New York City Department of Health & Mental Hygiene
Bureau of Communicable Diseases
&
New York City Department of Environmental Protection
Bureau of Water Supply

Waterborne Disease Risk Assessment Program 2014 Annual Report

March 2015

Prepared in accordance with Section 8.1 of the NYSDOH Revised 2007 Filtration Avoidance Determination

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The authors wish to acknowledge the dedication of the other members of the Waterborne Disease Risk Assessment Program Team, and the assistance of Fran Guerriero (DEP) and Giselle Merizalde (DOHMH).

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EXECUTIVE SUMMARY

The primary objectives of New York City's Waterborne Disease Risk Assessment Program are to: (a) obtain data on the rates of giardiasis and cryptosporidiosis, along with demographic and risk factor information on case-patients; and (b) provide a system to track diarrheal illness to ensure rapid detection of any outbreaks. The program, jointly administered by the Department of Health and Mental Hygiene (DOHMH) and the Department of Environmental Protection (DEP), began in 1993. This report provides an overview of program progress, and data collected, during 2014.

DISEASE SURVEILLANCE

Active disease surveillance for giardiasis and cryptosporidiosis began in July 1993 and November 1994, respectively, and continued through 2010. In January 2011, active laboratory surveillance for giardiasis and cryptosporidiosis was replaced by an electronic reporting system. This report presents the number of cases and case rates for giardiasis and cryptosporidiosis in 2014 (and includes data from past years for comparison). Also, demographic information for cases of giardiasis and cryptosporidiosis in 2014 was gathered and is summarized in this report. Telephone interviews of cryptosporidiosis case-patients to gather potential risk exposure information continued, and selected results are presented. Giardiasis and cryptosporidiosis rates have been on a general downward trend over the years of this surveillance program. The giardiasis case rate increased from 9.2 per 100,000 population in 2013 to 10.4 per 100,000 (864 cases) in 2014, and the cryptosporidiosis case rate increased from 1.0 per 100,000 to 1.2 per 100,000 (102 cases) during the same period.

SYNDROMIC SURVEILLANCE / OUTBREAK DETECTION

The tracking of sentinel populations or surrogate indicators of disease ("syndromic surveillance") can be useful in assessing gastrointestinal (GI) disease trends in the general population. Such tracking programs provide greater assurance against the possibility that a citywide outbreak would remain undetected. In addition, such programs can potentially play a role in limiting the extent of an outbreak by providing an early indication of a problem so that control measures may be rapidly implemented.

The City maintains four distinct and complementary outbreak detection systems: One system involves the tracking of chief complaints from hospital emergency department (ED) logs; under another system DOHMH monitors and assists in the investigation of GI outbreaks in eight sentinel nursing homes; a third system tracks the number of stool specimens submitted to a clinical laboratory for microbiological testing; and a fourth system involves the monitoring of sales of over-the-counter or non-prescription anti-diarrheal medications.

The City's anti-diarrheal medication monitoring activities has had two components: the "ADM" system and the "OTC" system. The two systems monitor daily sales of non-prescription antidiarrheal medications at major store chains. In 2012 the ADM and OTC systems were merged. An evaluation report by NYC of the impact of the merger of the two systems was completed, and was sent to NYSDOH and USEPA June 18, 2014. The evaluation report concluded that overall the combined system is equal to or better than the two systems previously in place.

A summary of syndromic surveillance findings for 2014 pertaining to GI illness is presented. Sustained citywide signals in the ED system were observed in February, March, October, November and December, which is consistent with annual gastrointestinal viral trends. There was no evidence of a drinking water-related outbreak in New York City in 2014.

INFORMATION SHARING AND PUBLIC EDUCATION

Information on *Cryptosporidium* and *Giardia* continues to be available on New York City Department of Environmental Protection's and New York City Department of Health and Mental Hygiene's websites, including annual reports on program activities, fact sheets on giardiasis and cryptosporidiosis, and results from the Department of Environmental Protection's source water protozoa monitoring program.

INTRODUCTION

The ongoing primary objectives of New York City's Waterborne Disease Risk Assessment Program (WDRAP) are to:

- obtain data on the rates of giardiasis and cryptosporidiosis, along with demographic and risk factor information on case-patients; and
- provide a system to track diarrheal illness to ensure rapid detection of any outbreaks.

Two City agencies are involved in this effort: the Department of Environmental Protection (DEP) and the Department of Health and Mental Hygiene (DOHMH). In addition to participation by staff from both agencies, a special interagency unit, the Parasitic Disease Surveillance Unit, was established to implement major components of this program. In the year 2001, the staff of the Parasitic Disease Surveillance Unit was merged with staff from the DOHMH Bureau of Communicable Disease (BCD). Staff members employed by DEP and DOHMH now jointly work on WDRAP activities as well as on other communicable disease activities. This merger increases the efficiency of the DOHMH BCD but does not affect WDRAP operations.

Following below is a summary of program highlights and data for the year 2014. For this report the population denominators used to calculate rates were intercensal population estimates for all years except 2000 and 2010 to 2012. For the years 1994 through 1999, intercensal population estimates per year were used based upon linear interpolation between the 1990 and 2000 NYC Census[1]. For the years 2001 through 2009, 2013 and 2014, intercensal population estimates for each year were used from data produced by DOHMH based on the US Census Bureau Population Estimate Program and housing unit data obtained from the NYC Department of City Planning. For 2010 to 2012, the year 2010 NYC Census data were used[2]. Because rates for the years 2001 through 2009, 2013 and 2014 were calculated for this report using intercensal population estimates, they may differ from previously reported rates based on year 2000 and 2010 NYC Census data. Other variations in data between this report and previous reports may be due to factors such as disease reporting delays, correction of errors, and refinements in data processing (for example, the removal of duplicate disease reports). All rates in this report are annual case rates. Caution must be exercised when interpreting rates based on very small case numbers.

For mapping purposes, United Hospital Fund (UHF) neighborhood of case-patient residence was used. New York City is divided on the basis of zip code into 42 UHF neighborhoods. Maps illustrating annual rates by UHF neighborhood are included in this report.

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[1] For 1994-2000 NYC intercensal data citywide, by borough, and by UHF neighborhood see https://sasebiweb200.health.dohmh.nycnet/epiquery/Census/index.html

[2] For 2010 NYC Census data by geographic area and demographic subgroup see https://sasebiweb200.health.dohmh.nycnet/epiquery/Census/index2010.html

In this report, race/ethnicity-specific case rates for 2014 are based upon intercensal population estimates and include the race/ethnicity categories used by the US Census Bureau Population Estimate Program. Prior to 2011, there was one race/ethnicity category entitled "Asian, Pacific Islander, American Indian, Alaskan Native, non-Hispanic." Since 2011, separate categories have been used for non-Hispanic Asians, non-Hispanic Pacific Islanders and Native Hawaiians, non-Hispanic American Indian and non-Hispanic of two or more races.

Beginning with the 2011WDRAP Annual Report, socioeconomic status (SES) is now included as a measure as part of the demographic description of cases of giardiasis and cryptosporidiosis in NYC. Differences in SES among cases of a disease may indicate economically-related disparities in health. In February 2011, a working group of DOHMH epidemiologists proposed a standard demographic variable, neighborhood poverty, to measure disparities in disease for all routinely collected disease surveillance data that includes geolocating information on case-patients (i.e., street address and zip code). Neighborhood poverty is a potential proxy for individual SES and also may have an independent effect on the incidence of certain diseases. The poverty level of the neighborhood of case-patient residence is measured as the percentage of individuals in the neighborhood who live below the federal poverty level, as reported in census data. (The use of neighborhood poverty as an SES measure in public health surveillance is described further in: Krieger N, Chen JT, Waterman PD, Rehkopf DH, Subramanian SV. Painting a Truer Picture of US Socioeconomic and Racial/Ethnic Health Inequalities: the Public Health Disparities Geocoding Project. *American Journal of Public Health*. 2005; 95[2]: 312-323.)

The neighborhood unit that is analyzed and aggregated for the poverty level tables in this report is the NYC census tract. Neighborhood-level poverty was defined in terms of the percent of census tract residents with household income level below 100% of the federal poverty level. Four categories for data analysis were used: low neighborhood poverty (<10% of residents have household incomes that are below the federal poverty level), medium neighborhood poverty (10-19%), high neighborhood poverty (20-29%), and very high neighborhood poverty (>30%). In this report, American Community Survey 2008-2012 data were used for census tract poverty levels.

PART I: DISEASE SURVEILLANCE

Giardiasis

New York City implemented a program of active laboratory surveillance for giardiasis in July 1993 to ensure complete reporting of all laboratory-diagnosed cases. Active laboratory surveillance (involving regular site visits or telephone contact with laboratories) continued through 2010. Starting January 2011, active surveillance was replaced by an electronic laboratory reporting system. Case rates and basic demographic findings were originally compiled and reported on a quarterly basis (through July 2002), then on a semi-annual basis (2003-2012), and now are compiled and reported on an annual basis (per NYC FAD discussions).

During 2014, a total of 864 cases of giardiasis were reported to DOHMH and the annual case rate was 10.4 per 100,000. Annual case numbers increased 12.6% from 2013 to 2014. Similar variability has been observed between prior years within a general downward trend from 1994 to 2014 (decline of 64.8%) (see Table 1 and Figure 1).

Since September 1995, case investigations for giardiasis are conducted only for case-patients who are in a secondary transmission risk category (e.g., food handler, health care worker, child attending day care, or day care worker), or when giardiasis clusters or outbreaks are suspected. Only one such case of giardiasis was reported in 2014, and it was investigated.

The following provides some highlights from the surveillance data for giardiasis among New York City residents from January 1 through December 31, 2014. Additional data are presented in the tables, figures and maps that appear later in this report.

Borough of case-patient residence

Borough of case-patient residence was known for all 864 giardiasis case-patients who resided in New York City. Manhattan had the highest borough-specific annual case rate (18.1 cases per 100,000) (Table 2). The highest UHF neighborhood-specific case rate was found in the Chelsea-Clinton neighborhood in Manhattan (49.3 cases per 100,000) (Map 1 and Table 3).

Sex

Information regarding sex was available for all cases. The number and rate of giardiasis cases were higher in males than females, with 595 males (15.0 cases per 100,000), 267 females (6.1 cases per 100,000), and 2 transgender persons reported. The highest sex- and borough-specific case rate was observed among males residing in Manhattan (30.0 cases per 100,000) (Table 2).

Age

Information regarding age was available for all cases. The highest age group-specific case rates, with all genders combined, were among children 5 to 9 years old (16.2 cases per 100,000) followed by children less than 5 years old (15.4 cases per 100,000) and persons 20-44 years old (12.4 cases per 100,000). The highest age group and sex-specific case rate was among males 20-44 years old (19.5 cases per 100,000) (Table 4). The two highest age-group and borough-specific case rates were persons 20-44 years old in Manhattan (23.7 cases per 100,000), followed by persons 45-59 years old in Manhattan (22.4 cases per 100,000) (Table 5).

Race/Ethnicity

Information regarding race/ethnicity was available for 64 of 864 cases (8.0 %). Ascertainment of race/ethnicity status for giardiasis cases was poor. As indicated above, giardiasis case-patients are not routinely interviewed unless they are in occupations or settings that put them at increased risk for secondary transmission or if they are part of a suspected cluster or outbreak. For the majority of giardiasis cases, race/ethnicity information, when provided, is not based upon self-report, but rather upon the impressions of health care providers, which may be inaccurate. For this reason, and because race/ethnicity information was missing from many giardiasis disease reports, race/ethnicity findings pertaining to giardiasis cases diagnosed in 2014 are not presented in this report.

Census Tract Poverty Level

Age-adjusted case rates for giardiasis among four levels of census tract poverty, with levels encompassing low poverty to very high poverty, ranged from 8.9 to 12.5 cases per 100,000 population, with the lowest rate occurring in census tracts with high poverty levels (Table 6).

Cryptosporidiosis

Cryptosporidiosis was added to the list of reportable diseases in the New York City Health Code, effective January 1994. Active disease surveillance for cryptosporidiosis began in November 1994 and continued through 2010. Starting in 2011, active surveillance was replaced by electronic laboratory reporting.

Case interviews for demographic and risk factor data were initiated in January 1995 and are ongoing. Case rates and basic demographic findings were originally compiled and reported on a quarterly basis (through July 2002), then on a semi-annual basis (2003–2012), and are now compiled and reported on an annual basis (per NYC FAD).

Confirmed and probable cryptosporidiosis cases are included in this report. Confirmed cases are those in which the laboratory method used has a high positive predictive value such as light microscopy of stained slide, enzyme immunoassay, polymerase chain reaction, and direct fluorescent antibody test. Probable cases are those in which the laboratory method used has a low positive predictive value (such as the immunochromatographic card/rapid test) or in which the method used for diagnostic testing was not known. The probable case classification for cryptosporidiosis also includes those cases in which laboratory confirmation was not obtained, but the case was epidemiologically linked to a confirmed case and clinical illness was consistent with cryptosporidiosis. DOHMH BCD reports both confirmed and probable cryptosporidiosis cases to the Centers for Disease Control and Prevention (CDC) through the National Electronic Telecommunications System for Surveillance.

During 2014, a total of 102 cases of cryptosporidiosis were reported to DOHMH. The annual case rate was 1.2 per 100,000. Annual case numbers increased 27.5% from 2013 to 2014. From 1995 to 2014 annual case numbers have declined 78.3% (Table 7). The number of cases diagnosed each month for the period November 1994 to December 2014 is indicated in Figure 2. Because diagnosis may occur sometime after onset, information is collected in the interview regarding date of symptom onset. The date of onset can be used more accurately than date of diagnosis to estimate when case-patients were likely exposed to *Cryptosporidium*. The number of cryptosporidiosis cases by month of onset for the period January 1995 to December 2014 is presented in Figure 3.

The following provides some highlights from the surveillance data for cryptosporidiosis among New York City residents from January 1 through December 31, 2014. Additional data are presented in the tables, figures and maps that appear later in this report.

Borough of case-patient residence

Information on borough of residence was available for all cases of cryptosporidiosis. Manhattan had the highest borough-specific annual case rate (2.8 cases per 100,000) (Table 8). The highest UHF neighborhood-specific case rate was in the East Harlem neighborhood in Manhattan (5.3 cases per 100,000) (Map 2 and Table 9).

Sex

Information regarding sex was available for all cases. The number and rate of cryptosporidiosis cases were higher in males than females, with 69 males (1.7 cases per 100,000) and 33 females (0.8 cases per 100,000) reported. The borough- and sex-specific case rate was highest for males in Manhattan (3.5 cases per 100,000) (Table 8).

Age

Information regarding age was available for all cases. The highest age group-specific case rates were observed in persons <5 years old, and 20-44 years old (1.8 cases per 100,000 for both groups). The highest age group- and sex-specific case rates were in males 20-44 years old (2.5 cases per 100,000) (Table 10). The three highest age group and borough-specific case rates occurred in children less than five years old, 5-9 year olds, and 20-44 year olds, all in Manhattan (4.8, 4.7, and 4.0 cases per 100,000, respectively) (Table 11).

Race/Ethnicity

Race/ethnicity information was available for 94 of 102 cases (92.2%). Citywide, the racial/ethnic group-specific case rate was highest among Black non-Hispanics (1.6 cases per 100,000). The highest race/ethnicity and borough-specific case rate occurred among non-Hispanics of two or more races in the Bronx (7.4 cases per 100,000); however, there was only one case in this race group/borough category. The next highest race group and borough specific case rates occurred in Black-non-Hispanics in Manhattan (3.3 cases per 100,000) (Table 12). The highest age group and race/ethnicity-specific case rates occurred among 45-59 year old non-Hispanics of two or more races (1 case, 5.2 cases per 100,000), followed by 20-44 year Black non-Hispanics (19 cases, 2.8 cases per 100,000) and Hispanics less than five years old (5 cases, 2.6 cases per 100,000) (Table 13).

Census Tract Poverty Level

Age-adjusted case rates for cryptosporidiosis among four levels of census tract poverty ranged from 0.9 to 1.5 cases per 100,000 (Table 14). Case rates for census tracts at the four poverty levels were similar and close to the citywide cryptosporidiosis case rate (1.2 cases per 100,000. This fairly narrow distribution of case rates among census tract poverty levels suggests that neighborhood poverty and level of household income have not been determinants in the occurrence and diagnosis of cryptosporidiosis in New York City in 2014.

Cryptosporidiosis and Immune Status

Trends observed over the years in reported number of cryptosporidiosis cases have differed between persons living with HIV/AIDS and those who are immunocompetent. Reported cryptosporidiosis cases among persons living with HIV/AIDS decreased considerably, from 392 in 1995 to 45 in 2014, thus causing a decline in the overall number of cryptosporidiosis cases in

New York City. However, during the same time period (1995-2014), the number of cases of cryptosporidiosis among immunocompetent persons has shown less variation, ranging from a high of 139 cases in 1999 to a range of 29 to 75 cases in the years 2001 – 2014 (see figures 4, 5 and 6). An analysis of trends using Poisson regression to compare the number of cases of cryptosporidiosis among persons with HIV/AIDS to the number of cases among the immunocompetent indicates that the overall decline from 1995 to 2014 was significantly greater in patients who were immunocompromised than in those who were not ($P<.01$). This decline is generally thought to be due to highly active antiretroviral therapy which was introduced in 1996-1997 for persons living with HIV/AIDS.

Cryptosporidiosis and Potential Risk Exposures

Of the 102 cryptosporidiosis cases diagnosed among NYC residents in 2014, questionnaires concerning potential exposures were completed in 74 cases (72.5%). Reasons for non-completion of questionnaires were: unable to locate case-patient (13 cases, 12.7%), refused (11 cases, 10.8%), unable to interview due to incapacitating illness (3 cases, 2.9%) and died (1 case, 1%). Of the immunocompetent case-patients, interviews were completed for 44 case-patients (88%). Among persons with HIV/AIDS, interviews were completed for 28 case-patients (62.2%), and interviews were completed for 2 case-patients (66.7%) who were immunocompromised for reason other than HIV/AIDS. Summary data for 1995 through 2014 on commonly reported potential risk exposures, obtained from case-patient interviews of persons with HIV/AIDS and from interviews of persons who are immunocompetent, are presented in Tables 15 and 16, respectively. Information has also been collected regarding type of tap water consumption, and is presented in Tables 17 and 18. Tables 15 to 18 indicate the percentage of case-patients who reported engaging in each of the listed potential risk exposures for cryptosporidiosis before disease onset. However, it must be noted that the determination of an association between exposure to possible risk factors for cryptosporidiosis and acquisition of cryptosporidiosis cannot be made without reference to a suitable control population (i.e., non-*Cryptosporidium*-infected controls). As exposure data for a control population are not available, such determinations of association cannot be made.

Though no conclusions about association can be reached, in an attempt to assess if there are any patterns of interest, data has been compared between patients who are immunocompromised due to HIV/AIDS and patients who are immunocompetent. Looking at four potential risk categories from Tables 15 and 16 using the chi-square test for comparison of data since 2001, the following results were observed. Patients who were immunocompetent were significantly more likely to report international travel ($P<.01$ all years except 2009, $P<.05$); and to report exposure to recreational water in all years except 2003, 2006, 2007, and 2011 (2001,2002, $P<.01$; 2003, $P=.17$; 2004, $P<.05$; 2005, $P<.01$; 2006, $P=.24$; 2007, $P=.06$; 2008, $P<.05$; 2009-2010, $P<.01$, 2011, $P=.06$, 2012-2014, P=<.01). There was no statistically significant difference between these two groups in the proportion of cases reporting animal contact in 2001 to 2014, or reporting high-risk sex in 2001 to 2005, 2007, and 2009 to 2014. In 2006 and 2008, the proportion of cases reporting high-risk sex was significantly higher among persons with HIV/AIDS than among immunocompetent persons ($P<.01$). It should be noted that high-risk sex in this context refers to having a penis, finger or tongue in a partner's anus. Information about sexual practices is gathered via phone interview and may not be reliable. These data indicate that, for most years, immunocompetent case-patients were more likely to travel internationally and have recreational water exposure than immunocompromised case-patients. International travel and exposure to recreational water may be more likely risk factors for the acquisition of cryptosporidiosis in the immunocompetent group. However, as noted above, the extent to which these risk factors may have been associated with cryptosporidiosis cannot be determined without comparison to a control population.

PART II: SYNDROMIC SURVEILLANCE / OUTBREAK DETECTION

Introduction

The tracking of sentinel populations or surrogate indicators of disease ("syndromic surveillance") can be useful in assessing gastrointestinal (GI) disease trends in the general population. Such tracking programs provide greater assurance against the possibility that a citywide outbreak would remain undetected. In addition, such programs can potentially play a role in limiting the extent of an outbreak by providing an early indication of a problem so that control measures may be rapidly implemented. Over the years, beginning in the 1990s, the City has established and maintained a number of distinct and complementary outbreak detection systems. One system monitors and assists in the investigation of GI outbreaks in sentinel nursing homes. Another system monitors the number of stool specimens submitted to a participating clinical laboratory for microbiological testing, and a third system utilizes hospital emergency department (ED) chief complaint logs to monitor for outbreaks. The ED system is relied upon most for monitoring the burden of diarrheal illness in NYC. The City has also utilized two systems for monitoring sales of anti-diarrheal medications: the Anti-Diarrheal Monitoring System (ADM) and the Over-the-Counter medication (OTC) system. These pharmacy systems were merged in 2012 as the OTC-ADM system. (NOTE: both the ADM and OTC systems track sales of non-prescription anti-diarrheal medications. The program names were chosen simply as a way to distinguish the two systems).

Other than the ED system, which is now mandated under the New York City Health Code, all systems rely upon the voluntary participation of the organizations providing the syndromic data. A summary of syndromic surveillance findings pertaining to GI illness for 2014 is provided in the final section of this part, on pages 10 to 11 (and in Figures 7, 8, 9 and 10).

Program Components – Overviews and Updates

A. Nursing Home Sentinel Surveillance

The nursing home surveillance system began in March 1997 and was significantly modified in August 2002. Under the current protocol, when a participating nursing home notes an outbreak of gastrointestinal illness that is legally reportable to the New York State Department of Health (NYSDOH), the nursing home also notifies designated WDRAP team members working in the DOHMH BCD. Such an outbreak is defined as onset of diarrhea and/or vomiting involving three or more patients on a single ward/unit within a seven-day period, or more than the expected (baseline) number of cases within a single facility. All participating nursing homes have been provided with stool collection kits in advance. When such an outbreak is noted, specimens are to be collected for testing for bacterial culture and sensitivity, ova and parasites, *Cryptosporidium*, viruses, and *Clostridium difficile* toxin testing. Though *C. difficile* is not a waterborne pathogen, *C. difficile* toxin testing was added in April 2010 in order to address a need expressed by infection control practitioners in the nursing homes, and was intended to help ensure compliance with the sentinel nursing home protocol.

DOHMH BCD staff facilitates transportation of the specimens to the City's Public Health Laboratory. Testing for culture and sensitivity occurs at the Public Health Laboratory. On May 1, 2011 the DOHMH Public Health Laboratory discontinued parasitology testing. Specimens for ova and parasites and *Cryptosporidium*, as well as for viruses and *C. difficile* toxin testing, are currently being sent to NYSDOH Wadsworth Center. There are currently eight nursing homes participating in the program. Three are in Manhattan, two are in the Bronx, two are in Queens, and one is in Brooklyn. As feedback for their role in outbreak detection, participating nursing homes are provided with copies of Waterborne Disease Risk Assessment Program annual reports.

During the months of April, June, September and December 2014, WDRAP team members made site visits to all eight nursing homes participating in the Nursing Home Sentinel Surveillance system. During the site visits, the DOHMH staff members reviewed with nursing administration or infection control staff the rationale for the program and program protocol. In addition, the DOHMH staff members verified that the nursing homes had adequate stool collection supplies on hand. All participating nursing homes are visited at least once a year to help ensure compliance with the program protocol.

B. Clinical Laboratory Monitoring System

The number of stool specimens submitted to clinical laboratories for bacterial and parasitic testing also provides information on gastrointestinal illness trends in the population. NYC's Clinical Laboratory Monitoring program currently collects data from one large laboratory, designated as Laboratory A in this report. (The number of participating laboratories has changed over time, as reported in prior WDRAP reports.) Laboratory A transmits data by fax to DOHMH BCD two times per week, indicating the number of stool specimens examined per day for: (a) bacterial culture and sensitivity, (b) ova and parasites, and (c) *Cryptosporidium.*

Clinical Laboratory Monitoring results are reviewed upon receipt. Beginning in August 2004, DOHMH started implementation of a computer model to establish statistical cut-offs for significant increases in clinical laboratory submissions. The model uses the entire historical dataset, that is, since November 1995 for Laboratory A. Sundays and holidays are removed because the laboratories do not test specimens on those days. Linear regression is used to adjust for average day-of-week and day-after-holiday effects as certain days routinely have higher volumes than other days. The cumulative sums (CUSUM) method is applied to a two-week baseline to identify statistically significant aberrations (or signals) in submissions for ova and parasites and for bacterial culture and sensitivity. CUSUM is a quality control method that has been adapted for aberration-detection in public health surveillance. (CUSUM is described further in: Hutwagner L, Maloney E, Bean N, Slutsker L, Martin S. Using Laboratory-Based

Surveillance Data for Prevention: An Algorithm for Detecting *Salmonella* Outbreaks. *Emerging Infectious Diseases*. 1997; 3[3]: 395-400.)

C. Anti-Diarrheal Medication Monitoring

NYC began tracking anti-diarrheal drug sales as an indicator of gastro-intestinal illness trends in 1995, via a system operated by DEP.[3] Major modifications/enhancements to NYC's anti-diarrheal medication surveillance program have been made over the years, including: initiation and then expansion of DEP's ADM program; initiation of DOHMH's OTC program in 2002; and most recently, the merger of the ADM and the OTC systems. The ADM and OTC systems were merged in order to simplify the processing and analysis of pharmacy data, and combine the strengths of the two systems. The merger took effect in April 2012 and the combined OTC-ADM system is operated by DOHMH.

The first full year of operation of the merged OTC-ADM system was 2013. Enhancements of the combined system include: an increased number of stores providing data into one database for analysis, broader geographic coverage in a single database, new analytic methods, and separate analyses for citywide increases in sales of over-the-counter, non-bismuth-containing anti-diarrheal medications and of bismuth subsalicylate medications. An approximate average of 345 pharmacies (range of 340-350) provide daily sales reports. DOHMH conducted an evaluation of the impact of the merger of the two systems, and a final report on the evaluation was prepared, and sent to NYSDOH and USEPA June 18, 2014. In 2014, there was one day when data transmission to the OTC-ADM system was incomplete. On this day data was received from 51 stores and back data from the remaining stores could not be obtained. No unusual increases in diarrheal illness were detected in our mainstay ED system on the day that the OTC-ADM system experienced problems.

D. Hospital Emergency Department Monitoring

NYC initiated monitoring of hospital emergency department (ED) visits as a public health surveillance system in 2001. Throughout most of 2014, DOHMH received electronic data from 51 of New York City's 53 EDs reporting approximately 11,000 visits per day, roughly 98% of all ED visits citywide. Hospitals transmit electronic files each morning containing chief complaint and demographic information for patient visits during the previous 24 hours. Patients are classified into syndrome categories, and daily analyses are conducted to detect any unusual patterns, or signals. The two syndromes used to track gastrointestinal illness are vomiting syndrome and diarrhea syndrome. Temporal citywide analyses assess whether the frequency of ED visits for the syndrome has increased in the last one, two or three days compared to the previous fourteen days. Spatial analyses scan the data for geographic clustering in syndrome visits on the most recent day compared to the previous 14 days. Clustering is examined by both hospital location and residential zip code. Statistical significance is based on Monte Carlo probability estimates that adjust for the multiple comparisons inherent in examining many

[3] The first NYC anti-diarrheal medication tracking system, involving data from a regional distributor serving independent pharmacies, was implemented in 1995. This system was discontinued in 2000 due to a diminishing data stream. This summary of NYC anti-diarrheal medication monitoring programs therefore begins with discussion of the ADM system which began operation in 1996.

candidate clusters each day. The threshold of significance for citywide and spatial signals was set at P<.01, indicating that fewer than 1 out of every 100 analyses would generate a cluster due to chance alone. Beginning March 11, 2005, the threshold of significance for spatial signals was changed to P<.005, while the threshold of significance for citywide signals remained at P<.01. (The system is described further in: Heffernan R, Mostashari F, Das D, Karpati A, Kulldorf M, Weiss D. Syndromic Surveillance in Public Health Practice, New York City. *Emerging Infectious Diseases*. 2004; 10[5]: 858-864.)

Findings: Summary of Syndromic Surveillance Signals

Syndromic surveillance signals alone cannot be used to determine etiologic diagnoses. Also, experience has shown that most signals, especially localized spatial signals in the emergency department system or signals in the laboratory or anti-diarrheal medication monitoring systems, may be statistical aberrations and not related to public health events. The systems are therefore used in concert. A signal in one system is compared to other systems to see whether or not there are concurrent signals. In this report, Figures 7 to 10 summarize GI disease signals from NYC's syndromic surveillance systems. Figures 7 and 8 summarize ED system trends and signals for 2014. Figures 9 and 10 summarize signal results from all syndromic surveillance systems operated by DOHMH during 2014.

Figure 7 shows a graphic representation of the ratio of daily ED visits for the vomiting syndrome to all other daily ED visits for syndromes not tracked by ED syndromic surveillance ("other visits") from January 1 to December 31, 2014. The graph also indicates the occurrence of citywide signals and of the spatial residential zip code and hospital signals. Figure 8 is the same graph for the syndrome of diarrhea. Figures 7 and 8 indicate that citywide signals for vomiting and diarrhea occurred primarily in February, March, October, November and December. There were sustained (i.e., > 1-day) citywide vomiting signals from February 2-3, March 11-12 and 16-18, October 12-13, November 29-30 and December 14-15, 21-22 and 24-28; and citywide diarrhea signals March 2-4, October 15-16 and November 23-25. ED signals for vomiting and diarrhea in February, March, October, November and December are consistent with historical experience showing a seasonal increase in viral gastroenteritis due to norovirus and/or rotavirus.

Figures 9 and 10 are time-series plots of signals from NYC syndromic surveillance systems for the gastrointestinal syndrome covering the period January 1 to June 30, and July 1 to December 31, 2014, respectively. Results from all of the GI syndromic surveillance systems are included (i.e., the ED, clinical laboratory, OTC-ADM, and sentinel nursing home systems). For the ED and OTC-ADM systems, only citywide signals have been included. As discussed above, there was sustained citywide ED system signaling in February, March, October November and December, likely representing the seasonality of rotavirus and norovirus. In the clinical laboratory system, there was sustained signaling on April 29-30. For these dates (April 29-30), no specimens tested for *Cryptosporidium* were found to be positive. During this reporting period, no GI outbreaks were reported among the eight nursing homes participating in sentinel surveillance.

In summary, for the period January through December 2014, there were multiple citywide signals for gastrointestinal illness in the ED system in February and March and again in October, November and December. Sustained citywide signals in the ED system in the beginning and end of the year are consistent with annual gastrointestinal viral trends. There was no evidence of a drinking water-related outbreak in New York City in 2014.

PART III: INFORMATION SHARING AND PUBLIC EDUCATION

Information pertaining to NYC's Waterborne Disease Risk Assessment Program and related issues continue to be available on both the DEP and DOHMH websites, including results from the City's source water protozoa monitoring program. Documents on the websites include:

DOHMH Webpages:

- *Giardiasis fact sheet*
  http://www.nyc.gov/html/doh/html/diseases/cdgia.shtml

- *Cryptosporidiosis fact sheet*
  http://www.nyc.gov/html/doh/html/diseases/cdcry.shtml

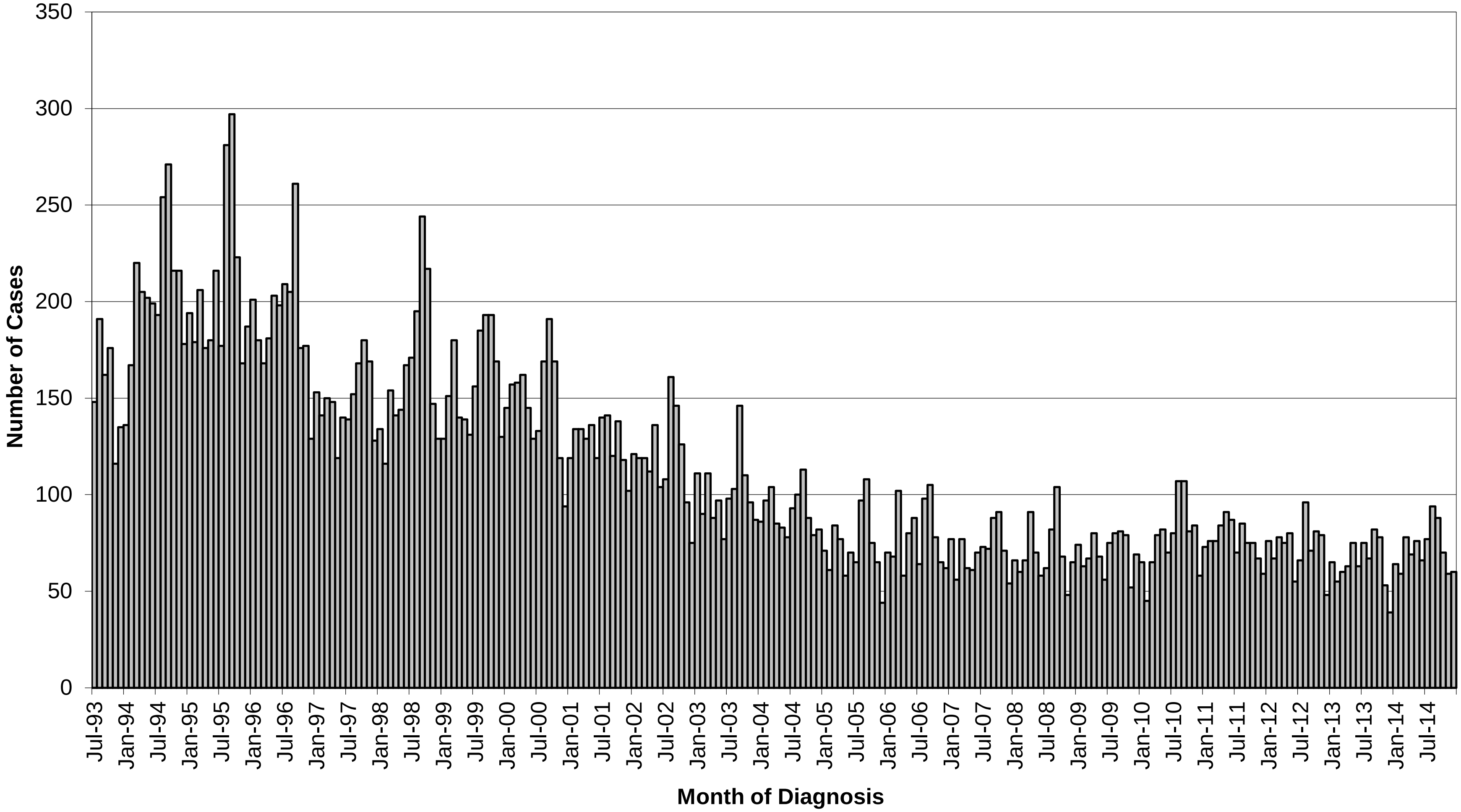
DEP Webpages:

- *DEP Water Supply Testing Results for Giardia and Cryptosporidium*
  (Data are collected and entered on the website each week. Historical data are also included.)
  http://www.nyc.gov/html/dep/html/drinking_water/pathogen.shtml

- *Waterborne Disease Risk Assessment Program's Annual Reports, 1997-present*
  http://www.nyc.gov/html/dep/html/drinking_water/wdrap.shtml

- *New York City Drinking Water Supply and Quality Statement, 1997-present*
  http://www.nyc.gov/html/dep/html/drinking_water/wsstate.shtml

Figure 1: Giardiasis, number of cases by month of diagnosis, New York City, July 1993 - December 2014



<u>TABLE 1</u>: **Giardiasis**, number of cases and case rates, New York City, 1994 - 2014

Year	Number of Cases	Case Rate per 100,000
1994	2,457	32.3
1995	2,484	32.4
1996	2,288	29.6
1997	1,787	22.9
1998	1,959	24.9
1999	1,896	23.9
2000	1,771	22.1
2001	1,530	19.0
2002	1,423	17.6
2003	1,214	15.0
2004	1,088	13.4
2005	875	10.7
2006	938	11.4
2007	852	10.3
2008	840	10.0
2009	844	10.1
2010	923	11.3
2011	918	11.2
2012	872	10.7
2013	767	9.2
2014	864	10.4

Note:

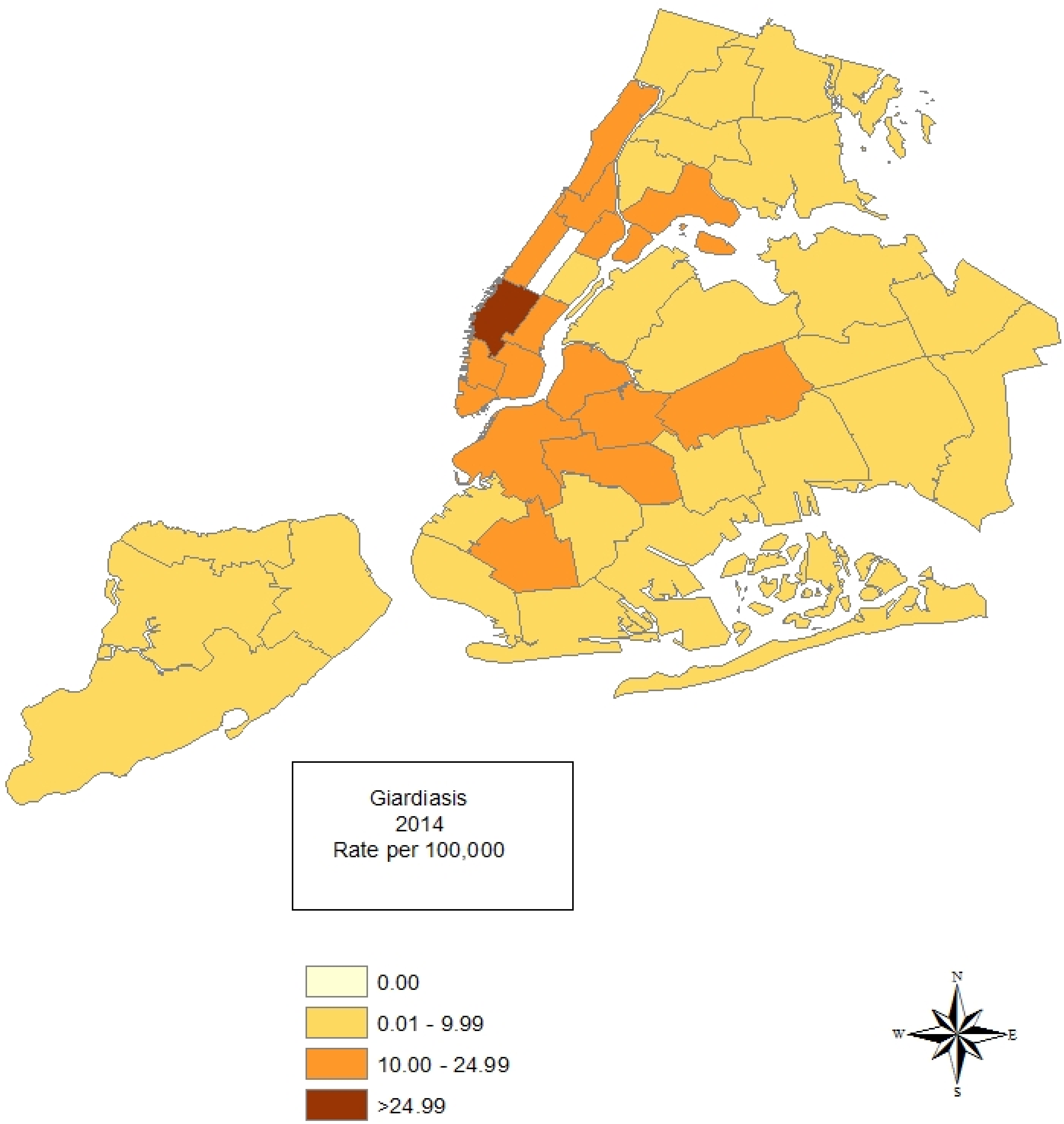
- Active disease surveillance for giardiasis began in July 1993. Starting January 2011, active laboratory surveillance was replaced by an electronic reporting system.
- Case numbers in this table conform to case numbers as they appear in the NYC Department of Health and Mental Hygiene Bureau of Communicable Disease surveillance databases for the years 1989-2014, and rates have been accordingly adjusted. Yearly case numbers and rates in this table may therefore differ from case numbers and rates that appeared in prior WDRAP reports.

TABLE 2: **Giardiasis**, number of cases and annual case rate per 100,000 population by sex and borough of residence, New York City, 2014

	Borough of residence					
Sex	Citywide number (rate)	Manhattan number (rate)	Bronx number (rate)	Brooklyn number (rate)	Queens number (rate)	Stat Is number (rate)
Male	595 (15.0)	229 (30.0)	68 (10.3)	167 (13.7)	118 (10.7)	13 (5.7)
Female	267 (6.1)	64 (7.5)	45 (6.0)	94 (7.0)	58 (5.0)	6 (2.5)
Trans-gender	2	0	0	2	0	0
Total	864 (10.4)	293 (18.1)	113 (8.0)	263 (10.3)	176 (7.7)	19 (4.0)

Map 1

Giardiasis annual case rate per 100,000 population
by UHF neighborhood - New York City (2014)



<u>Table 3:</u> Giardiasis, number of cases and annual case rate per 100,000 by UHF neighborhood of residence, New York City, 2014

UHF Neighborhood	Borough	Number	Population	Rate
Chelsea-Clinton	Manhattan	73	147967	49.3
Greenwich Village-Soho	Manhattan	19	85349	22.3
C.Harlem-Morningside Hgts	Manhattan	36	165446	21.8
Lower Manhattan	Manhattan	10	54752	18.3
Greenpoint	Brooklyn	22	127826	17.2
Williamsburg-Bushwick	Brooklyn	34	212420	16.0
Upper West Side	Manhattan	35	224570	15.6
Ridgewood-Forest Hills	Queens	38	246252	15.4
Union Sq-Lower East Side	Manhattan	31	202756	15.3
Washington Heights-Inwood	Manhattan	36	254534	14.1
Borough Park	Brooklyn	47	343853	13.7
Downtown-Heights-Slope	Brooklyn	31	227431	13.6
Gramercy Park-Murray Hill	Manhattan	18	136402	13.2
East Harlem	Manhattan	14	112669	12.4
Hunts Point-Mott Haven	Bronx	15	139723	10.7
Bed Stuyvesant-Crown Hgts	Brooklyn	33	320426	10.8
Sunset Park	Brooklyn	13	131717	9.9
West Queens	Queens	49	498223	9.8
Long Island City-Astoria	Queens	20	214967	9.3
Pelham-Throgs Neck	Bronx	28	302976	9.2
Southwest Queens	Queens	24	268895	8.9
Upper East Side	Manhattan	20	225908	8.9
Kingsbridge-Riverdale	Bronx	8	92323	8.7
High Bridge-Morrisania	Bronx	18	211512	8.5
Coney Island-Sheepshead Bay	Brooklyn	25	299409	8.3
East Flatbush-Flatbush	Brooklyn	25	299842	8.3
Fresh Meadows	Queens	8	97755	8.2
Bensonhurst-Bay Ridge	Brooklyn	17	216213	7.9
Crotona-Tremont	Bronx	16	209824	7.6
Fordham-Bronx Park	Bronx	18	257315	7.0
Willowbrook	Stat Is	5	85992	5.8
Port Richmond	Stat Is	4	70996	5.6
Jamaica	Queens	16	292525	5.5
Northeast Bronx	Bronx	10	192364	5.2
Flushing-Clearview	Queens	11	264146	4.2
Canarsie-Flatlands	Brooklyn	8	197486	4.1
East New York	Brooklyn	7	189012	3.7
Stapleton-St. George	Stat Is	4	124666	3.2
South Beach-Tottenville	Stat Is	6	189074	3.2
Rockaway	Queens	3	115234	2.6
Southeast Queens	Queens	5	197333	2.5
Bayside-Littleneck	Queens	2	88590	2.3

*This table does not include two cases of giardiasis occurring in Manhattan residents in which UHF neighborhood could not be determined.

TABLE 4: Giardiasis, number of cases and annual case rate per 100,000 population by age group and sex, New York City, 2014

	Sex			
Age group	Male number (rate)	Female number (rate)	Trans-gender (rate)	Total number (rate)
<5 years	45 (16.1)	39 (14.6)	0	84 (15.4)
5-9 years	44 (17.8)	34 (14.4)	0	78 (16.2)
10-19 years	49 (10.0)	29 (6.1)	0	78 (8.1)
20-44 years	309 (19.5)	94 (5.6)	2	405 (12.4)
45-59 years	110 (14.5)	36 (4.2)	0	146 (9.1)
≥ 60 years	38 (6.2)	35 (4.0)	0	73 (4.9)
Total	595 (15.0)	267 (6.1)	2	864 (10.4)

<u>TABLE 5</u>: Giardiasis, number of cases and annual case rate per 100,000 population by age group and borough of residence, New York City, 2014

	Borough of residence					
Age group	Citywide number (rate)	Manhattan number (rate)	Bronx number (rate)	Brooklyn number (rate)	Queens number (rate)	Stat Is number (rate)
<5 years	84 (15.4)	11 (13.2)	22 (20.4)	31 (16.5)	17 (12.3)	3 (10.7)
5-9 years	78 (16.2)	11 (17.3)	16 (16.0)	28 (17.2)	22 (17.4)	1 (3.4)
10-19 years	78 (8.1)	11 (8.4)	18 (8.8)	25 (8.0)	24 (9.5)	0
20-44 years	405 (12.4)	173 (23.7)	38 (7.4)	129 (12.9)	57 (6.6)	8 (5.1)
45-59 years	146 (9.1)	67 (22.4)	8 (3.0)	32 (6.8)	32 (6.8)	7 (6.8)
≥ 60 years	73 (4.9)	20 (6.4)	11 (5.1)	18 (4.2)	24 (5.7)	0
Total	864 (10.4)	293 (18.1)	113 (8.0)	263 (10.3)	176 (7.7)	19 (4.0)

<u>Table 6:</u> Giardiasis, number of cases and case rates by census tract poverty level, New York City, 2014

Census Tract Poverty Level	Number of Cases	Case Rate per 100,000	Age adjusted rates
Low[a]	212	9.5	9.2
Medium[b]	298	12.4	12.5
High[c]	192	10.7	10.7
Very high[d]	160	9.2	8.9
Total[g]	862	10.5	

[a] Low poverty: <10% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[b] Medium poverty: 10-19% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[c] High poverty: 20-29% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[d] Very high poverty: >=30% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[e] Two cases (0.2%) were excluded from the total 2014 case count because geolocating information for census tract identification was unavailable.

Table 7: Cryptosporidiosis, number of cases and case rates, New York City, 1994 – 2014

Year	Number of Cases	Case Rate per 100,000
1994	288	3.8
1995	471	6.1
1996	334	4.3
1997	172	2.2
1998	207	2.6
1999	261	3.3
2000	172	2.1
2001	122	1.5
2002	148	1.8
2003	126	1.6
2004	138	1.7
2005	148	1.8
2006	155	1.9
2007	105	1.3
2008	107	1.3
2009	81	1.0
2010	107	1.3
2011	86	1.1
2012	125	1.5
2013	80	1.0
2014	102	1.2

Note:

- Active disease surveillance for cryptosporidiosis began in November 1994. Starting January 2011, active laboratory surveillance was discontinued as it had been replaced by an electronic reporting system.
- Case numbers in this table conform to case numbers as they appear in the NYC Department of Health and Mental Hygiene Bureau of Communicable Disease surveillance databases for the years 1989-2014, and rates have been accordingly adjusted. Yearly case numbers and rates in this table may therefore differ from case numbers and rates that appeared in prior WDRAP reports.

Figure 2: Cryptosporidiosis, number of cases by month of diagnosis, New York City, November 1994 - December 2014

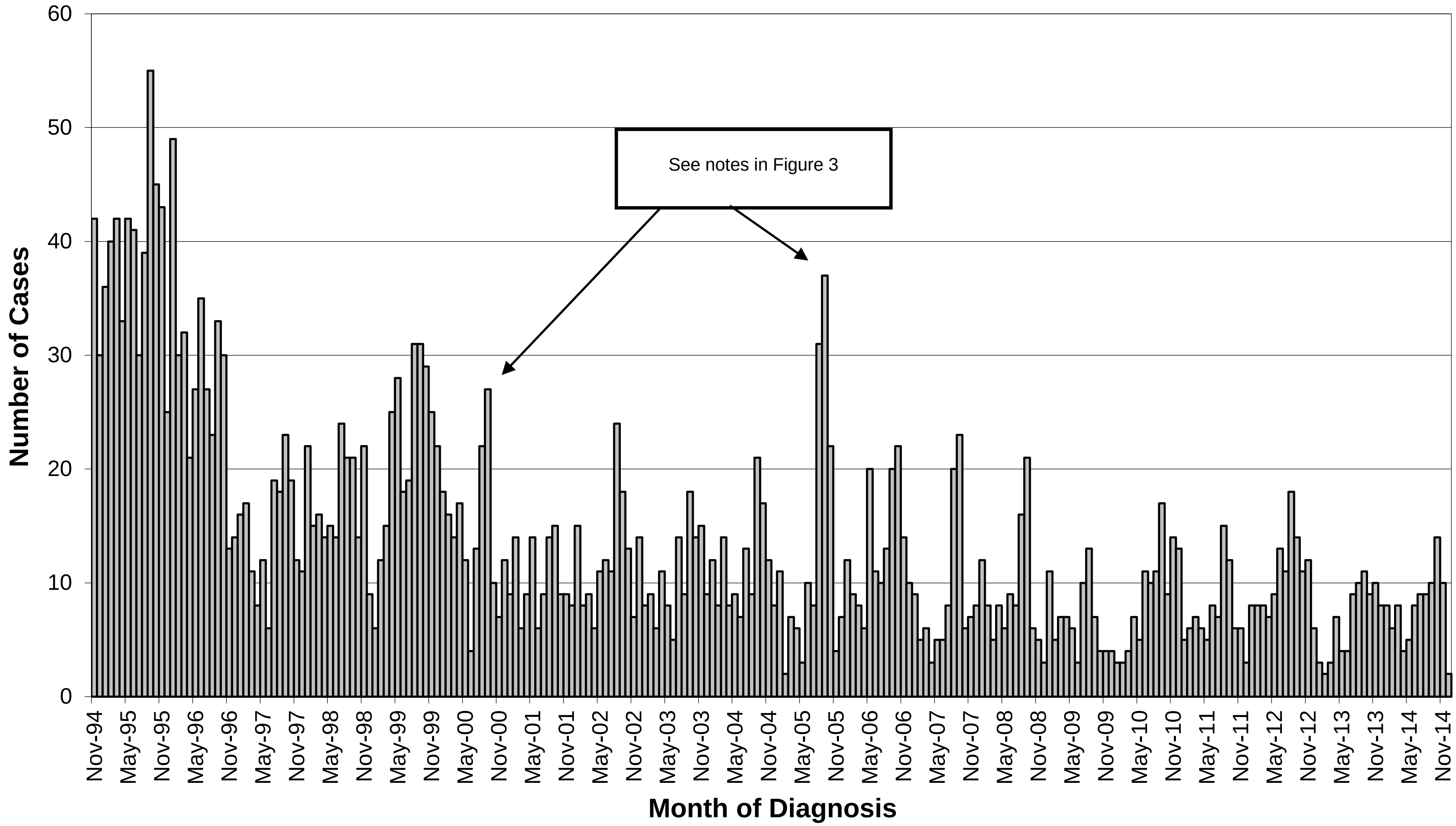


Figure 3: Cryptosporidiosis, number of cases by month of onset, New York City, January 1995 - December 2014*

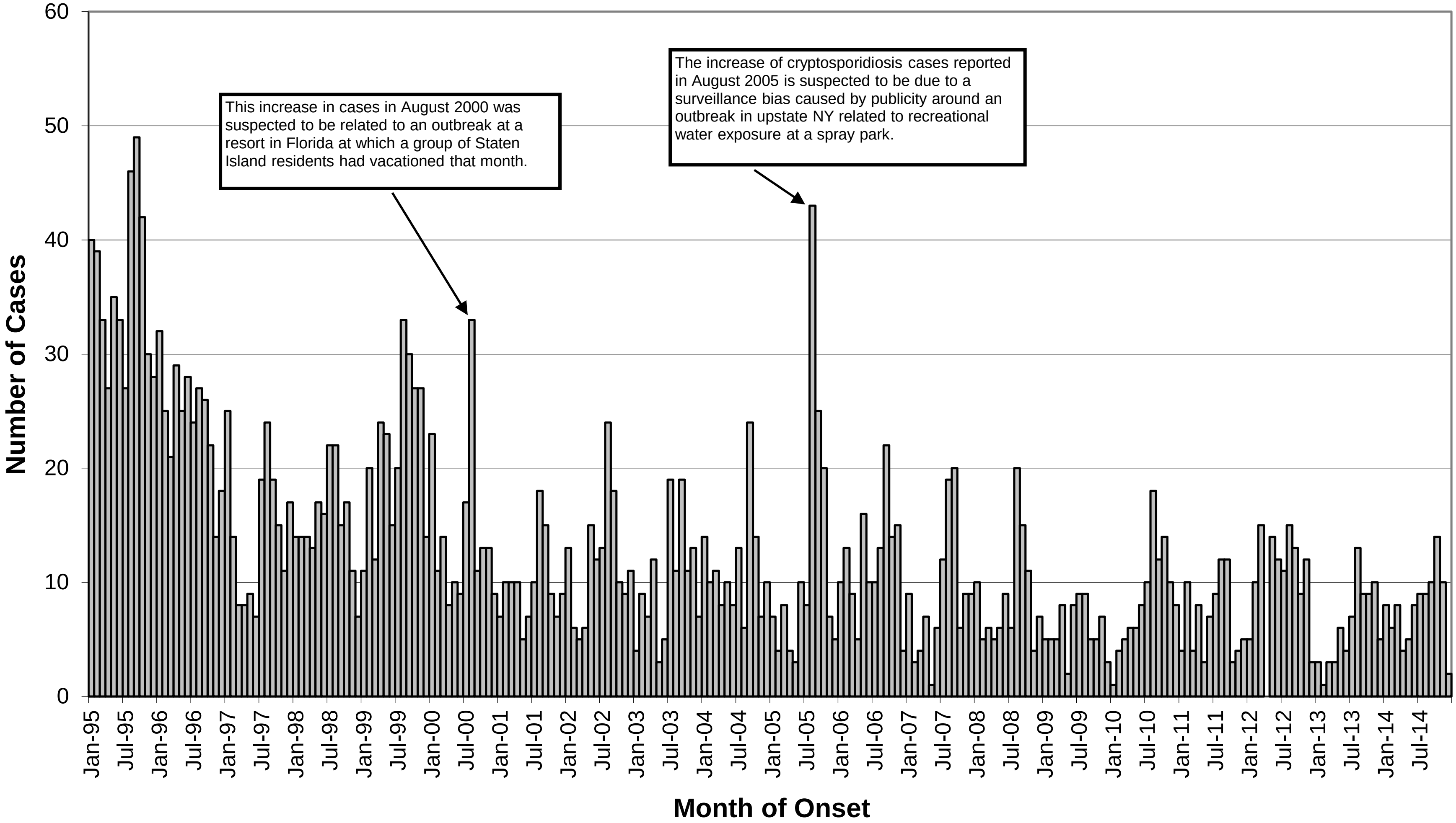


TABLE 8: **Cryptosporidiosis**, number of cases and annual case rate per 100,000 population by sex and borough of residence, New York City, 2014

	Borough of residence					
Sex	Citywide number (rate)	Manhattan number (rate)	Bronx number (rate)	Brooklyn number (rate)	Queens number (rate)	Stat Is number (rate)
Male	69 (1.7)	27 (3.5)	19 (2.9)	13 (1.1)	10 (0.9)	0
Female	33 (0.8)	19 (2.2)	3 (0.4)	8 (0.6)	2 (0.2)	1 (0.4)
Total	102 (1.2)	46 (2.8)	22 (1.6)	21 (0.8)	12 (0.5)	1 (0.2)

Map 2

Cryptosporidiosis annual case rate per 100,000 population
by UHF neighborhood - New York City (2014)

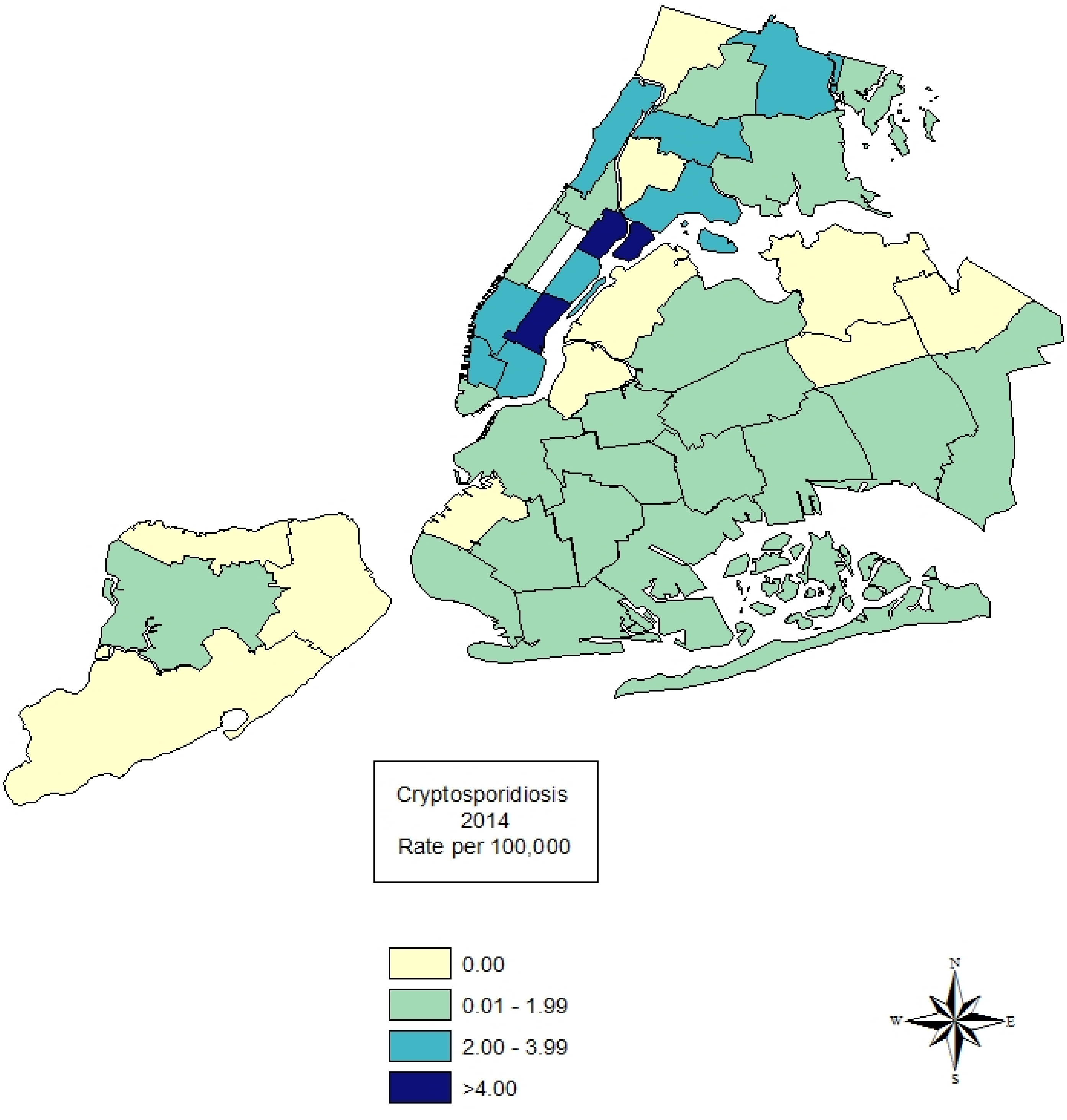


TABLE 9: Cryptosporidiosis, number of cases and annual case rate per 100,000 population by UHF neighborhood of residence, New York City, 2014

UHF Neighborhood	Borough	Number	Population	Rate
East Harlem	Manhattan	6	112669	5.3
Gramercy Park-Murray Hill	Manhattan	6	136402	4.4
Washington Heights-Inwood	Manhattan	10	254534	3.9
Greenwich Village-Soho	Manhattan	3	85349	3.5
Northeast Bronx	Bronx	6	192364	3.1
Upper East Side	Manhattan	7	225908	3.1
Hunts Point-Mott Haven	Bronx	4	139723	2.9
Chelsea-Clinton	Manhattan	4	147967	2.7
Crotona-Tremont	Bronx	5	209824	2.4
Union Sq-Lower East Side	Manhattan	4	202756	2.0
Lower Manhattan	Manhattan	1	54752	1.8
Downtown Heights-Slope	Brooklyn	4	227431	1.8
East Flatbush-Flatbush	Brooklyn	5	299842	1.7
Ridgewood-Forest Hills	Queens	4	246252	1.6
Fordham-Bronx Park	Bronx	4	257315	1.6
Upper West Side	Manhattan	3	224570	1.3
C Harlem-Morningside Hgts	Manhattan	2	165446	1.2
Willowbrook	Staten Is	1	85992	1.2
Southwest Queens	Queens	3	268895	1.1
East New York	Brooklyn	2	189012	1.1
Southeast Queens	Queens	2	197333	1.0
Coney Island-Sheepshead Bay	Brooklyn	3	299409	1.0
Pelham-Throgs Neck	Bronx	3	302976	1.0
Williamsburg-Bushwick	Brooklyn	2	212420	0.9
Rockaway	Queens	1	115234	0.9
Bed Stuyvesant-Crown Hgts	Brooklyn	2	320426	0.6
Canarsie-Flatlands	Brooklyn	1	197486	0.5
Bensonhurst-Bay Ridge	Brooklyn	1	216213	0.5
Jamaica	Queens	1	292525	0.3
Borough Park	Brooklyn	1	343853	0.3
West Queens	Queens	1	498223	0.2

<u>TABLE 10:</u> Cryptosporidiosis, number of cases and annual case rate per 100,000 population by age group and sex, New York City, 2014

	Sex		
Age group	Male number (rate)	Female number (rate)	Total number (rate)
<5 years	5 (1.8)	5 (1.9)	10 (1.8)
5-9 years	3 (1.2)	1 (0.4)	4 (0.8)
10-19 years	3 (0.6)	2 (0.4)	5 (0.5)
20-44 years	40 (2.5)	19 (1.1)	59 (1.8)
45-59 years	15 (2.0)	5 (0.6)	20 (1.2)
≥ 60 years	3 (0.5)	1 (0.1)	4 (0.3)
Total	69 (1.7)	33 (0.8)	102 (1.2)

<u>TABLE 11</u>: Cryptosporidiosis, number of cases and annual case rate per 100,000 population by age group and borough, New York City, 2014

	Borough of residence					
Age group	Citywide number (rate)	Manhattan number (rate)	Bronx number (rate)	Brooklyn number (rate)	Queens number (rate)	Stat Is number (rate)
<5 years	10 (1.8)	4 (4.8)	3 (2.8)	1 (0.5)	2 (1.4)	0
5-9 years	4 (0.8)	3 (4.7)	0	1 (0.6)	0	0
10-19 years	5 (0.5)	1 (0.8)	2 (1.0)	1 (0.3)	1 (0.4)	0
20-44 years	59 (1.8)	29 (4.0)	12 (2.3)	11 (1.1)	7 (0.8)	0
45-59 years	20 (1.2)	8 (2.7)	4 (1.5)	6 (1.3)	2 (0.4)	0
≥ 60 years	4 (0.3)	1 (0.3)	1 (0.5)	1 (0.2)	0	1 (1.1)
Total	102 (1.2)	46 (2.8)	22 (1.6)	21 (0.8)	12 (0.5)	1 (0.2)

<u>TABLE 12</u>: Cryptosporidiosis, number of cases and annual case rate per 100,000 population by race/ethnicity and borough of residence, New York City, 2014

	Borough of residence					
Race/Ethnicity	Citywide number (rate)	Manhattan number (rate)	Bronx number (rate)	Brooklyn number (rate)	Queens number (rate)	Stat Is number (rate)
Hispanic	25 (1.0)	12 (2.9)	5 (0.7)	3 (0.6)	5 (0.8)	0
White, non-Hispanic	31 (1.1)	18 (2.3)	2 (1.3)	7 (0.8)	3 (0.5)	1 (0.3)
Black, non-Hispanic	30 (1.6)	7 (3.3)	11 (2.6)	9 (1.1)	3 (0.7)	0
Asian, non-Hispanic	7 (0.6)	4 (2.1)	1 (1.9)	2 (0.7)	0	0
Pacific Islander, Native Hawaiian, non-Hispanic	0	0	0	0	0	
American Indian, non-Hispanic	0	0	0	0	0	0
Two or more races, non-Hispanic	1 (0.8)	0	1 (7.4)	0	0	0
Unknown	8	5	2	0	1	0
Total	102 (1.0)	46 (2.8)	22 (1.6)	21 (0.8)	12 (0.5)	1 (0.2)

<u>TABLE 13</u>: Cryptosporidiosis, number of cases and annual case rate per 100,000 population by race/ethnicity and age group, New York City, 2014

	Age group						
Race /ethnicity	< 5 years number (rate)	5-9 years number (rate)	10-19 years number (rate)	20-44 years number (rate)	45-59 years number (rate)	≥ 60 years number (rate)	Total number (rate)
Hispanic	5 (2.6)	0	2 (0.6)	14 (1.5)	3 (0.7)	1 (0.3)	25 (1.0)
White, non-Hispanic	2 (1.3)	3 (2.4)	1 (0.4)	16 (1.5)	8 (1.5)	1 (0.2)	31 (1.1)
Black, non-Hispanic	2 (1.6)	0	0	19 (2.8)	8 (2.0)	1 (0.3)	30 (1.6)
Asian, non-Hispanic	1 (1.6)	1 (1.7)	1 (0.9)	4 (0.8)	0	0	7 (0.6)
Pacific Islander, Native Hawaiian, non-Hispanic	0	0	0	0	0	0	0
American Indian, non-Hispanic	0	0	0	0	0	0	0
Two or more races, non-Hispanic	0	0	0	0	1 (5.2)	0	1 (0.8)
Unknown	0	0	1	6	0	1	8
Total	5 (0.9)	2 (0.4)	4 (0.4)	51 (1.6)	16 (1.0)	2 (0.1)	102 (1.2)

<u>Table 14</u>: Cryptosporidiosis, number of cases and case rates by census tract poverty level, New York City, 2014

Census Tract Poverty Level	Number of Cases	Case Rate per 100,000	Age adjusted rates per 100,000
Low[a]	32	1.4	1.5
Medium[b]	21	0.9	0.9
High[c]	26	1.5	1.5
Very high[d]	21	1.2	1.2
Total[g]	100	1.2	

[a] Low poverty: <10% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[b] Medium poverty: 10-19% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[c] High poverty: 20-29% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[d] Very high poverty: >=30% of residents have household incomes that are below 100% of the federal poverty level, per American Community Survey 2008-2012.

[e] Two cases (2 %) were excluded from the total case count because census tract data was unavailable.

Figure 4: Cryptosporidiosis, number of cases among persons living with HIV/AIDS by month of diagnosis, New York City, January 1995 - December 2014

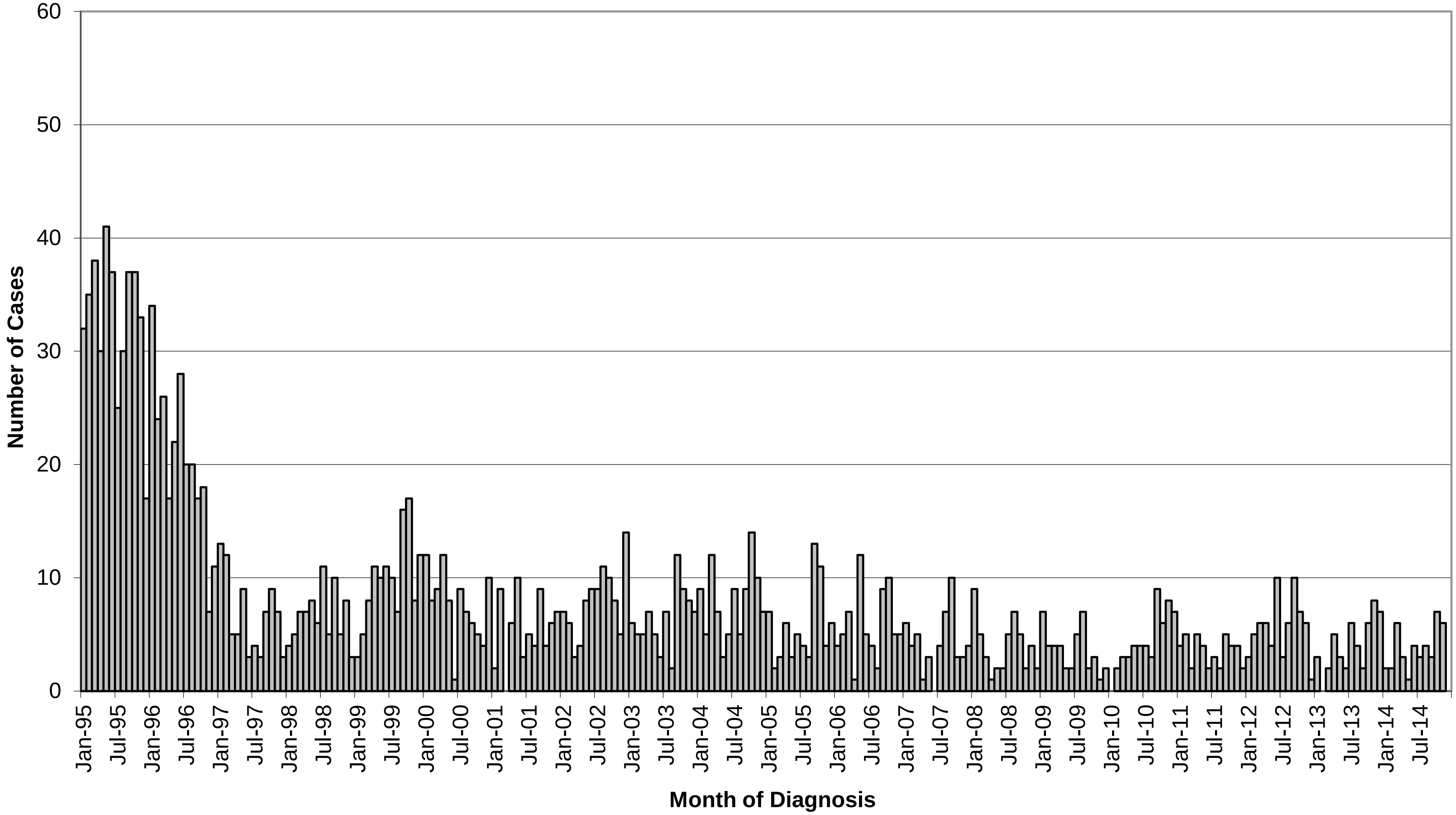
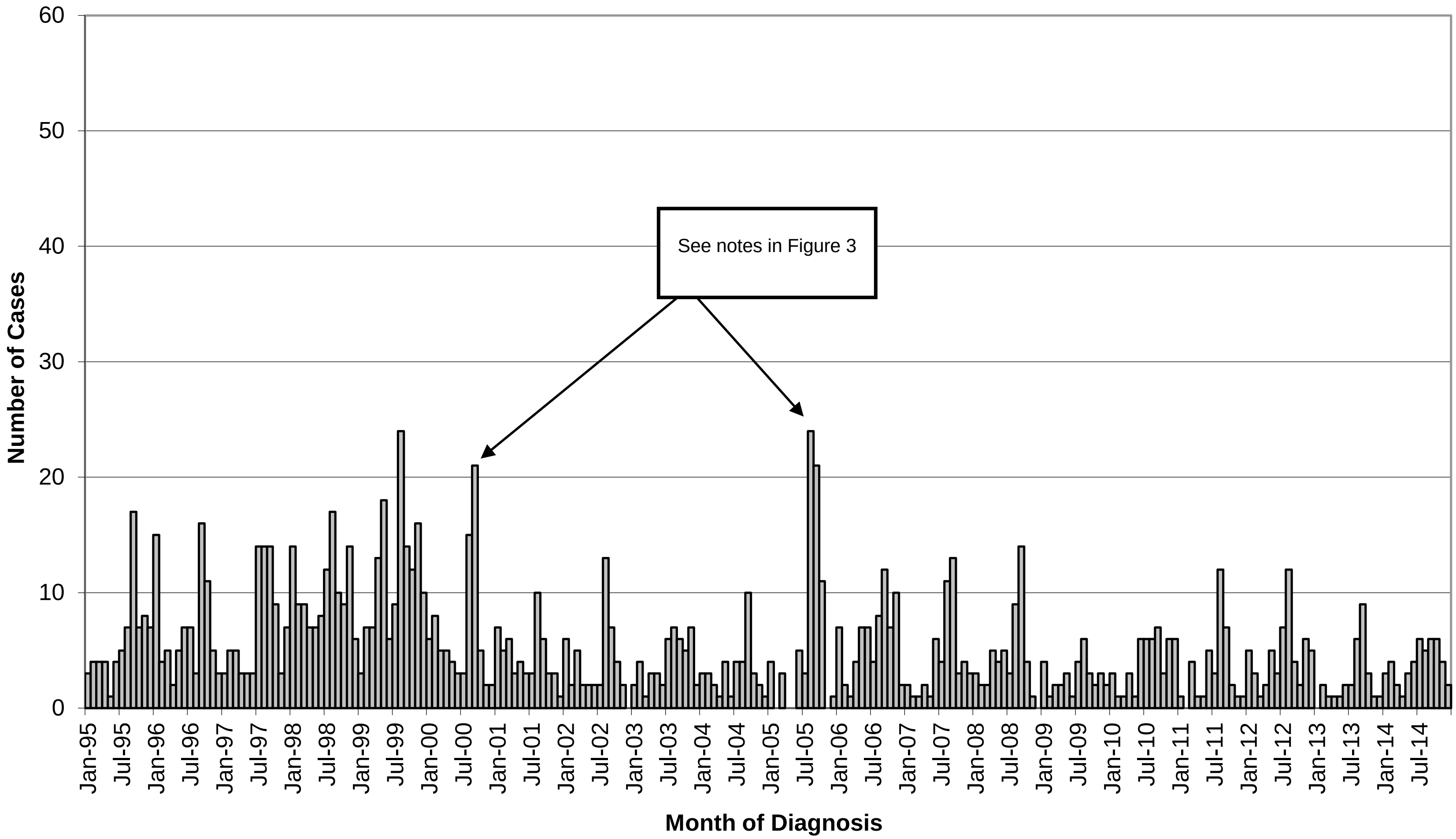


Figure 5: Cryptosporidiosis, number of cases among immunocompetent persons by month of diagnosis, New York City, January 1995 - December 2014



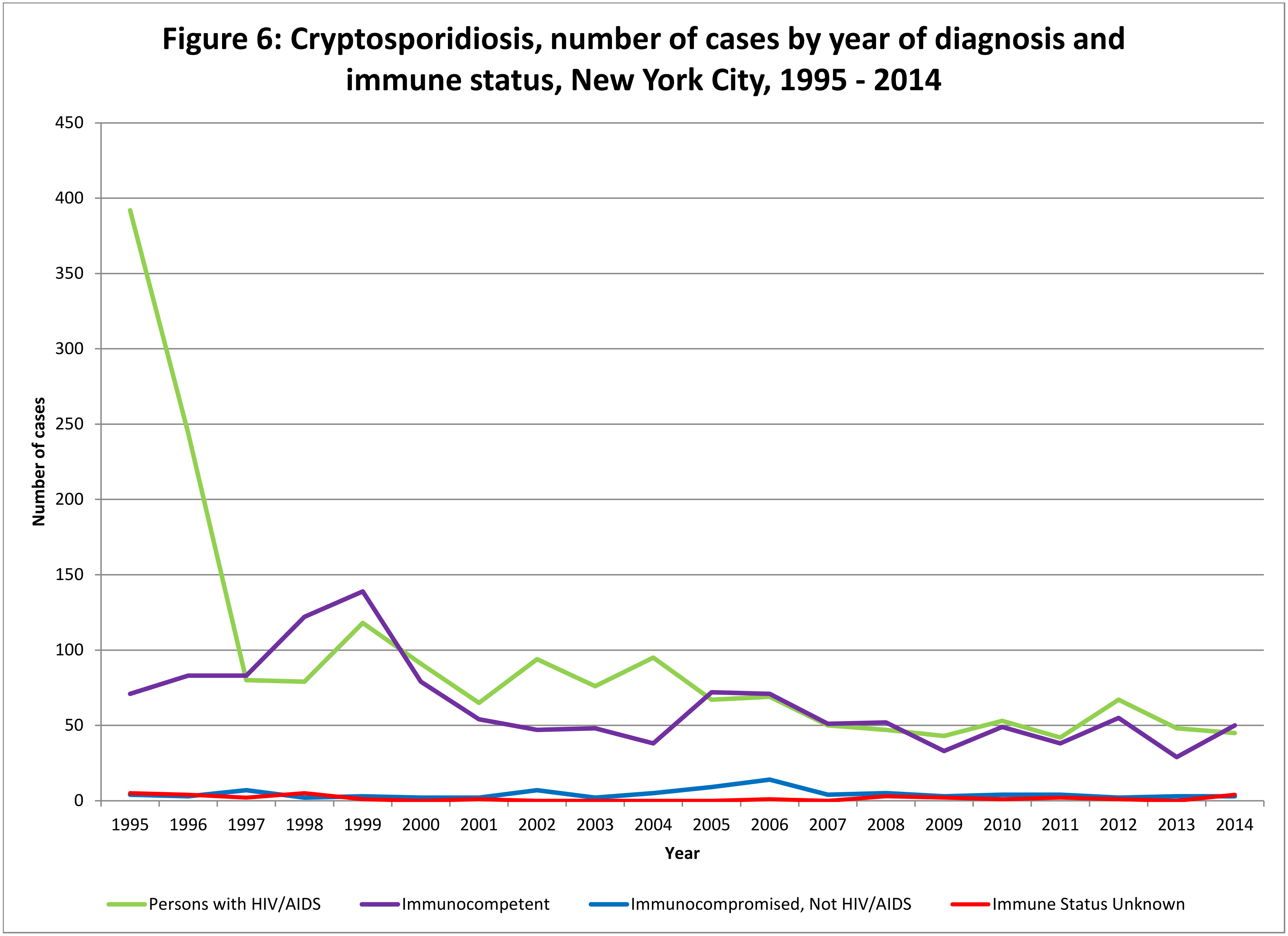


Figure 6: Cryptosporidiosis, number of cases by year of diagnosis and immune status, New York City, 1995 - 2014
Number of cases
450
400
350
300
250
200
150
100
50
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year
Persons with HIV/AIDS
Immunocompetent
Immunocompromised, Not HIV/AIDS
Immune Status Unknown

<u>Table 15:</u> Percentage of interviewed c**ryptosporidiosis** case-patients reporting selected potential risk exposures before disease onset,[a] persons with HIV/AIDS, New York City, 1995 - 2014

Exposure Type	Persons with HIV/AIDS																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Contact with an Animal[b]	35%	35%	33%	36%	35%	43%	24%	42%	40%	31%	33%	38%	31%	44%	42%	20%	36%	34%	29%	43%
High-risk Sexual Activity[c] (≥ 18 years old)	22%	22%	9%	15%	20%	25%	16%	23%	24%	34%	27%	31%	21%	39%	35%	7%	14%	23%	17%	25%
International Travel[d]	9%	9%	9%	13%	18%	14%	10%	11%	13%	15%	17%	9%	6%	7%	8%	7%	4%	6%	13%	4%
Recreational Water Contact[e]	16%	8%	16%	12%	16%	15%	8%	10%	21%	13%	5%	18%	17%	14%	8%	10%	14%	8%	13%	4%

Note:

- **Determination of an association between exposure to possible risk factors for cryptosporidiosis and acquisition of cryptosporidiosis cannot be made without reference to a suitable control population (i.e., non-*Cryptosporidium*-infected controls).**

- Format of case interview form changed on 1/1/1997, 5/11/2001, 8/21/2002, and 4/26/2010. Details regarding changes made to the interview form and Exposure Types from 1995-2014 are noted below.

[a] From 1/1/1995 to 4/25/2010, case-patients were asked about potential risk exposures during the month before disease onset. Starting 4/26/2010, case-patients were asked about potential risk exposures during the 14 days before onset.

[b] Contact with an Animal - Includes having a pet, or visiting a farm or petting zoo (1995-1996); expanded to include: or visiting a pet store or veterinarian office (1997-2012); or other animal exposure (2014).

[c] High-risk Sexual Activity - Includes having a penis, finger or tongue in sexual partner's anus (1995-2014).

[d] International Travel - Travel outside the United States (1995-2014).

[e] Recreational Water Contact - Includes swimming in a pool, or swimming in or drinking from a stream, lake, river or spring (1995-1996); expanded to include: or swimming in the ocean or visiting a recreational water park (1997-2012); or swimming in a hot tub or swimming or drinking water from a pond or body of water (2014).

<u>Table 16:</u> Percentage of interviewed **Cryptosporidiosis** case-patients reporting selected potential risk exposures before disease onset,[a] immunocompetent persons, New York City, 1995 – 2014

Exposure Type	Immunocompetent Persons																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Contact with an Animal[b]	7%	41%	41%	32%	35%	26%	37%	35%	23%	34%	36%	36%	34%	28%	40%	18%	41%	33%	38%	34%
High-risk Sexual Activity[c] (≥ 18 years old)	14%	25%	12%	10%	12%	23%	15%	30%	13%	31%	17%	3%	19%	7%	18%	4%	5%	11%	8%	11%
International Travel[d]	30%	29%	26%	28%	28%	40%	47%	33%	45%	47%	45%	40%	47%	52%	37%	44%	35%	50%	62%	41%
Recreational Water Contact[e]	21%	27%	40%	24%	22%	32%	35%	35%	34%	33%	52%	28%	36%	40%	50%	33%	35%	46%	48%	32%

Note:

- **Determination of an association between exposure to possible risk factors for cryptosporidiosis and acquisition of cryptosporidiosis cannot be made without reference to a suitable control population (i.e., non-*Cryptosporidium*-infected controls).**

- Format of case interview form changed on 1/1/1997, 5/11/2001, 8/21/2002, and 4/26/2010. Details regarding changes made to the interview form and Exposure Types from 1995-2014are noted below.

[a] From 1/1/1995 to 4/25/2010, case-patients were asked about potential risk exposures during the month before disease onset. Starting 4/26/2010, case-patients were asked about potential risk exposures during the 14 days before onset.

[b] Contact with an Animal - Includes having a pet, or visiting a farm or petting zoo (1995-1996); expanded to include: or visiting a pet store or veterinarian office (1997-2012); or other animal exposure (2014).

[c] High-risk Sexual Activity - Includes having a penis, finger or tongue in sexual partner's anus (1995-2014).

[d] International Travel - Travel outside the United States (1995-2014).

[e] Recreational Water Contact - Includes swimming in a pool, or swimming in or drinking from a stream, lake, river or spring (1995-1996); expanded to include: or swimming in the ocean, or visiting a recreational water park (1997-2012); or swimming in a hot tub or swimming or drinking water from a pond or body of water (2014).

* Year 2000 percentage of interviewed cryptosporidiosis cases does not include 14 cases associated with a point source exposure at a swimming pool in Florida.

Table 17: Percentage of interviewed **cryptosporidiosis** case-patients by type of tap water exposure before disease onset,[a] persons with HIV/AIDS, New York City, 1995 - 2014

Exposure Type	Persons with HIV/AIDS																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Plain Tap[b]	69%	70%	71%	64%	66%	63%	55%	54%	77%	49%	76%	67%	67%	64%	58%	63%	50%	63%	71%	54%
Filtered Tap[c]	12%	9%	10%	18%	20%	20%	14%	22%	13%	21%	7%	18%	11%	14%	15%	12%	25%	8%	8%	11%
Boiled Tap[d]	7%	7%	3%	5%	3%	6%	6%	0%	4%	6%	5%	7%	0%	11%	8%	2%	4%	4%	8%	11%
Incidental Plain Tap Only[e]	11%	15%	16%	15%	8%	12%	16%	19%	4%	15%	10%	4%	17%	7%	15%	15%	18%	20%	8%	18%
No Tap[f]	3%	2%	2%	0%	5%	4%	6%	4%	2%	5%	2%	2%	6%	4%	0%	3%	4%	4%	4%	0%

Note:

- **Determination of an association between exposure to possible risk factors for cryptosporidiosis and acquisition of cryptosporidiosis cannot be made without reference to a suitable control population (i.e., non-*Cryptosporidium*-infected controls).**

- Format of case interview form changed on 1/1/1997, 5/11/2001, 8/21/2000, and 4/26/2010. Details regarding changes made to the interview form and Tap Water Exposure Types from 1995-2014 are noted below.

[a] From 1/1/1995 to 4/25/2010, case-patients were asked about Tap Water Exposure during the month before disease onset. Starting 4/26/2010, case-patients were asked about Tap Water Exposure during the 14 days before onset.

[b] Plain Tap - Drank unboiled/unfiltered NYC tap water (1995-5/10/2001); or drank greater than 0 cups of unboiled/unfiltered NYC tap water (5/11/2001-12/31/2012).

[c] Filtered Tap - Drank filtered NYC tap water (1995-5/10/2001); or drank greater than 0 cups of filtered NYC tap water, and 0 or more cups of boiled NYC tap water, and no unboiled /unfiltered NYC tap water (5/11/2001-12/31/2014

[d] Boiled Tap - Drank boiled NYC tap water (1995-5/10/2001); or drank greater than 0 cups of boiled NYC tap water, and no unboiled /unfiltered NYC tap water, and no filtered NYC tap water (5/11/2001-12/31/2014).

[e] Incidental Plain Tap Only - Did not drink any NYC tap water but did use unboiled/unfiltered NYC tap water to brush teeth, or to wash vegetables/fruits, or to make ice (1995-1996); expanded to include: or to make juice from concentrate (1997-2014)

[f] No Tap - Did not drink any NYC tap water and did not use unboiled/unfiltered NYC tap water to brush teeth, or to wash vegetables/fruits, or to make ice (1995-1996); expanded to include: or to make juice from concentrate (1997-2014).

<u>Table 18:</u> Percentage of interviewed **cryptosporidiosis** case-patients by type of tap water exposure before disease onset,[a] immunocompetent persons, New York City, 1995 - 2014

Exposure Type	Immunocompetent Persons																			
	1995	1996	1997	1998	1999	2000*	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Plain Tap[b]	58%	63%	58%	67%	56%	56%	43%	33%	36%	27%	30%	30%	27%	30%	47%	33%	44%	30%	29%	48%
Filtered Tap[c]	18%	17%	21%	21%	25%	17%	31%	44%	36%	30%	25%	20%	22%	30%	23%	27%	18%	26%	24%	17%
Boiled Tap[d]	11%	10%	8%	3%	4%	2%	4%	0%	2%	7%	5%	8%	4%	14%	0%	7%	3%	2%	0%	0%
Incidental Plain Tap Only[e]	7%	9%	12%	8%	11%	8%	16%	21%	16%	13%	25%	28%	18%	14%	27%	22%	15%	15%	19%	11%
No Tap[f]	2%	4%	4%	3%	7%	17%	6%	2%	9%	21%	14%	14%	27%	12%	3%	11%	21%	26%	29%	21%

Note:

- **Determination of an association between exposure to possible risk factors for cryptosporidiosis and acquisition of cryptosporidiosis cannot be made without reference to a suitable control population (i.e., non-*Cryptosporidium*-infected controls).**

- Format of case interview form changed on 1/1/1997, 5/11/2001, 8/21/2000, and 4/26/2010. Details regarding changes made to the interview form and Tap Water Exposure Types from 1995-2014 are noted below.

[a] From 1/1/1995 to 4/25/2010, case-patients were asked about Tap Water Exposure during the month before disease onset. Starting 4/26/2010, case-patients were asked about Tap Water Exposure during the 14 days before onset.

[b] Plain Tap - Drank unboiled/unfiltered NYC tap water (1995-5/10/2001); or drank greater than 0 cups of unboiled/unfiltered NYC tap water (5/11/2001-12/31/2014).

[c] Filtered Tap - Drank filtered NYC tap water (1995-5/10/2001); or drank greater than 0 cups of filtered NYC tap water, and 0 or more cups of boiled NYC tap water, and no unboiled /unfiltered NYC tap water (5/11/2001-12/31/2014).

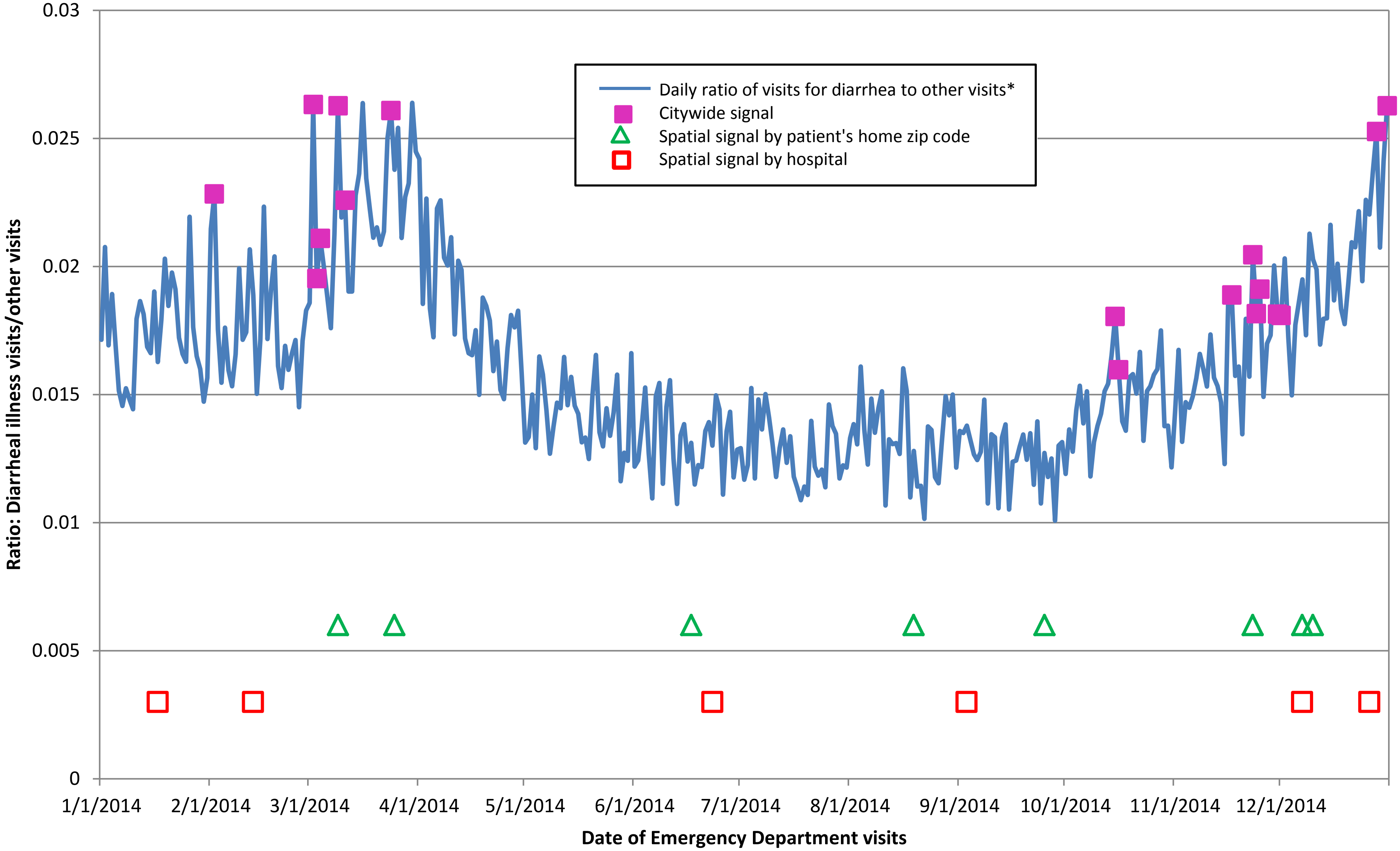
[d] Boiled Tap - Drank boiled NYC tap water (1995-5/10/2001); or drank greater than 0 cups of boiled NYC tap water, and no unboiled /unfiltered NYC tap water, and no filtered NYC tap water (5/11/2001-12/31/2014).

[e] Incidental Plain Tap Only - Did not drink any NYC tap water but <u>did</u> use unboiled/unfiltered NYC tap water to brush teeth, or to wash vegetables/fruits, or to make ice (1995-1996); expanded to include: or to make juice from concentrate (1997-2014)

[f] No Tap - Did not drink any NYC tap water and <u>did not</u> use unboiled/unfiltered NYC tap water to brush teeth, or to wash vegetables/fruits, or to make ice (1995-1996); expanded to include: or to make juice from concentrate (1997-2014).

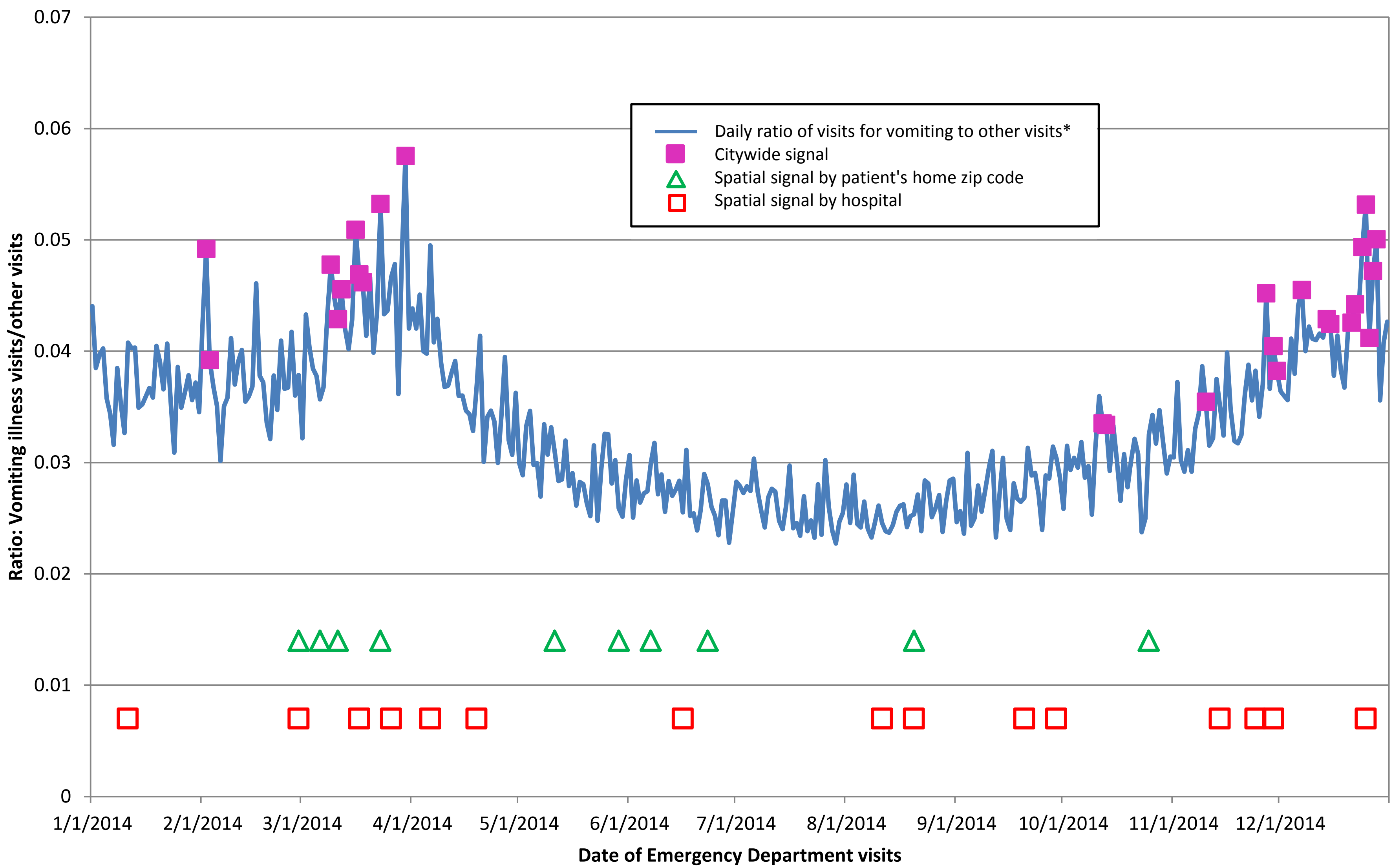
* Year 2000 percentage of interviewed cryptosporidiosis cases does not include 14 cases associated with a point source exposure at a swimming pool in Florida

Figure 7: Emergency Syndromic Surveillance, Trends in visits for the diarrhea syndrome, New York City, January 1, 2014 - December 31, 2014



*Other viists=visits to participating ED for conditions that do not fit in to one of the eight tracked syndromes (diarrhea, vomiting, respiratory, fever/influenza, asthma, spesis, cold, rash).

Figure 8: Emergency Department Syndromic Surveillance, Trends in visits for the vomiting syndrome, New York City, January 1, 2014 - December 31, 2014



*Other visits=visits to participating ED for conditions that do not fit in to one of the eight tracked syndromes (diarrhea, vomiting, respiratory, fever/influenza, asthma, sepsis, cold, rash).

Figure 9: Signals for Gastrointestinal Illness, Syndromic Surveillance Systems

New York City, January 1, 2014 - June 30, 2014

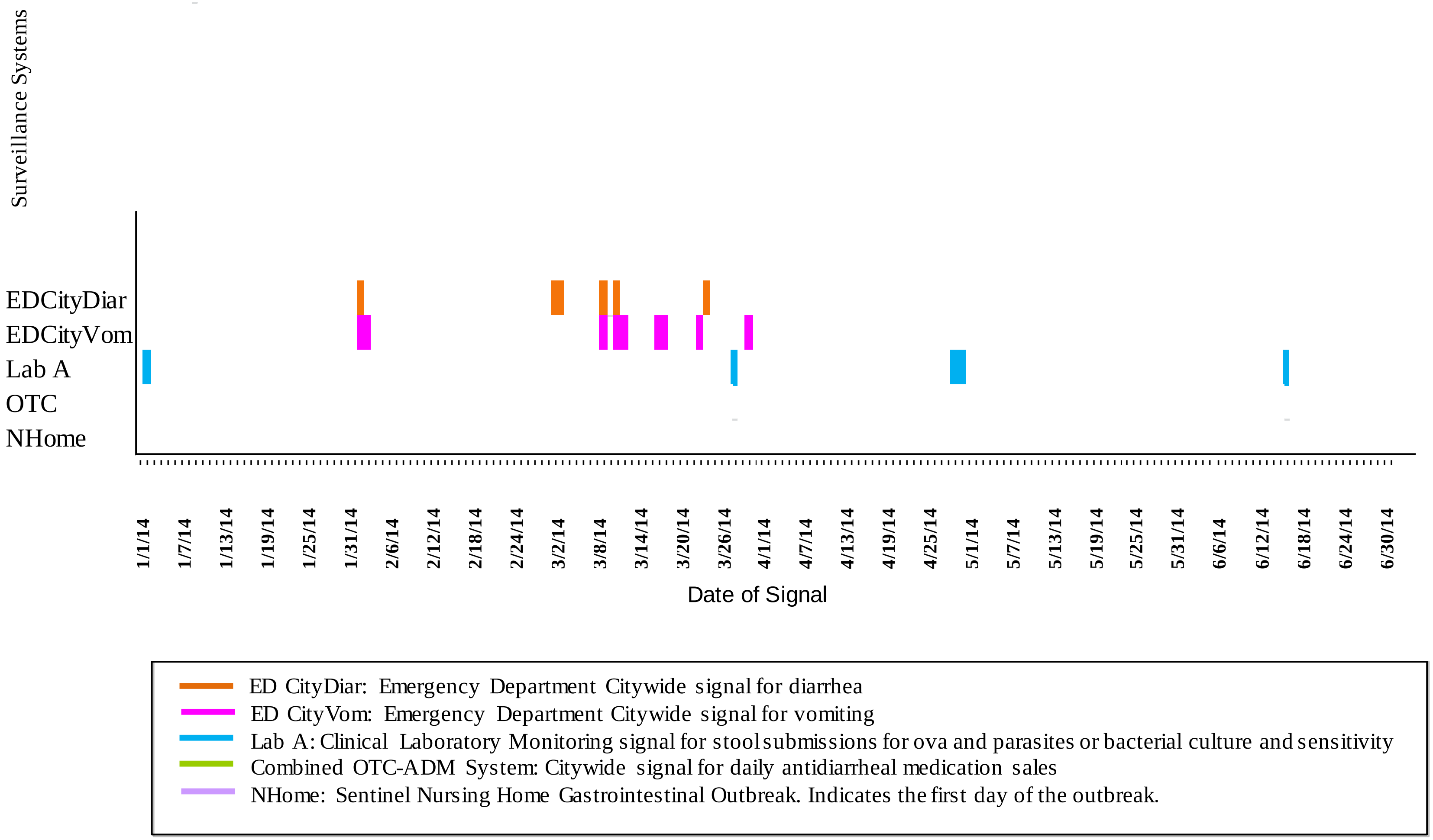


Figure 10: Signals for Gastrointestinal Illness, Syndromic Surveillance Systems

New York City, July 1, 2014 - December 31, 2014