for your salad? (check all that apply)
- Balsamic
 - Caesar
 - French
 - Greek
 - Italian
 - Italian light
 - Mango habanera
 - Thousand Islands
 - Other, please specify
 - I do not remember
 - I did not have any dressing on my salad

Note: Participants had the opportunity to respond to the same questions regarding seven additional meals they may have consumed at the Pita Pit on October 31, November 1, 2 and 5, 2007.

General Food Consumption History

G-1. Thinking back to the 3 days AFTER the last date you ate at the Pita Pit (either October 31, November 1, November 2 or November 5) did you eat food that you either used your meal plan to buy or purchased from any OTHER on or off - campus eating establishments, such as restaurants, take-out, fast-food, or cafeterias? For example, if you last ate at Pita Pit on November 1st, where did you eat on November 2, 3, and 4th?

- Yes
- No

G.2. If you answered “yes” to the previous question, please list the names of these OTHER eating establishments from which you either used your meal plan for, or

purchased from any OTHER on or off-campus eating establishments. List each on a new line in the following format: "name and location of establishment, date, time".

- 1.
- 2.
- 3.

G-3. Is there anything you would like to add that might help us with this investigation?

Detailed Food Analysis from Pita Outlet Case-Control Study

Comparison of Foods Eaten by Cases Compared to Controls for Analysis 1, 2 and 3

Table E-1: Analysis 1 - Foods Eaten by Laboratory-Confirmed Cases Compared to Questionnaire Controls

Individual Food Exposure	Laboratory-Confirmed Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
PITAS				
Assorted	0	1		
Black Forest Ham	0	0		
Bacon Lettuce Tomato	1	2		
Chicken (any pita)	18	33	2.64	1.2-6.05
Chicken Breast	N/A	17		
Chicken Caesar	N/A	16		
Club	0	3		
Dagwood	0	0		
Falafel	1	4	0.74	0.08-6.89
Gyro	0	5		
Philly	0	3		
Rib	0	2		
Roast Beef	0	1		
Seafood	0	0		
Souvlaki	3	10	0.89	0.23-3.46
Tuna	2	0		
Turkey	2	5	1.21	0.22-6.58
Vegetarian	2	13	0.43	0.09-2.0
Other	N/A	5		
Do not remember	N/A	1		
Bacon	4	N/A		
PITA TOPPINGS				
Baba Ganoush	0	2		
Cucumbers	15	44	1.04	0.47-2.33
Hummus	1	12	0.23	0.03-1.81
Iceberg Lettuce	16	49	0.96	0.43-2.14
Romaine Lettuce	7	26	0.75	0.29-1.95
Lettuce-Any Type	30	85	1.94	0.41-9.27
Mushrooms	13	37	1.09	0.48-2.47
Black olives	6	25	0.66	0.24-1.78
Green olives	8	17	1.55	0.60-4.03
Onions	8	39	0.48	0.20-1.20

Individual Food Exposure	Laboratory-Confirmed Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
Green peppers	13	53	0.56	0.25-1.25
Hot peppers	4	20	0.54	0.17-1.73
Pickles	6	28	0.56	0.21-1.51
Pineapple	3	11	0.80	0.21-3.07
Tomatoes	24	59	1.89	0.77-4.63
Other topping	N/A	3		
Do not remember topping type	N/A	0		
No toppings	N/A	0		
PITA-SAUCES				
Ancho Chiptole	N/A	0		
BBQ sauce	2	6	1.00	0.19-5.22
Balsamic Dressing	2	1		
Caesar Dressing	6	13	1.47	0.51-4.27
Dijon mustard	1	1		
Greek dressing	1	7	0.41	0.05-3.47
Honey mustard	2	11	0.52	0.11-2.46
Hot sauce	4	3	4.43	0.93-21.0
Italian dressing	2	2		
Mango habanera	0	0		
Mayonnaise	5	18	0.80	0.27-2.37
Mustard	0	5		
Ranch dressing	1	13	0.21	0.03-1.64
Secret Sauce	1	2		
Teriyaki Sauce	0	1		
Tzatziki	9	33	0.75	0.31-1.80
Other Sauce	N/A	2		
Do not remember sauce type	N/A	2		
No sauce	N/A	4		
PITA CHEESE				
Cheddar	22	46	2.39	1.02-5.58
Feta	4	26	0.39	0.12-1.20
Swiss	1	1		
Other type	N/A	0		
Do not remember type	N/A	4		
No cheese	N/A	12		
SALAD				
Caesar	N/A	0		
Chicken	2	4	1.53	0.27-8.79
Garden	N/A	0		
Greek	N/A	1		
Julienne	N/A	1		
Seafood	N/A	0		
Tuna	N/A	0		
Other Salad	N/A	2		

Individual Food Exposure	Laboratory-Confirmed Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
Do not remember salad type	N/A	0		
LETTUCE-SALAD				
Iceberg	N/A	4		
Romaine	2	6	1.00	0.19-5.22
Other Lettuce Type	N/A	0		
Do not remember lettuce type	N/A	0		
No Lettuce	N/A	0		
SALAD DRESSING				
Balsamic	N/A	1		
Caesar	N/A	1		
French	N/A	0		
Greek	N/A	2		
Italian	N/A	0		
Italian light	N/A	1		
Mango habanera	N/A	0		
Ranch	N/A	0		
Thousand Island	N/A	0		
Other Dressing type	1	0		
Do not remember dressing type	N/A	0		
No Dressing	1	2		
SALAD-Other Toppings				
Cheddar on Salad	1	N/A		
Feta on Salad	1	N/A		
Cucumber on Salad	1	N/A		
Tomato on Salad	1	N/A		
Green Pepper on Salad	1	N/A		
Red Onion on Salad	1	N/A		
OTHER				
Any Chicken exposure (salad or pita)	18	37	2.21	0.97-5.03

Table E-2: Analysis 2 - Foods Eaten by Non-Laboratory-Confirmed Cases Compared to Questionnaire Controls

Individual Food Exposure	Non-Laboratory-Confirmed Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
PITAS				
Assorted	1	1		
Black Forest Ham	2	0		
Bacon Lettuce Tomato	1	1		
Chicken (any pita)	9	22	1.39	0.51-3.73
Chicken Breast	N/A	13		
Chicken Caesar	N/A	9		
Club	2	3	2.1	0.33-13.47
Dagwood	0	0		
Falafel	2	4	1.55	0.26-9.11
Gyro	1	2		
Philly	1	3		
Rib	0	1		
Roast Beef	0	1		
Seafood	0	0		
Souvlaki	1	7	0.40	0.05-3.46
Tuna	0	0		
Turkey	1	4	0.74	0.08-6.98
Vegetarian	4	8	1.61	0.43-5.98
Bacon	3	N/A		
Other	N/A	2		
Do not remember	N/A	1		
PITA TOPPINGS				
Baba Ganoush	0	2		
Cucumbers	14	31	1.98	0.73-5.34
Hummus	6	9	2.38	0.74-7.67
Any Lettuce (on pita)	21	58	2.90	0.34-24.57
Iceberg Lettuce	12	33	1.20	0.46-3.16
Romaine Lettuce	4	14	0.83	0.24-2.83
Mushrooms	5	25	0.48	0.16-1.47
Black olives	5	19	0.73	0.24-2.25
Green olives	4	13	0.91	0.26-3.14
Onions	6	29	0.48	0.17-1.38
Green peppers	8	41	0.35	0.13-0.95
Hot peppers	7	16	1.46	0.51-4.21
Pickles	6	22	0.75	0.26-2.18
Pineapple	0	7		

Individual Food Exposure	Non-Laboratory-Confirmed Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
Tomatoes	19	44	3.17	0.85-11.86
Other topping	N/A	1		
Do not remember topping type	N/A	0		
No toppings	N/A	0		
PITA-SAUCES				
Ancho Chiptole	0	0		
BBQ sauce	2	5	1.22	0.22-6.79
Balsamic Dressing	0	0		
Caesar Dressing	5	7	2.48	0.70-8.81
Dijon mustard	0	0		
Greek dressing	2	3	2.10	0.33-13.47
Honey mustard	3	6	1.58	0.36-6.93
Hot sauce	2	3	2.10	0.33-13.47
Italian dressing	2	0		
Mango habanera	0	0		
Mayonnaise	3	14	0.59	0.15-2.27
Mustard	4	4	3.44	0.78-15.16
Ranch dressing	5	11	1.47	0.45-4.83
Secret Sauce	0	0		
Teriyaki Sauce	0	1		
Tzatziki	10	23	1.56	0.59-4.15
Other Sauce	N/A	1		
Do not remember sauce type	N/A	1		
No sauce	N/A	2		
PITA CHEESE				
Cheddar	11	33	1.00	0.38-2.63
Feta	4	15	0.76	0.22-2.58
Swiss	1	1		
Other type	N/A	0		
Do not remember type	N/A	2		
No cheese	N/A	9		
SALAD				
Caesar	N/A	0		
Chicken	1	3		
Garden	N/A	0		
Greek	N/A	1		
Julienne	N/A	0		
Seafood	N/A	0		
Tuna	N/A	0		
Other Salad	N/A	2		
Do not	N/A	0		

Individual Food Exposure	Non-Laboratory-Confirmed Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
remember salad type				
LETTUCE-SALAD				
Iceberg	0	3		
Romaine	0	4		
Other Lettuce Type	N/A	0		
Do not remember lettuce type	N/A	0		
No Lettuce	N/A	0		
SALAD DRESSING				
Balsamic	N/A	1		
Caesar	N/A	1		
French	N/A	0		
Greek	N/A	2		
Italian	N/A	0		
Italian light	N/A	0		
Mango habanera	N/A	0		
Ranch	N/A	0		
Thousand Island	N/A	0		
Other Dressing type	N/A	0		
Do not remember dressing type	N/A	0		
No Dressing	N/A	2		
OTHER SALAD ITEMS				
Falafel	0	N/A		
Cheddar Cheese	1	N/A		
Honey Mustard Dressing	0	N/A		
Cucumber	1	N/A		
Hot Peppers	1	N/A		
Tomato	1	N/A		
OTHER				
Any Chicken exposure (salad or pita)	10	25	1.37	0.52-3.63

Table E-3: Analysis 3 - Foods Eaten by Questionnaire Cases Compared to Questionnaire Controls

Individual Food Exposure	Questionnaire Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
PITAS				
Assorted	0	1		
Black Forest Ham	1	0		
Bacon Lettuce Tomato	0	2		
Chicken (any pita)	45	42	1.99	1.13-3.50
Chicken Breast	30	21	2.5	1.3-4.7
Chicken Caesar	15	21	0.98	0.47-2.03
Club	2	3	0.91	0.15-5.58
Dagwood	0	0		
Falafel	4	5	1.10	0.287-4.23
Gyro	4	6	0.91	0.25-3.33
Philly	1	4	0.34	0.04-3.05
Rib	0	3		
Roast Beef	1	1		
Seafood	0	0		
Souvlaki	8	12	0.90	0.35-2.32
Tuna	0	0		
Turkey	4	10	0.53	0.16-1.74
Vegetarian	4	13	0.39	0.12-1.25
Other	1	6	0.22	0.03-1.86
Do not remember	0	1		
PITA TOPPINGS				
Baba Ganoush	3	2	2.1	0.34-12.8
Cucumbers	41	53	1.1	0.64-1.95
Hummus	9	14	0.87	0.36-2.11
Iceberg Lettuce	34	63	0.57	0.32-1.00
Romaine Lettuce	22	31	0.97	0.51-1.82
Do not remember lettuce type	17	17	1.46	0.70-3.01
Mushrooms	24	45	0.63	0.35-1.14
Black olives	16	25	0.85	0.42-1.71
Green olives	15	20	1.04	0.50-2.16
Onions	38	46	1.24	0.71-2.18
Green peppers	42	61	0.89	0.51-1.56
Hot peppers	17	25	0.92	0.46-1.83
Pickles	20	37	0.66	0.35-1.25
Pineapple	5	14	0.46	0.16-1.33
Tomatoes	59	69	1.55	0.87-2.78
Other topping	4	3	1.87	0.41-8.58
Do not	2	1		

Individual Food Exposure	Questionnaire Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
remember topping type				
No toppings	0	0		
PITA-SAUCES				
Ancho Chiptole	0	0		
BBQ sauce	4	9	0.59	0.18-1.99
Balsamic Dressing	1	1		
Caesar Dressing	18	18	1.47	0.71-3.03
Dijon mustard	1	1		
Greek dressing	6	8	1.03	0.34-3.09
Honey mustard	12	15	1.11	0.49-2.52
Hot sauce	6	8	1.03	0.34-3.09
Italian dressing	5	2	3.58	0.68-18.91
Manga habanera	0	0		
Mayonnaise	11	19	0.76	0.34-1.7
Mustard	4	6	0.91	0.25-3.33
Ranch dressing	2	16	0.15	0.034-0.68
Secret Sauce	1	2		
Teriyaki Sauce	0	1		
Tzatziki	26	38	0.91	0.50-1.66
Other Sauce	3	2	2.10	0.34-12.8
Do not remember sauce type	4	2	2.83	0.51-15.8
No sauce	2	6	0.44	0.088-2.26
PITA CHEESE				
Cheddar	45	60	1.06	0.61-1.85
Feta	20	30	0.89	0.46-1.7
Swiss	1	1		
Other type	0	2		
Do not remember type	3	5	0.82	0.19-3.5
No cheese	10	13	1.06	0.44-2.55
SALAD				
Caesar	1	0		
Chicken	5	4	1.76	0.46-6.75
Garden	0	0		
Greek	0	1		
Julienne	1	1		
Seafood	0	0		
Tuna	0	0		
Other Salad	1	3		
Do not remember salad type	1	0		
LETTUCE-SALAD				

Individual Food Exposure	Questionnaire Cases	Questionnaire Controls	Unmatched odds ratio	95% Confidence Interval
Iceberg	1	4	0.34	0.04-3.05
Romaine	4	7	0.77	0.22-2.7
Other Lettuce Type	3	0		
Do not remember lettuce type	1	0		
No Lettuce	0	0		
SALAD DRESSING				
Balsamic	1	1		
Caesar	1	1		
French	0	0		
Greek	1	2		
Italian	3	0		
Italian light	1	1		
Mango habanera	0	0		
Ranch	1	1		
Thousand Island	0	0		
Other Dressing type	0	0		
Do not remember dressing type	1	0		
No Dressing	1	2		
OTHER				
Any Chicken (salad or pita)	50	46	2.17	1.23-3.83



Questionnaire for Ill Individuals (Case Questionnaire) for Campus Consumption Case-Control Study

December 2007

The Health Unit, in collaboration with the University of Western Ontario, is conducting the second phase of the salmonella investigation and requests your assistance in completing a brief on-line questionnaire. The questionnaire should take less than 5 minutes to complete. ALL students are eligible to complete this questionnaire, regardless of whether you were ill or not.

If you have a meal plan, the Health Unit may access your meal plan record for information about what you purchased over a three-day period. Your meal plan information will be used only for assisting in this investigation. All personal health information you provide will be kept confidential and only accessed by the Health Unit.

Once you complete a page and press submit, do not go back.

If you do not know an answer, or it is not applicable, please leave it blank.

Do not press "Enter" while completing this survey and be careful not to scroll too quickly with the scroll button on your mouse.

Notice of Collection: The personal information on this form is collected under the legislated authority of the Health Protection and Promotion Act, R.S.O., 1990, as amended. It is collected for the purposes of identifying the source of a community outbreak of salmonella and to help prevent further transmission of illness in the community. For further information about the collection of this information or this investigation, contact the Infectious Disease Control team at 519-663-5317 extension 2330.

Personal Information

1. First Name:
2. Last Name:
3. Gender: Male Female
4. Date of birth (D/M/Y)
5. Street address (if you live off-campus)
6. Name of Resident (if you live on-campus)
7. City
8. Postal Code
9. Phone Number
10. Email address
11. Student Number
12. What program/faculty/department at UWO are you enrolled in?

13. What year are you in?
- Undergraduate: Year 1
 - Undergraduate: Year 2
 - Undergraduate: Year 3
 - Undergraduate: Year 4
 - Graduate Studies: Masters (please specify which year)
 - Graduate Studies: Doctorate (please specify which year)
 - Dentistry (please specify which year)
 - Education (please specify which year)
 - Law (please specify which year)
 - Medicine (please specify which year)
 - Other (please specify)
14. Are you registered at a University-affiliated College (Brescia, Huron or King's)?
- Yes
 - No
 - Uncertain
15. Did you complete the questionnaire related to phase one of the salmonella investigation, which was about food eaten from Pita Pit?
- Yes
 - No
 - Uncertain

Meal Plan Information

16. Do you have a meal plan?
- Yes (if yes, continue to next question)
 - No (If checked, you will go to page Food Purchases on Campus)
 - Uncertain (If checked, you will go to page Food Purchases on Campus)
17. If you have a meal plan, what type of meal plan do you have?
- Rez meal plan
 - Campus meal plan - Flex Plan (5% off food purchases on campus)
 - Campus meal plan – PST-Exempt Plan (13% off food purchases on campus)
 - Campus meal plan – The Tax-Exempt Plan (19% off food purchases on campus)
 - University-affiliated College meal plan
 - Do not know what type of plan
 - Other, please specify
18. Between November 4 and November 26, 2007, which of the following best describes your use of your meal plan?
- Used my meal plan for ALL food purchases on campus
 - Used my meal plan for SOME food purchases on campus
 - Used my meal plan for NO food purchases on campus
 - Cannot remember how often I used my meal plan
 - Other, please specify

Review the following locations on campus where food is sold and mark the locations where you **generally purchase food AT LEAST ONCE A WEEK**. For each location,

check all that apply. Beside all locations where you purchase food AT LEAST ONCE A WEEK, estimate the average number of times you purchase food there per week.

Check if you generally purchase food at the following locations at least once a week and indicate the average number of times per week for the locations checked (please use numbers not words).

19. Residence cafeterias

- Delaware _____ times per week
- Elgin _____ times per week
- Essex _____ times per week
- Perth _____ times per week
- Saugeen- Maitland _____ times per week
- Sydenham _____ times per week

20. Althouse College – RU Hungry

- Short Order _____ times per week
- Campbell's Soup _____ times per week
- Domino's Pizza _____ times per week
- Lifestyles Refrigerator _____ times per week
- Tim Hortons _____ times per week

21. Elborn College – Betty's

- Short Order _____ times per week
- Campbell's Soup _____ times per week
- Lifestyle Refrigerator _____ times per week
- Tim Hortons _____ times per week

22. Engineering – DaVinci's (formerly called By Design)

- Lifestyles Refrigerator _____ times per week
- Tim Hortons _____ times per week

23. Law School – Chambers

- Lifestyles Refrigerator _____ times per week
- Tim Hortons _____ times per week

24. Medical Sciences Centre – Between Appointments

- Campbell's Soup _____ times per week
- Lifestyles Refrigerator _____ times per week
- Made in Japan _____ times per week
- Pita Pit _____ times per week
- Tim Hortons _____ times per week

25. Natural Sciences Centre – Einstein's

- Ah-So Sushi _____ times per week
- Campbell's Soup _____ times per week
- Freshens Smoothie Co. _____ times per week
- Lifestyles Refrigerator _____ times per week
- Starbucks _____ times per week

26. Natural Sciences Centre – Nucleus
- Campbell's Soup_____ times per week
 - Lifestyles Refrigerator_____ times per week
 - Made in Japan_____ times per week
 - Mr. Sub_____ times per week
 - Pizza Pizza_____ times per week
 - Tim Hortons_____ times per week
27. North Campus Building
- Lifestyles Refrigerator_____ times per week
 - Tim Hortons_____ times per week
 - Freshen Smoothie Co. _____ times per week
 - Extreme Pita_____ times per week
 - Starbucks_____ times per week
28. School of Business – The Enterprise
- Campbell's Soup _____ times per week
 - Domino's Pizza_____ times per week
 - Lifestyles Refrigerator_____ times per week
 - Tim Hortons_____ times per week
29. Social Sciences – Encounters
- Short Order_____ times per week
 - Campbell's Soup _____ times per week
 - Lifestyles Refrigerator_____ times per week
 - Starbucks_____ times per week
 - Tim Hortons_____ times per week
30. Somerville House – Lucy's
- Short Order For Breakfast_____ times per week
 - Campbell's Soup _____ times per week
 - Lifestyles Refrigerator_____ times per week
 - Made in Japan_____ times per week
 - Pita Pit_____ times per week
 - Pizza Pizza_____ times per week
 - Tim Hortons_____ times per week
31. South Valley Building – South Valley
- Tim Hortons_____ times per week
32. Talbot College – Encore Café
- Short Order_____ times per week
 - Campbell's Soup_____ times per week
 - Lifestyles Refrigerator_____ times per week
 - Mr. Sub_____ times per week
 - Pizza Pizza_____ times per week
 - Tim Hortons_____ times per week

33. DB Weldon Library – Quote Café
- Lifestyles Refrigerator_____ times per week
 - Starbucks_____ times per week
34. University Community Centre – Centre Spot
- Ah-So Sushi_____ times per week
 - Campbell's Soups_____ times per week
 - Freshens Smoothie Co. _____ times per week
 - Harvey's_____ times per week
 - Lifestyles Refrigerator_____ times per week
 - Manchu Wok_____ times per week
 - Pita Pit_____ times per week
 - Pizza Pizza_____ times per week
 - Salad Bowl_____ times per week
 - Tim Hortons – main level _____ times per week
 - Tim Hortons – lower level _____ times per week
 - Williams Coffee Pub_____ times per week
35. Westminster
- Lifestyles Refrigerator_____ times per week
 - Starbucks_____ times per week
36. Food outlets at University-affiliated Colleges
- Brescia University College_____ times per week
 - Huron University College_____ times per week
 - King's University College_____ times per week
37. What was your FIRST symptom?
- Vomiting
 - Diarrhea
 - Nausea
 - Abdominal pain/cramps
 - Headache
 - Fever
 - Chills
 - Other, please specify
38. What was the date that your FIRST symptom started? (D/M/Y)
39. On the day of your FIRST symptom, what was the time that your first symptom started? (Please include “am” or “pm”, e.g., 9:30 am, 4:00 pm)
40. Which of the following symptoms did you experience? (Check all that apply)
- Vomiting
 - Diarrhea
 - Nausea
 - Abdominal pain/cramps
 - Headache
 - Fever
 - Chills
 - Other, please specify

41. What date did you begin to have DIARRHEA? (D/M/Y)
42. What time did you begin to have diarrhea? (Please include “am” or “pm”, e.g., 9:30am, 4:00 pm)
43. Please indicate the number of times you had diarrhea over the worst 24 hour period.
44. Was the diarrhea bloody?
Yes
No
Uncertain
45. Did you seek medical attention as a result of your illness (e.g, TeleHealth, Emergency Care, Family Physician...)?
Yes
No
Uncertain
46. Did you miss any school as a result of your illness?
Yes
No
47. If you missed any school, how many days did you miss (please enter a number and not a word)
48. Are you still feeling ill?
Yes
No
Uncertain
49. If you are no longer feeling ill, on what date did your symptoms completely resolve? (D/M/Y)
50. This page lists sources of medical care. Please indicate whether you sought care from one or more of these sources.
51. Did you seek care from a Family Physician/Nurse Practitioner?
Yes
No
52. Name of clinic of Family Physician/Nurse Practitioner (if known)
53. Date of visit to Family Physician /Nurse Practitioner (D/M/Y)
54. Did you seek care from a hospital Emergency Department or Urgent Care Centre?
Yes
No

55. Name of the Emergency Department or Urgent Care Centre
56. Date of visit to the Emergency Department or Urgent Care Centre (D/M/Y)
57. Did you seek care from a Walk-In Clinic?
Yes
No
58. Name of the Walk-In Clinic
59. Date of visit to the Walk-In Clinic (D/M/Y)
60. Were you admitted to Hospital?
61. Name of the hospital to which you were admitted
62. Date of admission to this hospital (D/M/Y)
63. How many days were you in the hospital?
64. Did you seek any other type of care?
Yes, please specify:
No
65. Did you provide a stool sample for lab analysis?
Yes
No
- If you answered "Yes," please provide details in the two questions below.
66. Date you dropped off the stool sample (D/M/Y)
67. Result of the stool samples analysis (if known)
Positive for Salmonella
Negative for Salmonella
Other, please specify
I do not know
68. In the three days prior to the onset of your illness, were you in close contact with someone who had diarrhea?
Yes
No
Uncertain
- If you answered "yes", please ask them to contact the Health Unit if they have not already done so by calling 519-663-5317 ext. 2330 or after hours at 519-675-7523.
69. Is there anything you would like to add that might help us with this investigation?

If you are still symptomatic, please seek medical care if necessary and do not prepare food for others. Even if you are no longer having diarrhea, we recommend that you provide a stool sample, if you have not already done so, to Student Health Services.

If you are a food handler, child care worker or health care worker, do not work until you have been cleared by the Health Unit. Please call 519-663-5317 ext. 2330 and after hours 519-675-7523 for further information (Two negative stool cultures may be required).

Ensure you regularly wash your hands, especially after using the bathroom and before preparing / eating food.

Thank you very much for taking the time to complete this questionnaire.

Appendix G



Questionnaire for Well Individuals (Control Questionnaire) for Campus Consumption Case-Control Study

December 2007

The Health Unit, in collaboration with the University of Western Ontario, is conducting the second phase of the salmonella investigation and requests your assistance in completing a brief on-line questionnaire. The questionnaire should take less than 5 minutes to complete. ALL students are eligible to complete this questionnaire, regardless of whether you were ill or not.

If you have a meal plan, the Health Unit may access your meal plan record for information about what you purchased over a three-day period. Your meal plan information will be used only for assisting in this investigation. All personal health information you provide will be kept confidential and only accessed by the Health Unit.

Once you complete a page and press submit, do not go back.

If you do not know an answer, or it is not applicable, please leave it blank.

Do not press "Enter" while completing this survey and be careful not to scroll too quickly with the scroll button on your mouse.

Notice of Collection: The personal information on this form is collected under the legislated authority of the Health Protection and Promotion Act, R.S.O., 1990, as amended. It is collected for the purposes of identifying the source of a community outbreak of salmonella and to help prevent further transmission of illness in the community. For further information about the collection of this information or this investigation, contact the Infectious Disease Control team at 519-663-5317 extension 2330.

Personal Information

1. First Name:
2. Last Name:
3. Gender:
 - Male
 - Female
4. Date of birth (D/M/Y)
5. Street address (if you live off-campus)
6. Name of Resident (if you live on-campus)
7. City
8. Postal Code
9. Phone Number
10. Email address
11. Student Number
12. What program/faculty/department at UWO are you enrolled in?

13. What year are you in?
- Undergraduate: Year 1
 - Undergraduate: Year 2
 - Undergraduate: Year 3
 - Undergraduate: Year 4
 - Graduate Studies: Masters (please specify which year)
 - Graduate Studies: Doctorate (please specify which year)
 - Dentistry (please specify which year)
 - Education (please specify which year)
 - Law (please specify which year)
 - Medicine (please specify which year)
 - Other (please specify)
14. Are you registered at a University-affiliated College (Brescia, Huron or King's)?
- Yes
 - No
 - Uncertain
15. Did you complete the questionnaire related to phase one of the salmonella investigation, which was about food eaten from Pita Pit?
- Yes
 - No
 - Uncertain

Meal Plan Information

16. Do you have a meal plan?
- Yes (if yes, continue to next question)
 - No (If checked, you will go to page Food Purchases on Campus)
 - Uncertain (If checked, you will go to page Food Purchases on Campus)
17. If you have a meal plan, what type of meal plan do you have?
- Rez meal plan
 - Campus meal plan - Flex Plan (5% off food purchases on campus)
 - Campus meal plan – PST-Exempt Plan (13% off food purchases on campus)
 - Campus meal plan – The Tax-Exempt Plan (19% off food purchases on campus)
 - University-affiliated College meal plan
 - Do not know what type of plan
 - Other, please specify

18. Between November 5 and November 26, 2007, which of the following best describes your use of your meal plan?

- Used my meal plan for ALL food purchases on campus
- Used my meal plan for SOME food purchases on campus
- Used my meal plan for NO food purchases on campus
- Cannot remember how often I used my meal plan
- Other, please specify

Review the following locations on campus where food is sold and mark the locations where you **generally purchase food AT LEAST ONCE A WEEK**. For each location, check all that apply. Beside all locations where you purchase food AT LEAST ONCE A WEEK, estimate the average number of times you purchase food there per week.

Check if you generally purchase food at the following locations at least once a week and indicate the average number of times per week for the locations checked (please use numbers not words).

19. Residence cafeterias

- Delaware_____ times per week
- Elgin_____ times per week
- Essex_____ times per week
- Perth_____ times per week
- Saugeen- Maitland_____ times per week
- Sydenham_____ times per week

20. Althouse College – RU Hungry

- Short order_____ times per week
- Campbell's soup_____ times per week
- Domino's Pizza_____ times per week
- Lifestyles refrigerator_____ times per week
- Tim Hortons_____ times per week

21. Elborn College – Betty's

- Short order_____ times per week
- Campbell's soup_____ times per week
- Lifestyle refrigerator_____ times per week
- Tim Hortons_____ times per week

22. Engineering – DaVinci's (formerly called By Design)

- Lifestyles refrigerator_____ times per week
- Tim Hortons_____ times per week

23. Law School – Chambers

- Lifestyles refrigerator_____ times per week
- Tim Hortons_____ times per week

24. Medical Sciences Centre – Between Appointments

- Campbell's soup _____ times per week
- Lifestyles refrigerator _____ times per week
- Made in Japan _____ times per week
- Pita Pit _____ times per week
- Tim Hortons _____ times per week

25. Natural Sciences Centre – Einstein's

- Ah-So Sushi _____ times per week
- Campbell's Soup _____ times per week
- Freshens Smoothie Co. _____ times per week
- Lifestyles Refrigerator _____ times per week
- Starbucks _____ times per week

26. Natural Sciences Centre – Nucleus

- Campbell's Soup _____ times per week
- Lifestyles Refrigerator _____ times per week
- Made in Japan _____ times per week
- Mr. Sub _____ times per week
- Pizza Pizza _____ times per week
- Tim Hortons _____ times per week

27. North Campus Building

- Lifestyles Refrigerator _____ times per week
- Tim Hortons _____ times per week
- Freshen Smoothie Co. _____ times per week
- Extreme Pita _____ times per week
- Starbucks _____ times per week

28. School of Business – The Enterprise

- Campbell's soup _____ times per week
- Domino's Pizza _____ times per week
- Lifestyles refrigerator _____ times per week
- Tim Hortons _____ times per week

29. Social Sciences – Encounters

- Short Order _____ times per week
- Campbell's Soup _____ times per week
- Lifestyles Refrigerator _____ times per week
- Starbucks _____ times per week
- Tim Hortons _____ times per week

30. Somerville House – Lucy's

- Short Order For Breakfast _____ times per week
- Campbell's Soup _____ times per week
- Lifestyles Refrigerator _____ times per week
- Made in Japan _____ times per week
- Pita Pit _____ times per week
- Pizza Pizza _____ times per week
- Tim Hortons _____ times per week

31. South Valley Building – South Valley
 Tim Hortons _____ times per week
32. Talbot College – Encore Café
 Short Order _____ times per week
 Campbell's Soup _____ times per week
 Lifestyles Refrigerator _____ times per week
 Mr. Sub _____ times per week
 Pizza Pizza _____ times per week
 Tim Hortons _____ times per week
33. DB Weldon Library – Quote Café
 Lifestyles Refrigerator _____ times per week
 Starbucks _____ times per week
34. University Community Centre – Centre Spot
 Ah-So Sushi _____ times per week
 Campbell's Soups _____ times per week
 Freshens Smoothie Co. _____ times per week
 Harvey's _____ times per week
 Lifestyles Refrigerator _____ times per week
 Manchu Wok _____ times per week
 Pita Pit _____ times per week
 Pizza Pizza _____ times per week
 Salad Bowl _____ times per week
 Tim Hortons – main level _____ times per week
 Tim Hortons – lower level _____ times per week
 Williams Coffee Pub _____ times per week
35. Westminster
 Lifestyles Refrigerator _____ times per week
 Starbucks _____ times per week
36. Food outlets at University-affiliated Colleges
 Brescia University College _____ times per week
 Huron University College _____ times per week
 King's University College _____ times per week
37. Is there anything you would like to add that might help us with this investigation?

Thank you very much for taking the time to complete the questionnaire.

Appendix H

Detailed Food Outlet Analysis from Campus Consumption Case-Control Study

Comparison of questionnaire cases and questionnaire controls who regularly eat at specific food outlets

	Questionnaire Cases (n=102)	Questionnaire Controls (n=878)	Unmatched Odds Ratio	95% Confidence Interval
ALTHOUSE COLLEGE				
Short Order	1 (1.0%)	3 (0.3%)	2.89	0.30–28.02
Soup	0	2 (0.2%)	--	--
Dominos Pizza	0	1 (0.1%)	--	--
Lifestyles	0	6 (0.7%)	--	--
Tim Hortons	1 (1.0%)	11 (1.3%)	0.78	0.10–6.11
ELBORN COLLEGE				
Short Order	1 (1.0%)	0	--	--
Soup	0	0	--	--
Lifestyles	1 (1.0%)	1 (0.1%)	8.68	0.54–139.89
Tim Hortons	1 (1.0%)	4 (0.5%)	2.16	0.24–19.54
ENGINEERING				
Lifestyles	0	3 (0.3%)	--	--
Tim Hortons	6 (5.9%)	56 (6.4%)	0.92	0.39–2.19
LAW				
Lifestyles	2 (2.0%)	4 (0.5%)	4.37	0.79–24.16
Tim Hortons	5 (4.9%)	20 (2.3%)	2.21	0.81–6.02
MEDICAL SCIENCE				
Soup	0	1 (0.1%)	--	--
Lifestyles	0	10 (1.1%)	--	--
Made in Japan	0	8 (0.9%)	--	--
Pita Pit	1 (1.0%)	23 (2.6%)	0.37	0.05–2.75
Tim Hortons	5 (4.9%)	51 (5.8%)	0.84	0.33–2.15
NATURAL SCIENCE – EINSTEIN'S				
Ah-So Sushi	1 (1.0%)	20 (2.3%)	0.43	0.06–3.20
Soup	0	7 (0.8%)	--	--
Freshens Smoothie Co.	3 (2.9%)	27 (3.1%)	0.96	0.29–3.21
Lifestyles	2 (2.0%)	47 (5.4%)	0.35	0.09–1.48
Starbucks	7 (6.9%)	132 (15.0%)	0.42	0.19–0.92
NATURAL SCIENCE – NUCLEUS				
Soup	1 (1.0%)	8 (0.9%)	1.08	0.13–8.70
Lifestyles	6 (5.9%)	34 (3.9%)	1.55	0.64–3.79
Made in Japan	5 (4.9%)	41 (4.7%)	1.05	0.41–2.73
Mr. Sub	9 (8.8%)	55 (6.3%)	1.45	0.69–3.03
Pizza Pizza	7 (6.9%)	75 (8.5%)	0.79	0.35–1.76
Tim Hortons	20 (19.6%)	243 (27.7%)	0.64	0.38–1.06
NORTH				
Lifestyles	1 (1.0%)	11 (1.3%)	0.78	0.10–6.11
Tim Hortons	17 (16.7%)	173 (19.7%)	0.82	0.47–1.41
Freshens Smoothie Co.	0	24 (2.7%)	--	--
Extreme Pita	6 (5.9%)	44 (5.0%)	1.19	0.49–2.85
Starbucks	1 (1.0%)	24 (2.7%)	0.35	0.05–2.63

BUSINESS				
Soup	0	0	--	--
Dominos Pizza	0	0	--	--
Lifestyles	3 (2.9%)	4 (0.5%)	6.62	1.46–30.01
Tim Hortons	3 (2.9%)	4 (0.5%)	6.62	1.46–30.01
SOCIAL SCIENCE				
Short Order	2 (2.0%)	15 (1.7%)	1.15	0.26–5.11
Soup	2 (2.0%)	6 (0.7%)	2.91	0.58–14.59
Lifestyles	5 (4.9%)	24 (2.7%)	1.83	0.68–4.92
Starbucks	6 (5.9%)	40 (4.6%)	1.31	0.54–3.17
Tim Hortons	12 (11.8%)	142 (16.2%)	0.69	0.37–1.30
SOMERVILLE				
Short Order	1 (1.0%)	14 (1.6%)	0.61	0.08–4.70
Soup	0	3 (0.3%)	--	--
Lifestyles	3 (2.9%)	25 (2.8%)	1.03	0.31–3.49
Made in Japan	6 (5.9%)	45 (5.1%)	1.16	0.48–2.78
Pita Pit	5 (4.9%)	36 (4.1%)	1.21	0.46–3.15
Pizza Pizza	3 (2.9%)	23 (2.6%)	1.13	0.33–3.82
Tim Hortons	13 (12.7%)	90 (10.3%)	1.28	0.69–2.38
SOUTH				
Tim Hortons	4 (3.9%)	42 (4.8%)	0.81	0.29–2.31
TALBOT				
Short Order	1 (1.0%)	9 (1.0%)	0.96	0.12–7.62
Soup	0	7 (0.8%)	--	--
Lifestyles	2 (2.0%)	25 (2.8%)	0.68	0.16–2.92
Mr. Sub	4 (3.9%)	26 (3.0%)	1.34	0.46–3.91
Pizza Pizza	2 (2.0%)	25 (2.8%)	0.68	0.16–2.92
Tim Hortons	6 (5.9%)	55 (6.3%)	0.94	0.39–2.23
UCC CENTRE SPOT				
Ah-So Sushi	4 (3.9%)	27 (3.1%)	1.29	0.44–3.75
Soup	3 (2.9%)	11 (1.3%)	2.39	0.66–8.71
Freshens Smoothie Co.	2 (2.0%)	21 (2.4%)	0.82	0.19–3.53
Harveys	17 (16.7%)	116 (13.2%)	1.31	0.75–2.29
Lifestyles	10 (9.8%)	32 (3.6%)	2.87	1.37–6.04
Manchu Wok	14 (13.7%)	108 (12.3%)	1.13	0.62–2.06
Pita Pit	40 (39.2%)	113 (12.9%)	4.37	2.80–6.81
Pizza Pizza	16 (15.7%)	86 (9.8%)	1.71	0.96–3.06
Salad Bowl	20 (19.6%)	70 (8.0%)	2.82	1.63–4.86
Tim Hortons – Main Level	40 (39.2%)	255 (29.0%)	1.58	1.03–2.41
Tim Hortons – Lower Level	14 (13.7%)	145 (16.5%)	0.80	0.45–1.45
Williams Coffee Pub	9 (8.8%)	56 (6.4%)	1.42	0.68–2.97
WELDON LIBRARY				
Lifestyles	1 (1.0%)	19 (2.2%)	0.45	0.06–3.38
Starbucks	30 (29.4%)	164 (18.7%)	1.81	1.15–2.87
WESTMINSTER				
Lifestyles	0	0	--	--
Starbucks	0	4 (0.5%)	--	--
RESIDENCES				
Delaware	4 (3.9%)	75 (8.5%)	0.44	0.16–1.22

Elgin	1 (1.0%)	33 (3.8%)	0.25	0.03–1.87
Essex	6 (5.9%)	22 (2.5%)	2.43	0.96–6.15
Perth	4 (3.9%)	38 (4.3%)	0.90	0.32–2.58
Saugeen-Maitland	6 (5.9%)	53 (6.0%)	0.97	0.41–2.32
Sydenham	2 (2.0%)	44 (5.0%)	0.38	0.09–1.59
COLLEGES				
Brescia	0	31 (3.5%)	--	--
Huron	4 (3.9%)	26 (3.0%)	1.34	0.46–3.91
Kings	7 (6.9%)	66 (7.5%)	0.91	0.40–2.03

SECTION M

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