January 2014

# Foodnet Population Survey 2006-2007: Differences In Prevalence Of Health Care Seeking Behaviors And Exposures To Risk Factors For Foodborne Illness By Socioeconomic Status

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Epidemiology of Microbial Diseases

Yale School of Public Health

2014

**Acknowledgements**

First, I would like to express my thanks and appreciation to Dr. James Hadler for his guidance, suggestions, and evaluation of this analysis. I would also like to thank Dr. Melinda Pettigrew for her helpful suggestions and evaluation.

I would also like to express my gratitude to Sharon Hurd, Danyel Olson, Paula Clogher and the Emerging Infections Program staff for their advice, support, and encouragement.

Finally, I would like to thank my friends, family, and fellow Yale School of Public Health Students for their support and encouragement.

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**Abstract**

***Background*****:** Previous studies in Connecticut (CT) have shown an association between higher incidence of bacterial foodborne pathogens, including *Salmonella, Campylobacter*, and shiga-toxin producing *E. coli*. Two hypotheses have been proposed to explain this association: 1) individuals of higher SES are more likely to seek medical care and be diagnosed following an episode of diarrhea or 2) the prevalence of risk factors for bacterial foodborne pathogens is higher among those of higher SES. CT is positioned to examine these two hypotheses because the FoodNet population survey, a source of data on SES, prevalence of healthcare-seeking behavior specific to diarrhea and prevalence of risk factors for foodborne illness, was conducted here.

***Methods*****:** Using the 2006-2007FoodNet population survey, we had two sources of SES data:-household income level, as reported by each participant in the survey, and ZIP code tabulation area (ZCTA)-level poverty, which was determined from each participant's ZIP code and the 2000 Census. Household income level was broken down into four categories: <$25,000 per year, $25,000 to <$55,000, $55,000 to <$100,000, and ≥100,000. ZCTA-level poverty was broken down into four categories: <5%, 5% to <10%, 10% to <20% and ≥20% of residents living below the federal poverty level. The age and sex-adjusted prevalences of exposure to selected risk factors for bacterial foodborne pathogens in the preceding seven days and of seeking care for diarrhea were determined for each SES level in each category. Trends from lowest to highest SES levels in each category were examined using the chi-square test for trend.

***Results*****:** A total of 1237 CT residents over the age of 18 years were included in the analysis. After adjustment for age and sex, 10 risk factors were associated with increasing SES, including 5 for household and 8 for ZCTA SES, and 4 risk factors were associated with decreasing SES, including 2 for household and 2 for ZCTA SES. Among 210 persons with diarrhea, there was a paradoxical finding for phoning a doctor, with it being associated with higher SES by household income and lower SES by ZCTA-level poverty. Despite this there were no significant differences in visiting a doctor. The correlation of household income with ZCTA poverty categories was low (r=0.25)

***Conclusions*****:** We found 1) no clear association between visiting a physician for diarrhea and SES status; 2) a number of risk factors for sporadic illness and outbreaks were more common among those of higher area-based SES status than those of lower area-based SES status and few risk factors were more common among those of lower area-based SES status; 3) results from using area-based and individual SES were not always concordant. These findings have implications for control of foodborne bacterial pathogens and for surveillance both of foodborne pathogens and for prevalence of risk factors for them.

## Introduction

Previous studies in Connecticut have shown a relationship between area-based poverty and the incidence of bacterial foodborne illness. Specifically, the incidence of infections with Shiga toxin-producing *E. coli* (STEC) O157 and non-O157, *Campylobacter*, and certain strains of *Salmonella* are associated with higher socioeconomic status (SES) among adults. In a study of STEC incidence from 2000 to 2011, the incidence of both STEC O157 and non-O157 infections as census tract-level poverty decreased. In fact, residents of the wealthiest census tracts in Connecticut were four times as likely to contract an STEC infection as residents of the poorest census tracts[1].

Additionally, a study of *Salmonella* serotype-specific incidence showed significant relationships between the incidence of certain strains of *Salmonella* and area-based poverty in Connecticut among adults. The incidence of infections with *Salmonella* enteriditis, typhimurium, and Newport increased as census-tract level poverty decreased. However, the opposite association was observed for the incidence of *Salmonella* Heidelberg infections, with incidence of these infections increasing with increasing census tract-level poverty[2].

Studies in both Connecticut and Maryland have shown similar relationships between incidence of infections of *Campylobacter* and socioeconomic status among adults. A study of Connecticut indicated that the incidence of *Campylobacter* infections from 1999 to 2009 increased with decreasing census tract-level poverty level[3]. Additionally, a recent study from Maryland observed a similar relationship between the incidence of *Campylobacter* infections from 2002 to 2010 and area based poverty, with incidence of campylobacteriosis increasing with decreasing ZIP code-level poverty [4].

Two possible hypotheses have been proposed to explain the finding that higher area-based socioeconomic status is associated with higher incidence of bacterial foodborne illness based on confirmed, reported cases of infection. The first of these is that this finding is a spurious finding resulting from higher probability of those of higher socioeconomic status seeking health care and getting tested for any given diarrheal episode[4]. Alternatively, this finding could be a true finding resulting from the higher prevalence of risk factors for bacterial foodborne illness among adults with higher socioeconomic status.

The Foodborne Diseases Active Surveillance Network (FoodNet) conducts population-based active surveillance for laboratory confirmed cases of several infections, including infections with *Campylobacter,* Shiga toxin producing *E. coli*O157 and non-O157, and *Salmonella*[5]. In addition to active surveillance, FoodNet also conducts population-based telephone surveys of persons within the surveillance area in order to determine both the population probability that persons with diarrheal illness seek health care and get diagnostic testing as well as exposure to known risk factors for diarrheal illnesses. The FoodNet population survey contains both self-reported household income levels as well as zip code information, thereby providing two sources of socioeconomic information (household-based and area-based)[6].

As one of the ten FoodNet sites where the population survey was administered from 2006 to 2007 and the only one that has examined the association of area-based poverty with incidence of more than one foodborne bacterial pathogen, Connecticut is uniquely positioned to examine these two hypotheses by studying the effect of socioeconomic status on the prevalence of health care seeking behavior specific to diarrhea and risk factors for bacterial foodborne illness. Additionally, since the FoodNet population survey contains both household income and ZIP code information, we are also in a position where we can compare these two measures of socioeconomic status.

Data on risk factors for infection with bacterial foodborne pathogens come from two types of epidemiologic studies: studies of sporadic non-outbreak cases of disease and studies of outbreaks. Case-control studies in the FoodNet sites have helped to determine the risk factors for sporadic cases of *Salmonella* enteriditis, including eating undercooked eggs and eating chicken outside the home[7]. The consumption of contaminated shell eggs and egg-derived products has been associated with outbreaks of *S. enteriditis*[8,9]. Risk factors for sporadic cases of *Salmonella* typhimurium include consumption of undercooked meat[10] and eating eggs outside the home[11]. Eating eggs outside the home was also determined to be a major risk factor for sporadic cases of *Salmonella* Heidelberg, while contaminated eggs and poultry have been associated with outbreaks of *S.* Heidelberg[12]. Sporadic infections due to *Salmonella* Newport have been associated with eating undercooked eggs and eggs outside the home, as well as with uncooked ground beef[11,13]. Outbreaks of multiple strains of *Salmonella* infections have been associated with unpasteurized milk, cheese made from raw milk, undercooked contaminated beef and chicken products, as well as contaminated lettuce, leafy greens, and raw tomatoes[9,14-19]. Reptile and amphibian exposures have also been linked to sporadic cases and outbreaks of *Salmonella*[20-22].

Case control studies in the FoodNet sites have also been useful in examining the risk factors for sporadic STEC infections. Farm exposure, cattle exposure, eating pink hamburger or ground beef both at home and away from home, and eating at a table service restaurant were all identified as risk factors for sporadic cases of STEC O157 in a 2004 case control study in five FoodNet sites[23]. Outbreaks of STEC O157 have been linked to beef products, consumption of raw milk and raw milk cheese products, foods likely contaminated with bovine feces including lettuce, alfalfa sprouts, and apple cider, as well as attending child daycare/exposure to child in daycare[23]. Risk factors for STEC non-O157 are still being studied, but exposure to cattle has been identified as a risk factor for sporadic infections, and outbreaks have been identified as being linked to foods contaminated with bovine feces[24,25].

Risk factors for sporadic infections of *Campylobacter* include consumption of poultry, exposure to a house pet, and chicken eaten away from home[26]. Raw milk has been implicated as a vehicle in outbreaks of *Campylobacter*[27]. Finally, international travel has been implicated as a risk factor for several different strains of *Salmonella* infections[7,13,28], STEC O157 and non-O157 infections[29], and *Campylobacter* infections[26].

The objectives of this study were to 1) examine the association between socioeconomic status and the prevalence of health care seeking behavior following diarrheal illness; 2) examine the association between socioeconomic status and the prevalence of exposure to risk factors for foodborne illness; 3) better understand whether household or area-based economic status as determined from the FoodNet population survey correlate better with prevalence of healthcare seeking behaviors and risk factors for foodborne illness.

**Methods**

The 2006-2007 FoodNet population survey was administered over a twelve-month period in the ten FoodNet sites.  Survey participants were selected randomly using a two-stage, disproportionate, stratified sampling scheme. In the first stage, households in the surveillance areas were contacted by telephone via random digit dialing and in the second stage a household member over the age of one year was selected to participate. The survey included a variety of questions including sex, age, household income level, ZIP code of residence, education level, risk factors for exposure to bacterial foodborne pathogens in the preceding 7 days and whether the interviewee had diarrhea in the preceding month and if so, whether they sought health care and had diagnostic testing.  Two sets of questions were used to determine if the participant had consumed selected foods from any of seven food categories: dairy, meat and poultry, seafood, fresh vegetables, fresh fruits, processed and dried foods, and frozen foods.  Each participant was randomly selected to be asked one of the sets of questions, however there were identical questions about a subgroup of foods that have been commonly associated with either sporadic cases of foodborne pathogens or foodborne illness outbreaks (“high-risk” foods)[6,30].

Using the FoodNet population survey, we obtained two sources of socioeconomic data- household income level, as reported by each participant in the survey, and ZCTA-level poverty, which was determined from each participant’s ZIP code and the 2000 Census of Population and Housing. ZCTAs are statistical geographical units developed by the US Census to serve as a proxy for zip code level data, since census data are not collected at the zip code level. Using the 2000 Census, we obtained the percentage of people living below the poverty line at the ZCTA level, and classified them into four groups: <5% (high SES), 5% to <10%, 10% to <20% and ≥ 20% (low SES). The ZCTA level data for each participant served as the area-based poverty measure. Self-reported income level was also categorized into four groups: <$25,000 per year (low SES), $25,000 to <$55,000, $55,000 to <$100,000, and ≥100,000(high SES).

Analysis was limited to survey participants aged 18 and older. For each item from the population survey, proportions were calculated for each SES level in each of the two SES categories and tested for trend from the lowest to highest SES level in each category using the chi-square test for linear trend in SAS 9.3. The proportions for each item by SES category were then age and sex weighted to the 2005 Connecticut population, in order to control for potential differences in eating habits by age and sex. Participants were divided into four age groups for age standardization: 18 to 34, 35 to 49, 50 to 64 and greater than 65 years. Chi-square tests for trend were re-performed using Epi Info 7. P-values <0.05 were considered statistically significant. For variables associated with both household and ZCTA poverty, we attempted a stratified analysis in order to attempt to determine the independence of the relationships.

## Results

A total of 1801 Connecticut residents were interviewed as part of the FoodNet population survey from 2006 to 2007; 304 participants did not answer the question about household income and 45 participants did not provide zip code information, resulting in excluding these 349 participants from the analysis. Additionally 215 of the participants were below 18 years of age and were also excluded. A total of 1237 Connecticut residents over the age of 18 years were included. Of the participants 59.6% were female and 40.4% were male; and the majority were non-Hispanic whites (85.7%) over the age of 50 years (63.0%) (Table 1).

Overall, 21 risk factors for bacterial foodborne illness were examined. In the crude analysis, seven risk factors were associated with increasing SES (Table 2). Prevalence of consumption of any salad containing lettuce or greens and any exposure to any house pet including puppy, dog, cat or kitten were increased with increasing SES by both SES measures (increasing household income and decreasing area-based poverty). Prevalence of consumption of any eggs away from home, consumption of any raw tomatoes, any chicken eaten away from home, and having a child in the home in daycare all increased with increasing household income alone. Prevalence of consumption of any pink beef and any fresh hamburgers eaten at home increased with decreasing area-based poverty alone. Only two risk factors were associated with decreasing SES (Table 2). Prevalence of consumption of unpasteurized milk increased with decreasing SES by both household income level and area-based poverty. There were no risk factors associated with decreasing SES as measured by decreasing household income alone. The prevalence of consumption of unpasteurized cheese increased with decreasing SES as measured by increasing area-based poverty.

In order to control for possible differences in eating habits by age and sex and any age and sex differences within the sub-populations based on SES, the proportions for the exposures were also age and sex standardized to the 2005 CT population and the chi-square test for trend recalculated. After standardization, ten risk factors were associated with increasing SES (Table 3). Risk factors associated with both measures of increasing SES included prevalence of any fresh hamburger eaten at home that was pink, consumption of any pink beef, and any chicken eaten away from home (Figure 1). Risk factors that were associated with increasing household income alone were the prevalence of consumption of any raw tomatoes, and having a child in the home in daycare (Figure 2). Risk factors that were associated with decreasing area-based poverty group were the prevalence of consumption of any salad containing lettuce or greens, any international travel in the past 7 days, consumption of any runny eggs, visiting or working on a farm in the past 7 days, and any house pet exposure including puppies, dogs, cats, or kittens (Figure 3). After adjustment, four risk factors were associated with decreasing SES; none of which were associated with decreasing socioeconomic status by both SES measures. Prevalence of consumption of unpasteurized milk and exposure to any reptiles or amphibians was associated with decreasing SES by self-reported income alone (Figure 4). The prevalence of consumption of unpasteurized cheese and consumption of hamburgers or ground beef away from home were associated with decreasing SES by area-based poverty group alone (Figure 5).

We also used the population survey to assess the association between SES and health care seeking behavior following diarrhea. Crude analysis showed no differences by SES measures in the incidence of diarrhea in the past month (overall 210 cases, 17.0%). There also were no differences in the percentage of those with diarrhea who called (18.6%) or visited a doctor (18.1%). Among those visiting a doctor, 28.9% were asked for a stool specimen. The number asked for a stool specimen (n=11) was too low to do a meaningful analysis by SES status.

After adjustment for age and sex, there was a paradoxical finding of the percentage who phoned a doctor for diarrheal illness. Those most likely to phone a doctor were those with the highest household SES (37.8% vs. 12.1% for the lowest SES group, p=0.003). However, those living in the lowest SES (poorest) ZCTAs were more likely than those in the highest SES ZCTAs to call a doctor (38.5% vs 11.9%, p=0.02). Despite this, there were no significant differences in the percentages visiting a doctor. The numbers were insufficient to perform a stratified analysis to better understand the paradoxical finding related to phoning a doctor.

In order to assess the correlation between area-based poverty and self-reported household income, the two SES measures were stratified by each other. The two measures were weakly correlated (r=0.25) (Table 4).

## Discussion

Our study had several important findings related to the association previously found in Connecticut between the higher incidence of major foodborne bacterial pathogens in adults and higher area-based socioeconomic status. We found 1) no clear association between visiting a physician for diarrhea and socioeconomic status; 2) a number of risk factors for sporadic illness and outbreaks were more common among those of higher area-based socioeconomic status than those of lower area-based socioeconomic status and only four risk factors were more common among those of lower area-based socioeconomic status; 3) results from using area-based and individual socioeconomic were not always concordant, nor were the distributions of one by the other. These findings have implications for control of foodborne bacterial pathogens and for surveillance both of foodborne pathogens and for prevalence of risk factors for them.

In our study, we found no clear association between socioeconomic status and visiting a physician following diarrheal illness. A recent study from Maryland found a similar relationship between the incidence of infections of *Campylobacter* and socioeconomic status. However, the authors of this study attributed this relationship to greater access to healthcare among those with higher socioeconomic status. However, the study did not present the data to support this hypothesis. On the other hand, a 2006 study of the factors associated with seeking medical care and submitting a stool specimen using FoodNet population survey data from 2000-2001 and 2002-2003, found an association between lower socioeconomic status and seeking medical care, with those with an income of less than $25,000 per year more likely to seek medical care than those of higher income[31]. The results of this study present an opposing view to the possibility presented by the Maryland group that those with high socioeconomic status were more likely to seek medical attention due to greater access to medical care. In our study, we did not find a clear association between seeking medical care and socioeconomic status, suggesting that the previous findings in CT of a relationship between bacterial foodborne illness incidence and increasing socioeconomic status is not likely a result of differences in healthcare access/health seeking behavior, but rather a result of a higher prevalence of risk factors for bacterial foodborne illness among those with higher socioeconomic status.

Since active surveillance captures the geographical address of cases of bacterial foodborne illness, previous studies in Connecticut utilized census tract-level poverty as a measure of socioeconomic status to examine the relationship between bacterial foodborne illness incidence and socioeconomic status, following the recommendation of the Public Health Disparities Geocoding Project. This project concluded that census tract-level poverty was the most consistent and straightforward measure to describe and monitor socioeconomic inequalities in health[32]. Therefore, in this analysis we felt it would be important to also use an area-based poverty measure to assess the relationship between risk factors for foodborne illness and SES in order to look at the data the same way as the surveillance data in which the association was observed. Using area-based poverty as a measure of SES, we found eight risk factors to be associated with high socioeconomic status (i.e., low ZCTA-level poverty), including any fresh hamburger eaten at home that was pink, consumption of any pink beef, any chicken eaten away from home, consumption of any salad containing lettuce or greens, any international travel in the past 7 days, consumption of any runny eggs, visiting or working on a farm in the past 7 days, and having house pet exposure to puppies, dogs, cats, or kittens.  These include risk factors found in case-control studies of sporadic cases of *Salmonella*, shiga-toxin producing *E. coli*, and *Campylobacter* infections.

Since the FoodNet population survey also includes information on household income for each respondent, we also examined the association between socioeconomic status as determined by the self-reported income level from the population survey in order to assess if this measure also showed relationship to risk factors. This measure also was associated with three of the eight risk factors associated with high socioeconomic status using ZCTA-level poverty, but had no association with five of them. On the other hand, it identified an association with high socioeconomic status in two different risk factors, including prevalence of consumption of any raw tomatoes and having a child in the home in daycare.

While the majority of risk factors were associated with increasing socioeconomic status, the prevalence of consumption of unpasteurized milk, unpasteurized cheese, any hamburger or ground beef away from home and exposure to a reptile or amphibian increased with decreasing socioeconomic status. However, these are less frequent risk factors for disease. Interestingly, some factors did not show a clear association with socioeconomic status by either area-based poverty group or self-reported household income level. These risk factors for which there was no significant association included prevalence of consumption of beef away from home, eggs away from home, prefrozen hamburgers at home that were pink, cattle exposure in the past seven days, hamburgers or ground beef eaten at a fast food restaurant, and any chicken eaten in the home.

The two measures of socioeconomic status we used were not completely concordant, nor were the associations with prevalence of the various risk factors examined. It appears that area-based ZCTA-level poverty and household income level are not always measuring the same things[32]. For example, household income level may be a more unstable measure compared to area-based poverty, as the neighborhood a person lives in is more likely to remain the same from year to year, but his/her income could vary. Area-based poverty, in addition to measuring the probability that a person is poor, could also be measuring other factors such as proximity to fresh food sources and stores with a larger variety of food items[33].

The finding that higher socioeconomic status is associated with higher incidence of bacterial foodborne pathogens and prevalence of their risk factors has several control and surveillance implications. Interventions, in particular educational interventions, could be targeted at the populations at highest risk (i.e., higher SES) to reduce the incidence and disparities in bacterial foodborne illness. Socioeconomic status is an important measure that should continue to be measured by surveillance systems and analyzed in order to further understand and examine the association between socioeconomic status and incidence of bacterial foodborne illness. Furthermore, it is important to continue to measure the prevalence of exposure to foodborne illness risk factors in order track changes in exposures as well as determine ways of modifying risk.

Our study has several important limitations. Although our analysis included 1,237 respondents, for some of the exposures and health care access measures the number of respondents was quite small, which restricted our power to find significant associations. Additionally, we did not have sufficient numbers to examine the cross-relationship between the two socioeconomic measures. Our study also only includes data from the Connecticut FoodNet Population Survey, which may limit the generalizability of our results. Therefore, it would be useful for future studies to repeat these analyses, as well as analyses of surveillance data by area-based socioeconomic status, using data from all ten FoodNet sites in order to further elucidate the associations between socioeconomic status and the incidence of disease and prevalence of exposure to risk factors for bacterial foodborne illness.

In conclusion, our study suggests that the previously observed associations between incidence of bacterial foodborne illness and high socioeconomic status are attributable to differences in exposures to risk factors rather than health care access. Additionally, we found that a number of risk factors for both sporadic and outbreak associated bacterial foodborne illness were associated with increasing socioeconomic status, while only consumption of unpasteurized milk and unpasteurized cheese were associated with decreasing socioeconomic status. Furthermore, we found that our two measures of socioeconomic status were not always concordant, suggesting that if both area-based poverty measures and household income levels are available, both should be utilized in analysis. Control efforts need in part to focus in part on the group with the highest prevalence of risk factors. Ongoing surveillance efforts that include measuring incidence of disease and risk factors for foodborne illness by area-based socioeconomic status are indicated.

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**Tables and Figures**

Table 1: Demographic characteristics of 1237 participants ≥ 18 years, Connecticut FoodNet Population Survey, 2006-2007

| Demographic Characteristic | No. of Participants | Percentage of Participants |
|---|---|---|
| **Sex** | | |
| **Male** | 506 | 40.4 |
| **Female** | 746 | 59.6 |
| **Age** | | |
| **18-34** | 138 | 11.4 |
| **35-49** | 313 | 25.7 |
| **50-64** | 458 | 37.7 |
| **65+** | 307 | 25.3 |
| **Race** | | |
| **White** | 1053 | 85.7 |
| **African American** | 47 | 3.8 |
| **Hispanic** | 58 | 4.7 |
| **Other** | 71 | 5.8 |
| **Annual Self-Reported Income Level** | | |
| **<$25,000** | 189 | 15.1 |
| **$25,000-$55,000** | 351 | 28.0 |
| **$55,000-$100,000** | 398 | 31.8 |
| **>$100,000** | 314 | 25.1 |
| **Area-Based Poverty Group (% living below the poverty line by zip code)** | | |
| **<5%** | 775 | 62.7 |
| **5%-<10%** | 252 | 20.4 |
| **10%-<20%** | 140 | 11.3 |
| **≥20%** | 70 | 5.7 |
| **Place of Residence** | | |
| **City or Urban** | 307 | 24.5 |
| **Suburban** | 464 | 37.1 |
| **Town or Village** | 297 | 23.7 |
| **Rural** | 158 | 12.6 |
| **On a farm** | 20 | 1.6 |

Table 2: Unadjusted prevalence of food consumption (exposure to risk factors) in preceding 7 days by household income and ZCTA poverty levels, CT FoodNet population survey respondents (N=1,237)

| Risk Factors | Self - reported Income Level (I)<br><br>Area Based Poverty Group (P) | <$25,000<br><br>≥20% | $25,000- <$55,000<br><br>10%- <20% | $55,000- <$100,000<br><br>5% to <10% | ≥$100,000<br><br><5% | p-value | Prevalence Ratio |
|---|---|---|---|---|---|---|---|
| **Risk Factors for Multiple Diseases** | | | | | | | |
| Any salad eaten containing lettuce or greens* | (I) | 36.5% | 48.9% | 49.5% | 65.1% | <0.001 | 1.78 |
| | (P) | 31.6% | 47.8% | 43.2% | 56.5% | <0.001 | 1.79 |
| Consumption of anything from a salad bar* | (I) | 10.4% | 16.9% | 11.8% | 21.5% | 0.076 | 2.07 |
| | (P) | 15.8% | 22.4% | 9.9% | 16.1% | 0.773 | 1.02 |
| Consumption of unpasteurized milk | (I) | 4.9% | 2.3% | 2.5% | 1.3% | 0.032 | 0.27 |
| | (P) | 8.6% | 3.6% | 4.8% | 1.0% | <0.001 | 0.12 |
| Consumption of unpasteurized cheese | (I) | 2.2% | 0.9% | 1.5% | 2.3% | 0.565 | 1.05 |
| | (P) | 5.7% | 3.6% | 1.2% | 1.0% | 0.001 | 0.18 |
| Any hamburgers or ground beef eaten away from home | (I) | 10.4% | 20.8% | 18.3% | 17.5% | 0.413 | 1.68 |
| | (P) | 31.6% | 14.9% | 18.2% | 16.4% | 0.122 | 0.52 |
| Any other beef eaten away from home | (I) | 14.6% | 21.4% | 20.4% | 25.2% | 0.083 | 1.73 |
| | (P) | 7.9% | 26.9% | 15.2% | 23.2% | 0.113 | 2.94 |
| International travel within the past 7 days | (I) | 1.1% | 0.3% | 1.3% | 1.9% | 0.138 | 1.73 |
| | (P) | 0.0% | 0.7% | 1.2% | 1.3% | 0.309 | |
| Any eggs eaten away from home | (I) | 27.2% | 32.3% | 32.7% | 38.1% | 0.017 | 1.40 |
| | (P) | 27.1% | 35.0% | 33.7% | 33.1% | 0.709 | 1.22 |
| Any chicken eaten away from home* | (I) | 31.4% | 35.9% | 42.5% | 54.7% | <0.001 | 1.74 |
| | (P) | 37.5% | 39.7% | 41.9% | 43.4% | 0.407 | 1.16 |
| **Risk Factors for Salmonellosis** | | | | | | | |
| Any raw tomatoes* | (I) | 45.9% | 50.9% | 62.9% | 63.1% | 0.001 | 1.37 |
| | (P) | 39.5% | 64.2% | 53.0% | 58.5% | 0.189 | 1.48 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Any runny eggs | (I) | 32.1% | 35.5% | 34.2% | 31.2% | 0.600 | 0.97 |
| | (P) | 28.6% | 26.4% | 34.5% | 34.8% | 0.067 | 1.22 |
| Any reptile or amphibian exposure | (I) | 3.8% | 3.8% | 3.6% | 2.6% | 0.412 | 0.68 |
| | (P) | 4.3% | 0.7% | 3.6% | 3.7% | 0.364 | 0.86 |
| **Risk Factors for *E. coli* O157 and non O157** | | | | | | | |
| Fresh hamburgers eaten at home that were pink | (I) | 6.1% | 8.1% | 8.9% | 10.9% | 0.061 | 1.79 |
| | (P) | 4.4% | 5.7% | 6.4% | 10.5% | 0.008 | 2.39 |
| Prefrozen hamburgers eaten at home that were pink | (I) | 5.4% | 3.8% | 3.3% | 2.3% | 0.066 | 0.43 |
| | (P) | 1.4% | 3.6% | 2.8% | 3.9% | 0.317 | 2.79 |
| Any pink beef | (I) | 9.8% | 10.1% | 11.4% | 11.9% | 0.363 | 1.21 |
| | (P) | 5.7% | 7.9% | 8.7% | 12.7% | 0.011 | 2.23 |
| A child in the home in daycare | (I) | 1.1% | 3.2% | 3.0% | 6.1% | 0.005 | 5.55 |
| | (P) | 0.0% | 5.7% | 4.4% | 3.2% | 0.917 | |
| Any cattle exposure in the past 7 days | (I) | 1.6% | 0.6% | 0.8% | 0.3% | 0.179 | 0.1875 |
| | (P) | 0.0% | 1.4% | 1.6% | 0.4% | 0.333 | |
| Visit or work on a farm in the past 7 days | (I) | 2.7% | 3.5% | 2.3% | 2.9% | 0.986 | 1.07 |
| | (P) | 0.0% | 2.1% | 4.0% | 2.7% | 0.395 | |
| Burgers or ground beef eaten at a fast food restaurant* | (I) | 27.1% | 29.2% | 23.7% | 22.2% | 0.178 | 0.82 |
| | (P) | 31.6% | 31.3% | 22.7% | 24.7% | 0.249 | 0.78 |
| **Risk Factors for Campylobacteriosis** | | | | | | | |
| Any house pet exposure | (I) | 28.3% | 37.2% | 36.2% | 42.4% | 0.005 | 1.50 |
| | (P) | 31.4% | 30.7% | 36.5% | 38.6% | 0.053 | 1.23 |
| Any chicken eaten in the home* | (I) | 68.9% | 72.8% | 74.0% | 72.8% | 0.557 | 1.06 |
| | (P) | 71.4% | 75.2% | 72.6% | 77.4% | 0.438 | 1.08 |

*Questions only asked to subset of respondents

Table 3: Adjusted** prevalence of food consumption (exposure to risk factors) in preceding 7 days by household income and ZCTA poverty levels, CT FoodNet population survey respondents (N=1,237)

| **Risk Factors** | **Self-reported Income Level (I)**<br><br>**Area Based Poverty Group (P)** | **<$25,000**<br><br>**≥20%** | **$25,000-<$55,000**<br><br>**10%-<20%** | **$55,000-<$100,000**<br><br>**5% to <10%** | **≥$100,000**<br><br>**<5%** | **p-value** | **Prevalence Ratio** |
|---|---|---|---|---|---|---|---|
| **Risk Factors for Multiple Diseases** | | | | | | | |
| Any salad eaten containing lettuce or greens* | (I) | 31.0% | 48.0% | 47.3% | 47.3% | 0.112 | 1.53 |
| | (P) | 26.3% | 46.9% | 37.9% | 54.1% | 0.001 | 2.06 |
| Consumption of anything from a salad bar* | (I) | 10.0% | 17.1% | 9.8% | 18.5% | 0.206 | 1.85 |
| | (P) | 18.4% | 18.8% | 9.8% | 15.5% | 0.550 | 0.84 |
| Consumption of unpasteurized milk | (I) | 10.2% | 2.9% | 2.0% | 0.98% | <0.001 | 0.10 |
| | (P) | 7.2% | 3.6% | 5.3% | 9.4% | 0.085 | 1.31 |
| Consumption of unpasteurized cheese | (I) | 5.8% | 0.87% | 2.1% | 4.3% | 0.468 | 0.74 |
| | (P) | 7.2% | 3.6% | 1.2% | 2.3% | 0.013 | 0.32 |
| Any hamburgers or ground beef eaten away from home | (I) | 13.0% | 22.3% | 19.6% | 13.7% | 0.362 | 1.05 |
| | (P) | 39.5% | 18.8% | 17.4% | 17.4% | 0.004 | 0.44 |
| Any other beef eaten away from home | (I) | 18.0% | 18.3% | 21.2% | 21.5% | 0.399 | 1.19 |
| | (P) | 18.3% | 18.0% | 17.4% | 21.1% | 0.475 | 1.15 |
| International travel within the past 7 days | (I) | 1.1% | 0.58% | 1.3% | 1.0% | 0.802 | 0.91 |
| | (P) | 0.0% | 0.73% | 1.6% | 7.2% | <0.001 | |
| Any chicken eaten away from home* | (I) | 17.4% | 43.9% | 35.3% | 44.2% | <0.001 | 2.54 |
| | (P) | 22.6% | 39.7% | 42.9% | 48.6% | 0.003 | 2.15 |
| Any eggs eaten away from home | (I) | 26.6% | 35.1% | 31.4% | 37.0% | 0.078 | 1.39 |
| | (P) | 34.8% | 35.8% | 35.7% | 33.5% | 0.634 | 0.96 |
| **Risk Factors for Salmonellosis** | | | | | | | |
| Any raw tomatoes* | (I) | 43.0% | 51.7% | 62.5% | 60.3% | 0.008 | 1.40 |
| | (P) | 44.7% | 64.1% | 56.1% | 57.6% | 0.354 | 1.29 |
| Any runny eggs | (I) | 37.8% | 33.9% | 34.9% | 30.1% | 0.099 | 0.80 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (P) | 26.1% | 27.0% | 32.8% | 36.0% | 0.018 | 1.38 |
| Any reptile or amphibian exposure | (I) | 6.4% | 5.2% | 3.6% | 2.3% | 0.014 | 0.36 |
| | (P) | 2.9% | 0.7% | 4.9% | 4.5% | 0.161 | 1.55 |
| **Risk Factors for *E. coli* O157 and non O157** | | | | | | | |
| Fresh hamburgers eaten at home that were pink | (I) | 4.3% | 7.6% | 8.2% | 10.5% | 0.023 | 2.44 |
| | (P) | 2.9% | 5.8% | 5.7% | 9.3% | 0.021 | 3.21 |
| Prefrozen hamburgers eaten at home that were pink | (I) | 5.9% | 3.5% | 3.3% | 5.2% | 0.724 | 0.88 |
| | (P) | 1.4% | 4.4% | 2.8% | 4.7% | 0.206 | 3.36 |
| Any pink beef consumption | (I) | 9.6% | 8.9% | 10.5% | 13.7% | 0.050 | 1.43 |
| | (P) | 4.3% | 8.8% | 8.5% | 12.1% | 0.022 | 2.81 |
| A child in the home in daycare* | (I) | 2.2% | 5.2% | 4.8% | 9.2% | 0.001 | 4.18 |
| | (P) | 0.0% | 7.3% | 6.9% | 5.6% | 0.229 | |
| Any cattle exposure in the past 7 days | (I) | 2.7% | 1.4% | 0.9% | 0.98% | 0.134 | 0.36 |
| | (P) | 0.0% | 1.5% | 2.4% | 0.79% | 0.977 | |
| Visit or work on a farm in the past 7 days | (I) | 2.7% | 4.6% | 3.1% | 4.2% | 0.695 | 1.56 |
| | (P) | 0.0% | 1.5% | 5.3% | 4.5% | 0.030 | |
| Burgers or ground beef eaten at a fast food restaurant* | (I) | 25.0% | 44.0% | 24.5% | 30.1% | 0.319 | 1.20 |
| | (P) | 29.6% | 26.5% | 61.8% | 34.2% | 0.499 | 1.16 |
| **Risk Factors for Campylobacteriosis** | | | | | | | |
| Any house pet exposure in the past 7 days | (I) | 34.6% | 40.9% | 39.5% | 43.3% | 0.122 | 1.25 |
| | (P) | 30.0% | 32.1% | 39.3% | 43.4% | 0.005 | 1.45 |
| Any chicken consumed in the home* | (I) | 73.3% | 70.1% | 73.3% | 80.0% | 0.766 | 1.09 |
| | (P) | 70.2% | 70.5% | 74.0% | 73.0% | 0.224 | 1.04 |

*Questions only asked to subset of respondents
**Adjusted for age and sex by standardizing to the 2005 Connecticut population

Table 4: Summary table of significant risk factors for unadjusted and adjusted analyses.

| Risk Factors | Self-reported Income Level (I)<br><br>Area Based Poverty Group (P) | Significant in unadjusted analysis (Y/N) | Significant in adjusted** analysis (Y/N) |
|---|---|---|---|
| **Risk Factors for Multiple Diseases** | | | |
| Any salad eaten containing lettuce or greens* | (I) | Y | N |
| | (P) | Y | Y |
| Consumption of anything from a salad bar* | (I) | N | N |
| | (P) | N | N |
| Consumption of unpasteurized milk | (I) | Y | Y |
| | (P) | Y | N |
| Consumption of unpasteurized cheese | (I) | N | N |
| | (P) | Y | Y |
| Any hamburgers or ground beef eaten away from home | (I) | N | N |
| | (P) | N | Y |
| Any other beef eaten away from home | (I) | N | N |
| | (P) | N | N |
| International travel within the past 7 days | (I) | N | N |
| | (P) | N | Y |
| Any chicken eaten away from home* | (I) | Y | Y |
| | (P) | N | Y |
| Any eggs eaten away from home | (I) | Y | N |
| | (P) | N | N |
| **Risk Factors for Salmonellosis** | | | |
| Any raw tomatoes* | (I) | Y | Y |
| | (P) | N | N |
| Any runny eggs | (I) | N | N |
| | (P) | Y | Y |
| Any reptile or amphibian exposure | (I) | N | Y |
| | (P) | N | N |
| **Risk Factors for *E.*** | | | |

| | | | |
|---|---|---|---|
| ***coli* O157 and non O157** | | | |
| Fresh hamburgers eaten at home that were pink | (I) | N | Y |
| | (P) | Y | Y |
| Prefrozen hamburgers eaten at home that were pink | (I) | N | N |
| | (P) | N | N |
| Any pink beef consumption | (I) | N | Y |
| | (P) | Y | Y |
| A child in the home in daycare* | (I) | Y | Y |
| | (P) | N | N |
| Any cattle exposure in the past 7 days | (I) | N | N |
| | (P) | N | N |
| Visit or work on a farm in the past 7 days | (I) | N | N |
| | (P) | N | Y |
| Burgers or ground beef eaten at a fast food restaurant* | (I) | N | N |
| | (P) | N | N |
| **Risk Factors for Campylobacteriosis** | | | |
| Any house pet exposure in the past 7 days | (I) | Y | N |
| | (P) | Y | Y |
| Any chicken consumed in the home* | (I) | N | N |
| | (P) | N | N |

*Questions only asked to subset of respondents
**Adjusted for age and sex by standardizing to the 2005 Connecticut population

**Table 5**: Crude and adjusted** prevalence of health care seeking behavior by household income and ZCTA poverty levels, Connecticut FoodNet population survey respondents (N=210)

| Health Care Seeking Behavior | Self-reported Income Level (I)<br><br>Area Based Poverty Group (P) | <$25,000<br><br>≥20% | $25,000-<$55,000<br><br>10%-<20% | $55,000-<$100,000<br><br>5% to <10% | ≥$100,000<br><br><5% | p-value | Prevalence Ratio |
|---|---|---|---|---|---|---|---|
| **Crude prevalence of health care seeking behavior** | | | | | | | |
| Diarrheal Illness in the past month | (I) | 17.1% | 17.3% | 19.7% | 15.4% | 0.766 | 0.90 |
| | (P) | 17.7% | 23.4% | 20.0% | 15.7% | 0.066 | 0.89 |
| Phone a doctor for diarrheal illness in the past 7 days* | (I) | 12.1% | 23.3% | 14.1% | 23.9% | 0.492 | 1.93 |
| | (P) | 38.5% | 18.8% | 16.0% | 17.4% | 0.212 | 0.45 |
| Visit a doctor for diarrheal illness in the past 7 days* | (I) | 28.1% | 20.0% | 12.7% | 17.4% | 0.158 | 0.62 |
| | (P) | 30.8% | 25.0% | 12.2% | 17.4% | 0.224 | 0.56 |
| **Adjusted prevalence of health care seeking behavior** | | | | | | | |
| Diarrheal Illness in the past month | (I) | 17.8% | 19.6% | 20.6% | 15.4% | 0.283 | 0.87 |
| | (P) | 16.4% | 28.0% | 20.0% | 16.2% | 0.129 | 0.99 |
| Phone a doctor for diarrheal illness in the past 7 days* | (I) | 12.1% | 17.5% | 14.3% | 37.8% | 0.003 | 3.12 |
| | (P) | 38.5% | 19.4% | 22.0% | 11.9% | 0.016 | 0.31 |
| Visit a doctor for diarrheal illness in the past 7 days* | (I) | 25.0% | 17.5% | 10.0% | 20.0% | 0.735 | 0.80 |
| | (P) | 23.1% | 19.4% | 10.2% | 14.3% | 0.314 | 0.62 |

*Only asked to those who responded yes to having diarrheal illness in the past month
**Adjusted for age and sex by standardizing to the 2005 Connecticut population

Table 6: Correlation* between the ZCTA and household socioeconomic status.

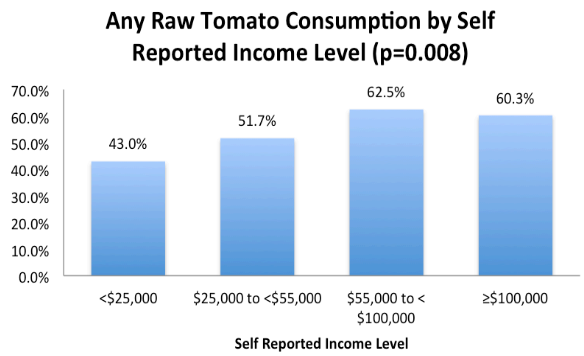
| | | ZCTA Based Area-based Poverty Group | | | |
|---|---|---|---|---|---|
| | | ≥20% | 10%-<20% | 5% to <10% | <5% |
| **Self-reported Household Income Level** | **<$25,000** | 2.2% (27) | 1.9% (23) | 4.9% (61) | 5.9% (73) |
| | **$25,000-<$55,000** | 1.8% (22) | 4.2% (52) | 6.2% (77) | 15.8% (196) |
| | **$55,000-<$100,000** | 15 (1.2%) | 3.5% (43) | 6.0% (74) | 21.3% (263) |
| | **≥$100,000** | 0.49% (6) | 1.8% (22) | 3.2% (40) | 19.6% (243) |

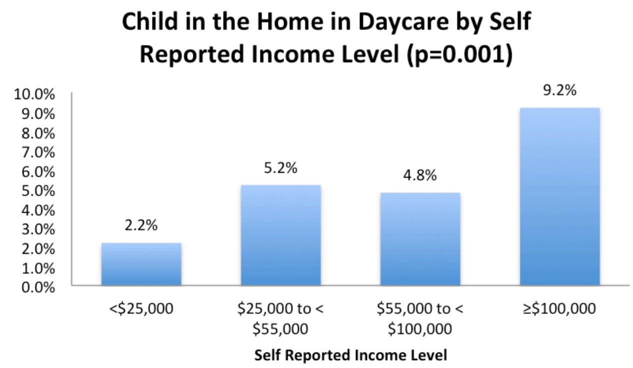
*r=0.25

Figure 1: Adjusted** prevalence of exposure to risk factors associated with higher socioeconomic status by both household income level and area-based poverty group.


**Adjusted for age and sex by standardizing to the 2005 Connecticut population

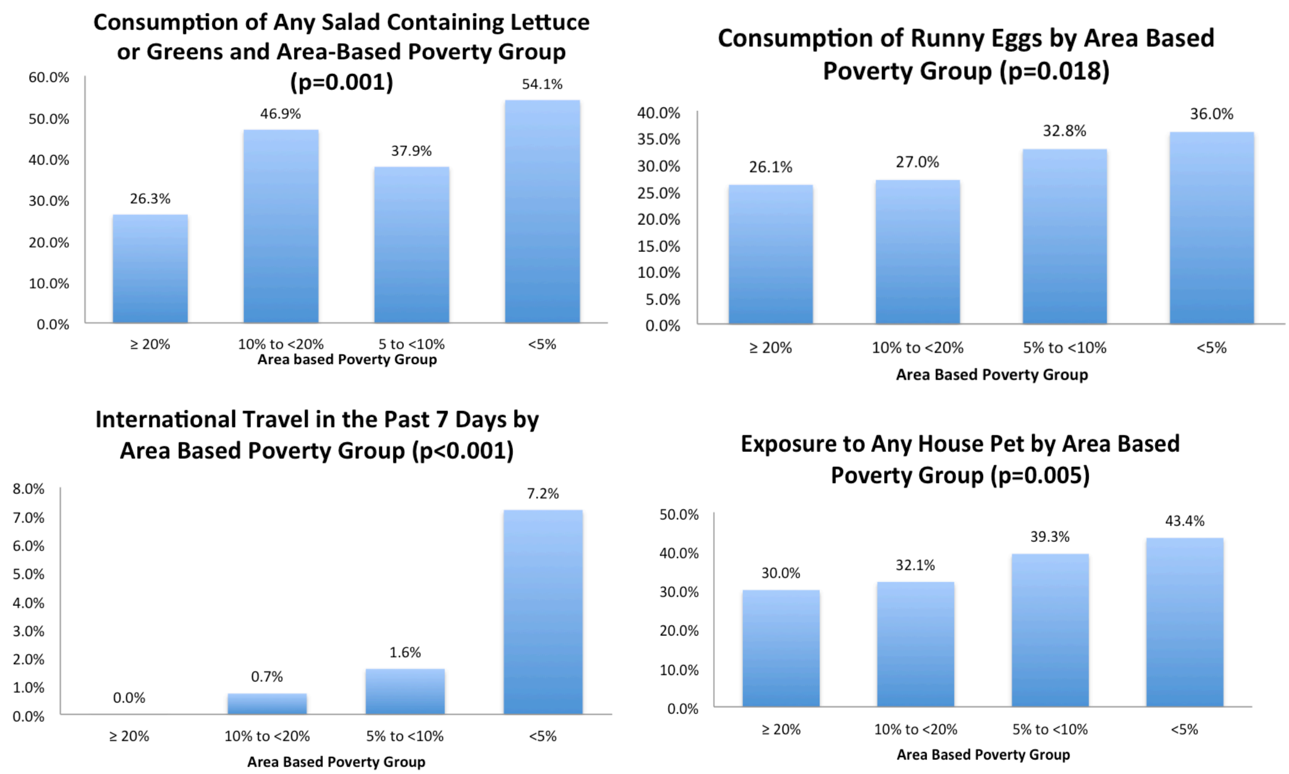
Figure 2: Adjusted** prevalence of Exposure to Risk Factors Associated with Higher Socioeconomic Status by Household Income-Level only.



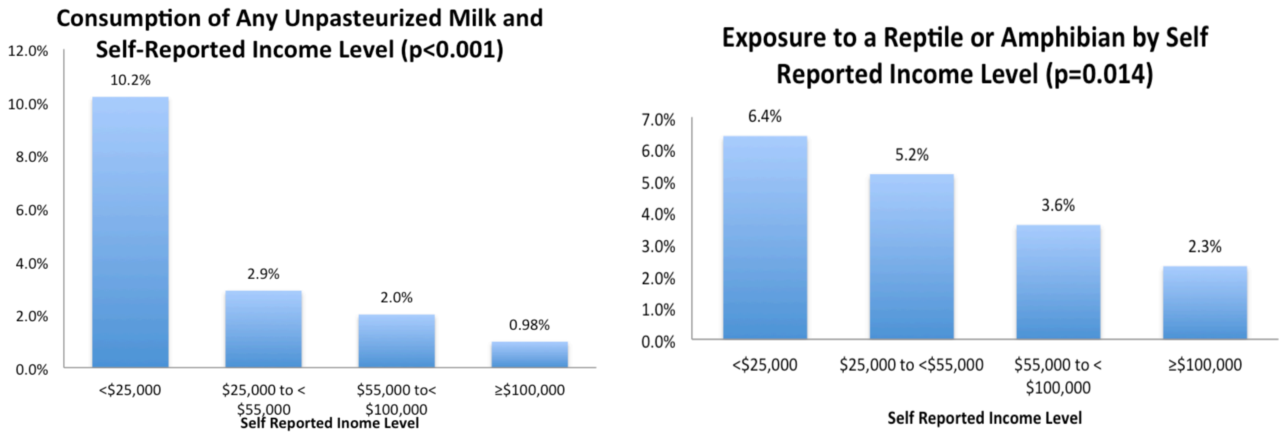

**Adjusted for age and sex by standardizing to the 2005 Connecticut population

Figure 3: Adjusted** prevalence of Exposure to Risk Factors Associated with Higher Socioeconomic Status by Area-Based Poverty Group only.



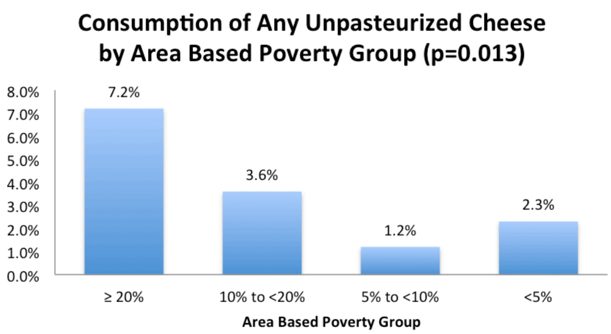

**Adjusted for age and sex by standardizing to the 2005 Connecticut population

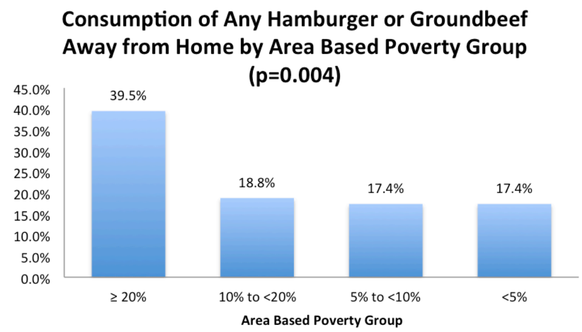
Figure 4: Adjusted** prevalence of Exposure to Risk Factors Associated with Lower Socioeconomic Status by Household Income-Level only.




**Adjusted for age and sex by standardizing to the 2005 Connecticut population

Figure 5: Adjusted** prevalence of Exposure to Risk Factors Associated with Lower Socioeconomic Status by Area-Based Poverty Group only.




**Adjusted for age and sex by standardizing to the 2005 Connecticut population