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Demographic and Clinical Indicators of Georgia Residents with a Foodborne Illness and a Sexually Transmitted Infection, 2004-2009

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Abstract

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Background

Conventional thought relates the transmission of foodborne enteric illnesses to be through contaminated food or through cross-contamination with the environment. Yet, research involving men who have sex with men (MSM) has established associations between sexual behaviors and the transmission of traditional foodborne illnesses. Using a diagnosis of sexually transmitted infection (STI) to establish a high-risk group, indicators for having both a foodborne illness and a sexually transmitted infection were described.

Methods

In this cross-sectional study, a secondary data analysis was conducted using data collected by the Georgia Department of Public Health during the period of January 1, 2004 to December 31, 2009 through the notifiable disease surveillance system. A total of 13,794 cases of foodborne illness were identified with 637 also having a sexually transmitted illness. Demographic indicators included were gender, race, ethnicity, age, and living in an urban area. Clinical indicators included were being hospitalized, foodborne and sexually transmitted illness, fever, headache, diarrhea, abdominal pain, vomiting, and nausea.

Results

From single variable analysis, being male (OR, 3.94 95% CI, 3.24-4.79) was associated with having both a foodborne and sexually transmitted illness, as was being Black or African American race (OR, 10.62 95% CI, 8.62-13.08), and living in an urban area (OR, 5.64 95% CI, 3.95-8.07). This subset of the population was more likely to go to the emergency department (OR, 1.47 95% CI, 1.09-1.99). For matched cases, the odds were increased for all individual foodborne illnesses compared to *Salmonella*. Multivariable analysis results were similar to single variable results with odds ratios remaining statistically significant for being male (OR, 2.81 95% CI, 2.16-3.65), Black or African American race (OR, 4.35 95% CI, 3.39-5.60), and living in an urban area (OR, 2.08 95% CI, 1.30-3.34).

Discussion

This is a previously unidentified risk group. There is much room for additional understanding of the behavioral factors related to the sexual transmission of foodborne illnesses. Future interventions need to focus on educating the general public and high-risk groups about the potential for transmission of foodborne illnesses with STIs.

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Introduction

Background & Significance

The World Health Organization (WHO) defines foodborne illnesses as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Every person is at risk of foodborne illness. They can be caused by bacterial, viral, parasitic, or chemical agents and can cause symptoms ranging from fever, vomiting, diarrhea, or even death. An estimated 1.8 million people worldwide died from diarrheal diseases in 2005 and a large proportion of these cases can be attributed to foodborne illnesses[1]. Foodborne illnesses are often caused by contaminated foods, through cross contamination with the environment, or from person-to-person through the fecal-oral route.

The global burden of foodborne illnesses is difficult to assess because many countries only have limited resources to apply to surveillance and reporting of disease.[1] Currently, the WHO is starting an initiative to fill the gaps in data. Some authors have attempted to estimate the financial burden of foodborne disease on society. A widely cited study by the FDA estimates the U.S. financial burden to be between $6.5 and $34.9 billion.[2] This most likely underestimates the total burden, as only the direct medical costs of 7 notifiable diseases were included and it is thought that there are more than 200 foodborne disease causing agents resulting in long-term health and financial problems for the patient and caregivers.[3]

Surveillance of infectious diseases is essential to the health of communities. Tracking and reporting of these illnesses enables assessing of trends and changes in disease occurrence, natural history, and pathways to exposure. The Foodborne

Disease Active Surveillance Network (FoodNet) is an active, population-based sentinel surveillance system with objectives related to the active surveillance of notifiable diseases and attribution of possible food or environmental sources. Established in 1995, the program is a collaborative effort among CDC, 10 state health departments, U.S. Department of Agriculture's Food Safety and Inspections Services (USDA-FSIS), and the Food and Drug Administration (FDA). FoodNet sites monitor approximately 15% of the U.S. population for cases of *Salmonella*, *Campylobacter*, *Shigella*, *Cryptosporidium*, and other illnesses. These enteric illnesses have a large impact on the residents of the FoodNet surveillance area. In 2009, there were 17,468 laboratory-confirmed cases of foodborne illness with the highest burden created by *Salmonella*, *Campylobacter*, *Shigella*, and *Cryptosporidium.*[3] Though not always foodborne, Hepatitis A is a contagious viral infection of the liver resulting from ingestion of fecal matter through contaminated foods, contaminated liquid, or close person-to-person contact. An estimated 25,000 new Hepatitis A infections occurred in 2007. *Giardia,* which is not traditionally considered a foodborne disease, is also transmitted through the fecal-oral route by way of food, water, or close contact with persons contaminated with *Giardia* cysts. In 2008, the national reported cases of giardiasis totaled 24,226.[4]

In recent years, the frequency of oral and anal sex among young people has increased.[47,48] These behaviors, which are associated with sexually transmitted infections,[40-46] also have the potential to increase fecal-anal transmission of illnesses that are spread by this route. For example, as the *Salmonella* bacterium is shed through feces, the ingestion of fecal matter while performing analingus or fellatio on a contaminated penis could be enough to transmit the disease.[5] A study comparing homosexual men with and without *Campylobacter* found that engaging in analingus was significantly associated with having an intestinal infection.[6,7]

Sexually transmitted infections (STI) can also have a large impact on a population's health and are one of the most common types of infectious diseases worldwide. According to the WHO, there is a global yearly incidence of 448 million curable STIs.[8] In the United States, the CDC's Sexually Transmitted Disease surveillance effort tracks and disseminates information on many STDs including Chlamydia, gonorrhea, and syphilis.

The Georgia Department of Public Health is one of the 10 participating FoodNet sites and also conducts surveillance of other enteric illnesses such as Hepatitis A and Giardia. Georgia had the highest rate per 100,000 for *Salmonella* (24.57) and *Campylobacter* (7.58) of all the FoodNet sites in 2009.[3] Georgia also has elevated rates of sexually-transmitted disease. For example, compared to other states in the U.S., Georgia had the third highest rate of primary and secondary (PS) syphilis in 2009.[9] At present, however, it is unclear whether the foodborne illnesses and sexually transmitted infections of Georgia residents are likely to occur in the same people, possibly sharing common risk behaviors.

Theoretical Framework

Before any health intervention related to fecal-oral transmission of disease can be designed, an assessment of the current problems and trends is needed. The PRECEDE-PROCEED Model (PPM) provides a framework for developing and evaluating health behavior change programs. The PPM framework is a logic model with the purpose of leading a health promoter through 8 phases social assessment to outcome evaluation. Phase 2 of the PRECEDE model identifies the epidemiological, behavioral, and environmental factors associated with an adverse health outcome that a health promotion intervention needs to target.

Purpose

The current study proposes to identify the epidemiological and demographic factors related to diagnosis with both a foodborne illness and a STD among Georgia residents between January 1, 2004 and December 31, 2009. Using PPM as a guide, it seeks to answer the following research questions:

1. What is the proportion of Georgia residents who have a diagnosed foodborne enteric illness and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?
2. What is the proportion of Georgia residents who have a diagnosed *Salmonella* infection and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?

3. What is the proportion of Georgia residents who have a diagnosed *Campylobacter* infection and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?
4. What is the proportion of Georgia residents who have a diagnosed *Shigella* infection and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?
5. What is the proportion of Georgia residents who have a diagnosed Hepatitis A infection and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?
6. What is the proportion of Georgia residents who have a diagnosed *Cryptosporidium* infection and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?
7. What is the proportion of Georgia residents who have a diagnosed *Giardia* infection and a diagnosed sexual transmitted disease between January 1, 2004 and December 31, 2009?
8. What are the demographic and clinical differences between Georgia residents who have a diagnosed foodborne enteric illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?
9. What are the demographic and clinical differences between Georgia residents who have a diagnosed *Salmonella* illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?

10. What are the demographic and clinical differences between Georgia residents who have a diagnosed *Campylobacter* illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?
11. What are the demographic and clinical differences between Georgia residents who have a diagnosed *Shigella* illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?
12. What are the demographic and clinical differences between Georgia residents who have a diagnosed Hepatitis A illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?
13. What are the demographic and clinical differences between Georgia residents who have a diagnosed *Cryptosporidium* illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?
14. What are the demographic and clinical differences between Georgia residents who have a diagnosed *Giardia* illness and a diagnosed sexually transmitted infection between January 1, 2004 and December 31, 2009 and those who only have a foodborne illness during the same period?
15. Is having a diagnosed *Campylobacter* infection associated with having a diagnosed sexually transmitted infection compared to those who are diagnosed with salmonellosis?

16. Is having a diagnosed *Shigella* infection associated with have a diagnosed sexually transmitted infection compared to those who are diagnosed with salmonellosis?
17. Is having a diagnosed Hepatitis A infection associated with have a diagnosed sexually transmitted infection compared to those who are diagnosed with salmonellosis?
18. Is having a diagnosed *Cryptosporidium* infection associated with have a diagnosed sexually transmitted infection compared to those who are diagnosed with salmonellosis?
19. Is having a diagnosed *Giardia* infection associated with have a diagnosed sexually transmitted infection compared to those who are diagnosed with salmonellosis?

Target Journal

Sexually Transmitted Diseases is the peer-reviewed journal of the American Sexually Transmitted Diseases Association and publishes original articles on a broad range of topics including laboratory, epidemiologic, behavioral, and public health issues. The purpose of this study is to report original research identifying risk groups among Georgia residents who had laboratory-confirmed foodborne enteric illnesses for also having STIs between January 1, 2004 and December 31, 2009. With this topic and focus, *Sexually Transmitted Diseases* is an appropriate journal for submission.

Criteria for Journal Submission

Original research articles are to be limited to 3000 words and include reports of newly delineated syndromes, new investigations into mechanisms of disease, and other contributions to etiology, epidemiology, sociology, or treatment. Manuscripts that do not adhere to the following criteria will be returned prior to undergoing peer review.

- All text should be double-spaced with font size no smaller than 12 point. Left and right margins should be set at 1 inch with all pages numbered and continuous line numbers inserted starting from page 1.
- Text should be organized under the following headings: Introduction, Materials, and Methods, Results, and Discussion. All references, tables and figures follow.
- Abbreviations should be defined at first mention in the text and in each table and figure. Citations involving brand names should include the manufacturer's name and address (city and state/country).
- The abstract should be limited to 250 words without cited references. The abstract should be organized under the following subheadings: Background, Methods, Results, and Conclusions. Limit the use of abbreviations and acronyms and list three to five key words or phrases.
- A title page must be included with the following information: (a) complete manuscript title, (b) authors' full name (limit 10), highest academic degrees, and affiliations, (c) name and address for correspondence, fax number, telephone number, and e-mail address, (d) address for reprints if different from

that of corresponding author, (e) word counts for summary, abstract, and text; and number of figures and tables, (f) a conflict of interest disclosure statement, (g) and all sources of support.

- A brief summary of findings (<30 words) is needed for the Table of Contents.
- Numbered references (limit of 30) should be used and the accuracy checked as the authors are responsible for their accuracy.
- Figures should be referenced in order of discussion. Brief and specific figure legends should be included for all figures and included on a separate manuscript page after the references.
- Tables should be created using the table-creating and editing feature of your word processing software. Tables should be cited consecutively in the text and numbered in the same order but included on a separate manuscript sheet including the table title, appropriate column headings, and legends. All tables should be self-explanatory and should supplement rather than repeat the text.

Literature Review

<u>Foodborne Illnesses and their Sexual Transmission</u>

Salmonella is a gram-negative bacterium, often transmitted through contaminated foods, causing symptoms of diarrhea, fever, and abdominal cramps. More serious complications can occur leading to hospitalization or even death. Even though everyone is susceptible to *Salmonella*, those with compromised immune systems, such as the elderly and infants, are more likely to have serious complications.[5] Although estimates are inaccurate at best, the global burden of non-typhoidal *Salmonella* has been reported to be 93.8 millions cases each year.[10] This is a definite public health concern both globally and locally. In the United States, there were 8,256 cases reported to the CDC in 2010[11] and Georgia had the highest rate, 24.57 cases per 100,000, of salmonellosis among the 10 FoodNet sites for 2009.[3]

There is much evidence that the bacterium can be transmitted through routes that were not often considered, previously. For example, as the bacteria are shed through feces, the ingestion of fecal matter while performing analingus or fellatio on a contaminated penis could be enough to transmit the disease.[5] Although medical and public health officials recommend abstaining from such behaviors during illness, the large dose required for infection is typically thought to be a barrier for such transmission.[12,13]

Campylobacter is another gram-negative bacterial infection that often causes inflammatory or non-inflammatory diarrhea, abdominal pain, and vomiting. Sometimes serious complications can occur from *Campylobacter*, such as Guilain-Barre syndrome, nephritis, or even death.[5] In the United States, there were 6,365 reported cases of *Campylobacter* in 2010 and Georgia had the lowest rate, 7.58 cases per 100,000, among all FoodNet sites. The prevalence among the general population is not known, but it is estimated to be between 1-11% for homosexual men.[6,7] Though animals are considered to be the main reservoirs of *Campylobacter*, transmission to humans usually occurs through ingestion of contaminated foods or directly from person-to-person through ingestion of contaminated fecal matter.[5,13]

Certain behaviors have been linked to transmitting *Campylobacter*. For example, when comparing homosexual men with and without *Campylobacter*, engaging in analingus was significantly associated with having an intestinal infection.[6,7] Additionally, in contrast to foodborne *Campylobacter* outbreaks with short outbreak durations, outbreaks of *Campylobacter* attributed to sexual practices can affect a significant number of people and have long outbreak duration.[14]

Cryptosporidium is a protozoon that causes watery diarrhea, abdominal cramps, fever, vomiting, and weight loss.[15] In the United States, in 2010, there were 1,290 cases reported from all FoodNet sites, but the CDC reported an incidence of 11,657 in 2007 for all states reflecting broader surveillance of the illness.[11,15] Though children 1-4 years old are most burdened by the illness, a low infectious dose of as few as 10 organisms causes transmission through the fecal-oral route.[16,17] In a case-control study, the authors found that contracting *Cryptosporidium* was statistically associated with having more than one sexual partner, and approached statistical association with anal insertive sex and attending a sex venue.[18]

Hepatitis A is a viral, vaccine-preventable disease, though not all persons are vaccine protected. The Hepatitis A vaccine program was increased in 1999 and has been widely lauded as the reason for decreased rates of Hepatitis A.[19] The CDC reports that an average of 28,000 cases occur each year. Since 2003, Georgia's incidence has been on the decline.

The illness traditionally affects male children and young adults the most, but in 2007, the highest rates were seen in persons aged 25-39 years old.[19] The illness is transmitted through the fecal-oral route due to unsanitary conditions resulting in contaminated food or water. The most common risk factor, however, is being in contact with a sexual partner or housemate who is infected with the virus. In 2007, 8% of reported cases reported this type of exposure.[19]

There is commonly a gender disparity in incidence of the Hepatitis A. It was this gender disparity that first brought on the hypothesis of sexual transmission of Hepatitis A as early as 1969[20]. Specific behaviors were cited as risk factors in the early 80's, when outbreaks among MSM in Sweden were found to be associated with oral-anal contact and having multiple sexual partners.[21] The association between Hepatitis A and these behaviors persists, even when statistically controlling for sexual preference.[22] Furthermore, these outbreaks can be especially dangerous for the community as they can be long lasting and have the potential of reaching lower risk populations through non-risky routes.[23]

The most reported intestinal parasite in the United States, *Giardia lamblia,* is found in 7.2% of all submitted stool samples.[24] It is a reportable illness in 45 states, and a total of 19,794 cases were reported to the CDC in 2007, although this number probably underestimates the total burden of the parasite since not all states were represented in the sample.[4] A total of 691 cases were reported in Georgia in 2008.[4]

The prevalence in the general population isn't known, but in high risk homosexual communities it is estimated to be between 5% and 12%.[25,26] Contributing to its ease of sexual transmission is the low infectious dose, as has been found by volunteer studies.[27] As reported by the CDC, contact with human feces is the greatest risk factor for infection with *Giardia*. Unfortunately, infection is often times asymptomatic leading to silent transmission to close contacts, potentially for months, as oocysts can be shed in large numbers for extended periods.[4,28-31] As with other enteric illnesses, oral-anal activity has been shown to be a risk-factor for transmission of *Giardia,* with one study finding 100% of infected patients reporting anal-oral activity.[26]

The sexual transmission of Shigella is commonly reported. It is a gram-negative bacterium with similar symptoms as other foodborne enteric, such as abdominal cramps and severe diarrhea. There are approximately 14,000 laboratory-confirmed cases of shigellosis each year and an estimated yearly total of 450,000 cases.[32,33] Georgia has the highest reported incidence rate, 6.71 cases per 100,000, among the FoodNet sites.[11] Although the rates are highest nationally for children less than 4 years old (16.61 per 100,000) and decrease dramatically for other age groups, there is a slight increase for the 20-49 year age group (2.75 per 100,000).[3] In urban settings and among high-risk groups, however, the patterns can be drastically different. The principle reservoir is humans, and being that it is highly contagious, increases as high as 4-10x have been documented in urban settings.[5,19,20] The disease can be transmitted through contaminated foods or water, but the main person-to-person cause is through the fecal-oral route. The small inoculum size is thought to be the main reason for the communicability of the disease.[5] Volunteer studies have shown an infectious dose as low as 10 organisms for *S. dystenteria* and 100 organisms for *S. flexneri 2a*[34].

Shigella outbreaks within the MSM community have been documented in studies as early as 1976 and specific sexual behaviors were first associated with transmission in 1977.[35,36] Although rates are widely documented to increase with HIV infection, Aragon et. al.,[36] showed an odds ratio of 10.2 independent of an HIV infection. In this population-based study, the odds of shigellosis associated with anal-oral contact was similar to that associated with HIV infection, OR 7.5 and OR 8.17 respectively.[37]

Among all reportable illnesses, *Chlamydia* and Gonorrhea are the two illnesses most reported to the CDC, with a combined 1.5 million cases reported each year. In 2009, the CDC received the most reports of Chlamydia ever, for a total of 1,244,180.[38] In contrast to gonorrhea, the rates for Chlamydia infections in women are traditionally higher than the rates for men, but recently the disparity has been closing. In 2009, the national rate for men was 219.3 cases per 100,000, but this rate is increasing with the availability of urine testing and current and historical rates may underestimate the burden.[38]

Sexually Transmitted Infections

Compared to other states in the U.S., Georgia had the third highest rate of primary and secondary (PS) syphilis in 2009.[9] The high number of cases puts a large financial strain on patients and healthcare in general. For both U.S. men and women in their youth, the financial burden is estimated to be $248.4 million and $77 million for Chlamydia and gonorrhea, respectively. Furthermore, Georgia has one of the highest rates of female positivity in the U.S., with an estimated 10% of samples testing positive and incidence rate of 411.2 per 100,000 for chlamydia.[39]

STIs can be transmitted through unprotected vaginal and anal sex.[40] Although the rates of oropharyngeal and anal STIs are not known, risky sexual behavior is cited as a frequent mode of transmission for these infections. Transmission of Chlamydia and gonorrhea has been reported to be transmitted through a wide range of sexual behaviors.[41-46] What is more, these behaviors are becoming increasingly prevalent among certain groups. In a national sample of 12,571 males and females 15-44 years old, 40% have had anal sex and the rates among the general population are rising.[47] In a population-based study of 11,262 youth aged 12-25 years old, the odds of females participating in anal sex rose 2 times over a 10-year period and exposure rose from 2% to 6%.[48] This trend is more pronounced for oral sex as the odds increased 3.27 times over the same 10-year period.[48] The increase in oral and anal sex could be due to their perceptions of the emotional or physical outcomes of the behaviors. Alarmingly, teens perceive no risk of acquiring some STDs from oral sex. Moreover, they perceive it has fewer overall risks and common benefits relative to vaginal sex, although these beliefs are contradicted by research.[49,50] The perceived lack of intimacy of the acts could be what is actually driving the behavior, allowing teens to believe they are keeping their virginity or their innocence.

As risky sexual behaviors are becoming more prevalent, there is a need for research to identify common populations at risk and risk factors for potentially sexually transmitted, enteric inections and traditional STIs. These two infections can be transmitted in similar ways and common groups may be at risk for contracting both illnesses through risky sexual behavior. Governmental agencies do not currently assess the sexual transmission of foodborne illnesses. With no current research in the area, this is topic on which no data are available, and one that the public health field is in need of exploring. If any risk groups are identified, interventions can be designed around to target these risk groups through physicians' offices, STD clinics, and broad population programs.

Materials and Methods

Participants

Participants were 13,794 Georgia residents with culture-confirmed *Salmonella, Campylobacter, Shigella, Hepatitis A, Cryptosporidium, Giardia, Chlamydia, Gonorrhea*, or syphilis infections between January 1, 2004 and December 31, 2009. These cultures could have been performed at either clinical laboratories or the Georgia Public Health Laboratory (GPHL). Participants must have been 18 years of age or older at the culture date to be considered for participation.

Measures

This study included individual-level data collected through the FoodNet and Georgia STD surveillance systems using both active and passive surveillance. Passive surveillance is the collection of data sent to the health department from clinics, laboratories, and other states. Active surveillance is when state health department employees contact laboratories to determine if a reportable pathogen had been isolated.

Foodborne Illness. State law OCGA31-12-2 mandates that foodborne pathogens be reported to state and local health departments for tracking and outbreak investigations. *Salmonella*, *Campylobacter*, and *Shigella* are tested by culture at either a clinical laboratory or GPHL. *Cryptosporidium* is diagnosed through laboratory identification of oocysts in stool, intestinal fluid, or biopsy samples. It can also be identified through a positive enzyme immunoassay (EIA) test. A diagnosis of giardiasis is obtained through EIA or the identification of Giardia cysts or trophozoites in stool, intestinal fluid, or biopsy. Acute Hepatitis A is diagnosed through the identification of immunoglobulin M (IgM) antibody to hepatitis A virus in a blood sample at either the clinical laboratory or GPHL. For the purpose of this study, the term foodborne illness will be us for any illness that is traditionally transmitted through food regardless of how the illness was actually transmitted.

Sexually Transmitted Infections. The STD Epidemiology Unit within the Georgia Department of Public Health (DPH) analyzes data, sent by passive surveillance, on reported *Chlamydia trachomatis* (chlamydia), *Neisseria gonorrhoeae* (gonorrhea), and *Treponema pallidum* syphilis infections. Positive laboratory test results associated with confirmed cases of chlamydia, gonorrhea, and early syphilis (primary, secondary, and early latent stages) are included in this study.

Chlamydia is diagnosed through isolation of *C. trachomatis* by culture or through demonstration of *C. trachomatis* in a clinical sample by an antigen or nucleic acid based test. Gonorrhea is diagnosed through isolation of typical gram-negative, oxidase-positive diplococci from a clinical specimen or demonstration of *N. gonorrhoeae* in a clinical sample by detection of antigen or nucleic acid. Gonorrhea can also be diagnosed through observation of gram-negative intracellular diplococci in a urethral smear. All stages of syphilis are diagnosed through laboratory demonstration of *Treponema pallidum* in clinical specimens by darkfield microscopy, direct fluorescent antibody, or equivalent methods and through stage specific clinical descriptions. Primary cases are characterized by one or more chancres. Secondary cases present with localized or diffuse mucocutaneous lesions and often times with generalized lymphadenopathy. Early latent syphilis is diagnosed when a person is infected with *T. pallidum* without symptoms or signs. Additionally, the early latent stage is considered when the initial infection occurred within the previous 12 months based on one or more of the following criteria:

- Documented seroconversion or fourfold or greater increase in titer of a nontroponemal test during the previous 12 months
- A history of symptoms consistent with primary or secondary syphilis during the previous 12 months
- A history of sexual exposure to a partner who had confirmed or probable primary or secondary syphilis or probable early latent syphilis
- Reactive nontreponemal and treponemal tests from a person whose only possible exposure occurred within the preceding 12 months.

Match. A match is defined as a patient with both a diagnosed foodborne enteric illness and a diagnosed STD between January 1, 2004 and December 31, 2009.

Demographics. Participant demographics included are gender, race, ethnicity, birth date, and age at onset. This information is entered into the State Electronic Notifiable Disease Surveillance System (SendSS) by state health workers, district epidemiologists, and clinical employees. Surveillance officers at GDPH obtain demographic information when details are missing from the original entry. Any categories with quantities of 5 or less were collapsed into the next classification.

Clinical Data. Surveillance officers at the GDPH contact clinical offices and laboratories to collect information pertaining to hospitalization and the following symptomology as reported in patient charts: fever, headache, diarrhea, abdominal pain, vomiting, and nausea. Clinical data was only collected for cases diagnosed with *Salmonella*, *Campylobacter*, and *Shigella* infections.

Rural or Urban Designation. The classification of urban, near urban, or rural is defined by the 2003 Rural-urban Continuum Codes designed by the United States Department of Agriculture. Continuum codes 1-3 were classified as Urban and codes 4-7 were designated as Near Urban, and codes 8-9 were classified as Rural. Any categories with quantities of 5 or less were collapsed into the next classification.

Procedure

This is a cross-sectional, descriptive study. A data set containing foodborne data was obtained from the GDPH Acute Disease Epidemiology Section. A data set with STD cases, diagnosis date, and diagnosed STD was provided by the GDPH STD Epidemiology Unit. The time period of January 1, 2004 to December 31, 2009 was chosen due to the completeness of data and the presence of pertinent variables.

Matches. Foodborne and STD datasets were combined in SAS (v 9.2) and matches determined by The Link King© record linkage software using the program's default algorithm for first name, last name, and date of birth. The final data set includes FoodNet data for all Georgia residents who were diagnosed with a foodborne illness. Additionally, all matched observations include the diagnosed STD(s) and diagnosis date(s).

Data Analysis

The final data set was analyzed on the following characteristics: (a) overall proportion of matches (b) enteric illness specific proportion of matches (c) demographic and clinical differences between matched and unmatched cases (d) demographic and clinical differences between matched and unmatched cases for each enteric illness. The following statistical tests were utilized: Chi-square or Fisher's Exact, Odds Ratios, and Logistic Regression. Compared to other foodborne illnesses, *Salmonella* has a high infectious dose and, therefore, transmission through sexual behaviors is unlikely. Because of this, *Salmonella* was used as the referent group analyses.

Results

A total of 13,742 Georgia residents were included in this study. These participants were 18 years or older when diagnosed with a foodborne illness.

Information for the entire sample is available in Table 1. The sample was 51.4% (n=7,061) male and 48.6% (n=6,681) female. The greatest frequencies of participants were white (n=7,893; 70.5%), non-Hispanic (n=8,401; 95.7%), 25-44 years old (n=6,018; 43.6%), and lived an urban area (n=10,682; 77.8%). Salmonellosis was the most common foodborne illness (n=5,280; 38.3%) and gonorrhea was the most common sexually transmitted infection (n=359; 35.1%) followed by Chlamydia (n=237; 23.2%). The majority of the sample was not hospitalized (n=6,997; 58.9%). The greatest frequencies of clinical symptoms were fever (n=1,682: 68.6%), diarrhea (n=2,672; 94.9%), abdominal pain (n=2,099; 81.0%), and nausea (n=1,792; 70.7%), without headache (n=1,168; 53.3%) or vomiting (1,374; 53.0%).

As shown in Table 2, gonorrhea (n=359; 35.1%) was the most frequently reported STD followed by *Chlamydia* (n=237; 23.2%). Gonorrhea was the most common STD occurring with all foodborne illnesses except for Salmonella infections where gonorrhea accounted for 30.6% (n=22) and *Chlamydia* accounted for 61.1% (n=44). Matches with salmonellosis were also primarily female (n=34; 60.7%). Primary syphilis was the least reported STD across all foodborne illnesses.

In single variable comparisons (Table 3), matched cases were more likely to be men (OR=3.94; 95% CI=3.24-4.79) when compared to women, and this disproportionate male to female ratio was most significant ($p<0.05$) among those diagnosed with cryptosporidium (OR=8.73; 95% CI: 4.87-15.68) compared to other selected enteric illnesses (Table 4). Patients of Black or African American race had increased odds (OR=10.62; 95% CI: 8.62-13.08) of being a match (i.e., having both and STD and a foodborne illness) when compared to white race. Matched cases were more likely to be from an urban area (OR=5.64; 95% CI: 3.95-8.07) than a rural area. Lack of data did not allow for an assessment of those diagnosed with acute Hepatitis A. Furthermore, age decreased the odds of being a match when 18-24 age group was compared to 25-44 age group (OR=0.86; 95% CI: 0.71-1.04) and ≥45 age group (OR=0.08; 95% CI: 0.06-0.12).

Matches differed from those without a diagnosed STD through exhibited clinical symptoms and illness severity. The crude odds ratios show that although matched cases had increased odds of going to the emergency room (OR=1.47; 95%

CI: 1.09-1.99) when compared to unmatched cases, matched cases also had decreased odds of having a fever (OR=0.57; 95% CI: 0.31-1.03), diarrhea (OR=0.34; 95% CI: 0.15-0.76), and nausea (OR=0.55; 95% CI: 0.31-0.99). The odds of being a matched case were increased for all other foodborne illnesses when compared with salmonellosis, but the odds were highest for those with cryptosporidiosis (OR=12.41; 95% CI: 9.04-17.03) and shigellosis (OR=11.65; 95% CI: 8.62-15.73) compared to those with salmonellosis.

Multiple logistic regression was conducted to examine the association between all the indicators and being a match. Two separate analyses were conducted all indicators: One for demographic indicators and one for clinical indicators. Before including all the independent variables in the analysis, multicollinearity was assessed through variance inflation factors (VIF) for the demographic indicators (VIF=1.00-1.21) and clinical indicators (VIF=1.04-1.68).

In the demographic indicator model, several independent variables were significant indicators for being a match after controlling for all other variables (Table 5). Males had significantly higher odds of being a match (OR=2.81; 95% CI: 2.16-3.65) compared to females. This relationship was most pronounced in matches diagnosed with cryptosporidium (OR=7.37; 95% CI: 3.30-16.45) as shown in Table 6. Also, racial differences were seen between matched and unmatched cases, as matched cases were significantly more likely ($p<0.05$) to be of Black or African American race was compared to white race for all foodborne illnesses. This trend could not be assessed for those with hepatitis A due to insufficient data. Being in an older age group decreased the odds of being a match compared to the 18-24 year age group.

Being ≥45 years old was protective as the odds of being a match was 0.16 (95% CI: 0.10-0.24) times the odds of not being in the 18-24 year age group. Living in an urban area was a significant indicator for being a match (OR=2.08; 95% CI: 1.30-3.34). Among all the foodborne illnesses, being diagnosed with cryptosporidiosis had the highest odds of being a match (OR=5.14; 95% CI: 3.50-7.37) when compared to being diagnosed with salmonellosis. The odds were increased for those diagnosed with any other individual foodborne illness compared to being diagnosed with salmonellosis.

Additionally, several clinical variables were significant indicators for being a match. For matches, the odds of going to the emergency department were 3.25 (95% CI: 1.25-8.42) times the odds of not being hospitalized (Table 7) after controlling for all other clinical factors. Also, matches were less likely to have diarrhea (OR=0.21; 95% CI: 0.08-0.53) or nausea (OR=0.31; 95% CI: 0.31-0.75).

Discussion

This is the first study to describe associated factors for adults who have both a foodborne illness and a sexually transmitted infection. Approximately 4.6% of this sample had both types of illnesses. Previous research has highlighted outbreaks of foodborne illness within the MSM community,[14,18,37] but this is the first research study to evaluate demographic and clinical characteristics of the subset of cases with notifiable foodborne illnesses and STIs, using data from the Georgia Department of Public Health. This study did not limit analysis to the MSM community.

A few findings in this study were in alignment with previous research. It was found that males represented a higher percentage of matches than females for all foodborne illnesses except *Salmonella*. This was expected from data reported from published outbreak investigations of within the MSM community,[14,18,37] but had never been demonstrated in people who have both a STI and a foodborne illness, even those that frequently described as being transmitted sexually. Additionally, the statistically significant association of living in an urban area to being a match was expected from previous research. This could be simply due to more people contracting these illnesses in metropolitan areas or it could be linked to an increase in prevalence of the behaviors that can spread both foodborne and sexually transmitted infections in urban populations.

In this study, women represented a larger percentage of those diagnosed with salmonellosis and a STI than men. This was the only foodborne illness with this gender characteristic. Matches with salmonellosis were primarily women (60.7%), black or African American (58.7%), and from a metropolitan area (71.9%). This subset of cases was also more likely to have a headache and less likely to have diarrhea. Thus, those with salmonellosis either had fewer symptoms or less severe symptoms to report to their medical care provider. Gender differences in health care utilization have been widely documented with women using more services, having an increased likelihood to seek help for ailments, and an increases perception of their symptoms.[51] This could explain the relationship between *Salmonella* matches having fewer symptoms yet being reported more in this sample. The male matches in this group could be underrepresented due to under-reporting or under-utilization of medical services.

Furthermore, for those diagnosed with a Salmonella infection, the most frequently diagnosed STD was *Chlamydia* (61.1%). Salmonellosis was the most frequently diagnosed illness in this sample at twice the frequency diagnosed as any other foodborne illness. Historically, women have been tested at higher frequencies for *Chlamydia* than men[37] even though this gap is closing with the advent of less invasive testing procedures. There are demographic disparities in testing rates, with black women being tested at higher rates than white women.[52] The larger percentage of females with salmonellosis and a sexually transmitted infection was possibly driven by increased Chlamydia testing in this population.

This study can help inform public health interventionists focused on either foodborne illnesses or STIs. The potential for an education or prevention program to have a large impact on at-risk Georgia residents is present. The underlying assumption of this study is that behaviors are the primary drivers of acquiring both types of illness, instead of environmental or immunocompromising factors. Theories of behavioral change can help to illuminate potential risky behaviors involved in acquiring both a foodborne and a sexually transmitted illness.

Although there is not a study that has assessed the current knowledge of the sexual transmission of traditional foodborne illnesses among the general population, the authors think that there is little knowledge among the general public regarding transmission of these illnesses through sexual behaviors. The most current published article regarding an ongoing shigellosis outbreak among MSMs in England[53] highlights the need for certain populations to be aware of the risks of certain activities and preventative measures to mitigate these risks. An educational program could have considerable results at the current knowledge level. Under the current study's findings and previous research, it is recommended that prevention be maximized through use of condoms and/or latex barriers when participating in any anal or oral-anal sex.

This study combined 6 years of foodborne and sexually transmitted infection data to provide a comprehensive and historical perspective on risk indicators for having both a foodborne illness and a sexually transmitted infection. By using probabilistic matching to combine data sets, the maximum number of observations was kept for analysis and representation of the general population. But, probabilistic matching also allows for the possibility of miss-matches.

Some limitations in this study relate to incomplete data and not enough data to draw significant conclusions across all demographic and clinical classifications. Firstly, symptoms were only collected on a couple of foodborne illnesses. Also, hospitalization was included in the same multivariate analysis as the clinical factors. Literature shows that demographic factors are as influential in predicting emergency department use as clinical manifestation of illness, so some demographic indicators should be included with emergency department use in future studies. Additionally, being a match was defined as having a foodborne illness and a STI at any point during the 6-year study period. Defining and identifying true co-infections that were diagnosed within 30 days of each other could provide additional insight into this population. Finally, different states and regions have unique foodborne exposures limiting the generalizability of this study.

This study is the beginning of a series of needed reports exploring a previously unidentified risk group. By using the Precede-Proceed Model, future research can identify the behavioral or environmental factors for transmitting or contracting foodborne illnesses through sexual behaviors. Sexually transmitted infections are becoming more prevalent among young people as are certain risky sexual behaviors. By providing an additional tool for medical practitioners to identify and prevent illness, public health can stand with medical science to provide the highest quality preventive and primary care.

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Tables

(following page)

Table 1: Frequencies of indicators for Georgia residents diagnosed with a laboratory-confirmed foodborne illness, January 2004 - December 2009

Indicators	n	# (%)
Gender	13742	
Male		7061 (51.4)
Female		6681 (48.6)
Race	11197	
White		7893 (70.5)
Black Or African American		2869 (25.6)
Other		435 (3.9)
Ethnicity	8775	
Hispanic		374 (4.3)
Non-Hispanic		8401 (95.7)
Age	13794	
18-24		1705 (12.4)
25-44		6018 (43.6)
>=45		6071 (44)
Hospitalized	11872	
Yes		4000 (33.7)
No		6997 (58.9)
Er Only		875 (7.4)
Foodborne Illness	13794	
Campylobacteriosis		2662 (19.3)
Cryptosporidiosis		1140 (8.3)
Giardiasis		2480 (18)
Hepatitis A (Acute)		494 (3.6)
Salmonellosis		5280 (38.3)
Shigellosis		1738 (12.6)
Sexually Transmitted Infection	1022	
Chlamydia		237 (23.2)
Gonorrhea		359 (35.1)
Syphilis, Primary		28 (2.7)
Syphilis, Secondary		228 (22.3)
Syphilis, Early Latent		170 (16.6)
Geography	13727	
Urban		10682 (77.8)
Not Urban		3045 (22.2)
Fever	2453	
Yes		1682 (68.6)
No		771 (31.4)
Headache	2191	
Yes		1023 (46.7)
No		1168 (53.3)
Diarrhea	2817	
Yes		2672 (94.9)
No		145 (5.1)
Abdominal Pain	2591	
Yes		2099 (81)
No		492 (19)
Vomiting	2592	
Yes		1218 (47)
No		1374 (53)
Nausea	2533	
Yes		1792 (70.7)
No		741 (29.3)

Table 2: Frequency of Sexually Transmitted Infections among Georgia residents diagnosed with a notifiable foodborne illness, January 2004 - December 2009

Sexually Transmitted Illness	All Matched Cases	Campylobacter	Cryptosporidium	Giardia
	# (%)	# (%)	# (%)	# (%)
Chlamydia	237 (23.2)	16 (23.9)	32 (13.9)	51 (16.2)
Gonorrhea	359 (35.1)	23 (34.3)	86 (37.4)	108 (34.4)
Syphilis, primary	28 (2.7)	2 (3)	4 (1.7)	9 (2.9)
Syphilis, secondary	228 (22.3)	18 (26.9)	57 (24.8)	90 (28.7)
Syphilis, early latent	170 (16.6)	8 (11.9)	51 (22.2)	56 (17.8)
n	1022	67	230	314

Table 2 continued: Frequency of Sexually Transmitted Infections among Georgia residents diagnosed with a notifiable foodborne illness, January 2004 - December 2009

Sexually Transmitted Illness	Hepatitis A (Acute)	Salmonella	Shigella
	# (%)	# (%)	# (%)
Chlamydia	7 (53.8)	44 (61.1)	87 (26.7)
Gonorrhea	4 (30.8)	22 (30.6)	116 (35.6)
Syphilis, primary	0 (0)	1 (1.4)	12 (3.7)
Syphilis, secondary	1 (7.7)	1 (1.4)	61 (18.7)
Syphilis, early latent	1 (7.7)	4 (5.6)	50 (15.3)
n	13	72	326

Table 3: Crude odds ratios for matched cases with any foodborne illness compared to unmatched cases

Indicators (n)	All Matched Cases OR (95% CI)
Gender (637)	
Male (508)	**3.94 (3.24-4.79)**
Female (129)	1.00
Race (531)	
White (120)	1.00
Black Or African American (460)	**10.62 (8.62-13.08)**
Other (7)	1.06 (0.49-2.28)
Ethnicity (472)	
Hispanic (12)	0.57 (0.32-1.03)
Non-Hispanic (460)	1.00
Age (640)	
18-24 (146)	1.00
25-44 (447)	0.86 (0.71-1.04)
>=45 (47)	**0.08 (0.06-0.12)**
Hospitalized (516)	
Yes (169)	1.01 (0.83-1.22)
No (294)	1.00
Er Only (53)	**1.47 (1.09-1.99)**
Geography (636)	
Urban (604)	**5.64 (3.95-8.07)**
Not Urban (32)	1.00
Fever (45)	
Yes (25)	0.57 (0.31-1.03)
No (20)	1.00
Headache (35)	
Yes (18)	1.21 (0.62-2.37)
No (17)	1.00
Diarrhea (52)	
Yes (45)	**0.34 (0.15-0.76)**
No (7)	1.00
Abdominal Pain (47)	
Yes (40)	1.35 (0.60-3.02)
No (7)	1.00
Vomiting (45)	
Yes (21)	0.99 (0.55-1.78)
No (24)	1.00
Nausea (47)	
Yes (27)	**0.55 (0.31-0.99)**
No (20)	1.00
Foodborne Illness (640)	
Campylobacter (46)	**1.61 (1.09-2.38)**
Cryptosporidium (136)	**12.41 (9.04-17.03)**
Giardia (193)	**7.73 (5.73-10.43)**
Acute Hepatitis A (12)	**2.28 (1.22-4.28)**
Salmonella (57)	1.00
Shigella (196)	**11.65 (8.62-15.73)**

p<0.05

Table 4: Crude odds ratios of demographic and clinical indicators for specific foodborne illness comparing matched cases to unmatched cases

Indicators	Campylobacter	Cryptosporidium	Giardia
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender			
Male	1.77 (0.94-3.33)	**8.73 (4.87-15.68)**	**7.94 (4.66-13.54)**
Female	1.00	1.00	1.00
Race			
White	1.00	1.00	1.00
Black Or African American	**9.50 (5.04-17.91)**	**5.50 (3.48-8.71)**	**5.45 (3.51-8.46)**
Other		3.35 (0.93-12.14)	0.36 (0.09-1.53)
Ethnicity			
Hispanic	[b]	0.74 (0.17-3.26)	0.41 (0.10-1.74)
Non-Hispanic		1.00	1.00
Age			
18-24	1.00	1.00	1.00
25-44	1.39 (0.61-3.19)	**0.61 (0.39-0.96)**	1.35 (0.88-2.08)
>=45	**0.35 (0.13-0.98)**	**0.08 (0.04-0.17)**	**0.22 (0.12-0.41)**
Hospitalized			
Yes	1.23 (0.60-2.52)	1.07 (0.73-1.56)	1.04 (0.61-1.76)
No	1.00	1.00	1.00
Er Only	**2.27 (1.01-5.12)**	1.08 (0.51-2.28)	
Geography			
Urban	**2.89 (1.03-8.09)**	**26.90 (3.74-193.73)**	**9.73 (3.09-30.65)**
Not Urban	1.00	1.00	1.00
Fever [a]			
Yes	[b]		
No			
Headache [a]			
Yes	[b]		
No			
Diarrhea [a]			
Yes	[b]		
No			
Abdominal Pain [a]			
Yes	[b]		
No			
Vomiting [a]			
Yes	[b]		
No			
Nausea [a]			
Yes	[b]		
No			

p<0.05

[a] clinical variables were collected for Salmonella, Shigella, and Campylobacter only

[b] insufficient data

Table 4 continued: Crude odds ratios of demographic and clinical indicators for specific foodborne illness comparing matched cases to unmatched cases

Indicators	Hepatitis A (Acute)	Salmonella	Shigella
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender			
Male	0.85 (0.27-2.66)	0.81 (0.47-1.39)	**4.50 (3.19-6.34)**
Female	1.00	1.00	1.00
Race			
White	1.00	1.00	1.00
Black Or African American	**29.22 (3.60-237.48)**	**6.49 (3.68-11.45)**	**8.90 (5.86-13.50)**
Other		2.40 (0.56-10.34)	
Ethnicity			
Hispanic	1.25 (0.15-10.49)	1.04 (0.25-4.33)	0.77 (0.30-1.97)
Non-Hispanic	1.00	1.00	1.00
Age			
18-24	1.00	1.00	1.00
25-44	0.37 (0.12-1.19)	**0.53 (0.30-0.93)**	**0.63 (0.44-0.89)**
>=45		**0.02 (0.004-0.07)**	**0.09 (0.04-0.19)**
Hospitalized			
Yes	2.53 (0.62-10.27)	1.007 (0.58-1.75)	1.18 (0.83-1.67)
No	1.00	1.00	1.00
Er Only		0.99 (0.35-2.85)	**1.72 (1.12-2.65)**
Geography			
Urban		1.17 (0.65-2.09)	**4.88 (2.38-10.03)**
Not Urban	1.00	1.00	1.00
Fever [a]			
Yes		**0.43 (0.19-0.98)**	0.62 (0.24-1.60)
No		1.00	1.00
Headache [a]			
Yes		1.54 (0.65-3.67)	0.57 (0.16-1.97)
No		1.00	1.00
Diarrhea [a]			
Yes		**0.15 (0.06-.37)**	
No		1.00	1.00
Abdominal Pain [a]			
Yes		0.72 (0.28-1.83)	3.59 (0.46-27.80)
No		1.00	1.00
Vomiting [a]			
Yes		0.71 (0.31-1.66)	0.98 (0.39-2.47)
No		1.00	1.00
Nausea [a]			
Yes		0.54 (0.23-1.23)	0.42 (0.17-1.03)
No		1.00	1.00

p<0.05

[a] clinical variables were collected for Salmonella, Shigella, and Campylobacter only

[b] insufficient data

Table 5: Adjusted odds ratios for all matches cases diagnosed with any foodborne illness controlling for all other demographic variables

Demographic Indicator	All Matched Cases
Gender	
Male	**2.81 (2.16-3.65)**
Race	
Black Or African American	**4.35 (3.39-5.6)**
Other	0.58 (0.26-1.28)
Ethnicity	
Hispanic	1.26 (0.65-2.44)
Age Group	
25-44	0.84 (0.65-1.08)
>=45	**0.16 (0.10-0.24)**
Geography	
Urban	**2.08 (1.30-3.34)**
Foodborne Illness	
Campylobacter	**1.59 (1.01-2.51)**
Cryptosporidium	**5.14 (3.50-7.37)**
Giardia	**3.57 (2.42-2.42)**
Hepatitis A (Acute)	1.52 (0.69-3.35)
Shigella	**4.88 (3.38-7.05)**

p<0.05

Table 6: Foodborne disease specific adjusted odds ratios for demographic indicators controlling for all other demographic variables

Demographic Indicator	Campylobacteriosis	Cryptosporidium	Giardia
Gender			
Male	1.43 (0.71- 2.93)	**7.37 (3.30-16.45)**	**7.49(2.67-20.97)**
Race			
Black Or African American	**7.81 (3.98-15.32)**	**2.13 (1.27-3.58)**	**2.52 (1.51-4.21)**
Other	[b]	1.85 (0.46- 7.39)	0.27 (0.06-1.19)
Ethnicity			
Hispanic	[b]	1.18 (0.24-5.84)	0.64 (0.14-2.85)
Age Group			
25-44	1.04 (0.41- 2.63)	0.61 (0.36-1.05)	1.55 (0.85-2.83)
>=45	0.35 (0.12-1.08)	**0.14 (0.06-0.34)**	**0.30 (0.11-0.81)**
Geography			
Urban	2.71 (0.81- 9.02)	6.99 (0.92-52.87)	**2.03 (1.03-56.77)**

p<0.05

[b] insufficient data

Table 6 continued: Foodborne disease specific adjusted odds ratios for demographic indicators controlling for all other demographic variables

Demographic Indicator	Hepatitis A (Acute)	Salmonella	Shigella
Gender			
Male	1.54 (0.31-7.70)	0.99 (0.53-1.87)	**3.32 (2.17-5.09)**
Race			
Black Or African American	[b]	**10.54 (5.15-21.56)**	**4.42 (2.73-7.16)**
Other	[b]	2.42 (0.41-14.41)	[b]
Ethnicity			
Hispanic	[b]	1.45 (0.25-8.55)	2.18 (0.66-7.21)
Age Group			
25-44	0.27 (0.05-1.35)	0.58 (0.29-1.17)	0.69 (0.45-1.07)
>=45		**0.03 (0.01-0.12)**	**0.21 (0.09-0.50)**
Geography			
Urban	[b]	0.75 (0.37-1.50)	3.20 (0.97-10.54)

p<0.05

[b] insufficient data

Table 7: Adjusted odds ratios for all matched cases and disease specific cases while controlling for all other clinical indicators

Clinical Indicator	All Foodborne	Salmonella	Shigella
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Hospitalized			
Yes	1.18 (0.53-2.61)	1.39 (0.53-3.64)	0.35 (0.04-3.31)
ER Only	**3.25(1.25-8.42)**	1.86 (0.38-9.09)	2.67 (0.63-11.36)
Headache			
Yes	1.91 (0.89-4.12)	2.54 (0.93-6.96)	1.02 (0.25-4.23)
Diarrhea			
Yes	**0.21 (0.08-0.53)**	**0.11 (0.04-0.33)**	[b]
Abdominal Pain			
Yes	1.60 (0.63-4.08)	1.11 (0.367-3.37)	3.89 (0.42-35.82)
Vomiting			
Yes	1.54 (0.65-3.66)	1.68 (0.55-5.14)	1.65 (0.19-14.52)
Nausea			
Yes	**0.31 (0.13-0.75)**	0.38 (0.12-1.21)	**0.12 (0.02-0.97)**

p<0.05

[b] insufficient data