

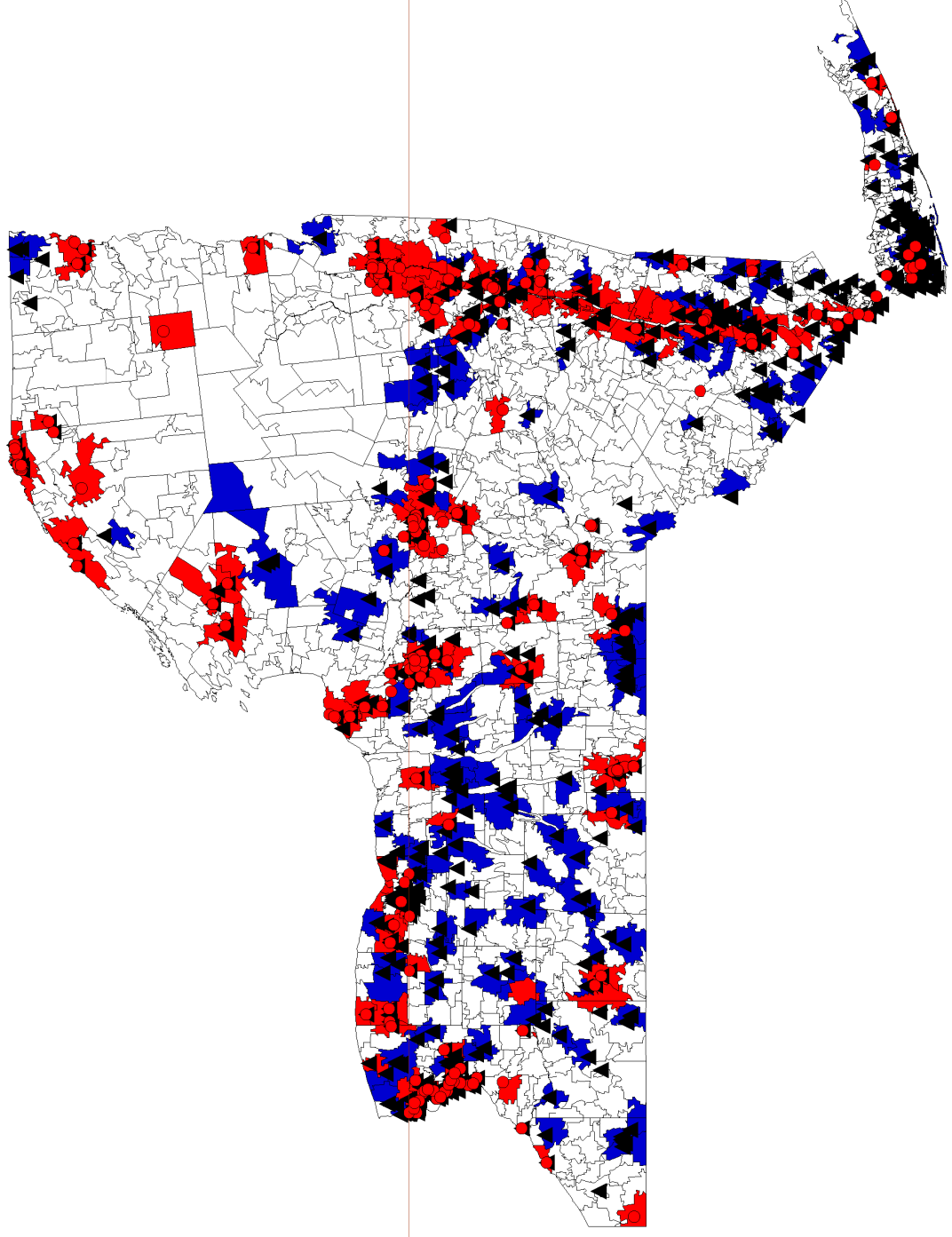
Respiratory Disease and Exposure to Environmental Contaminants

- David O. Carpenter, M.D.
- Institute for Health and the Environment
- University at Albany
- Rensselaer, NY 12144

Hypotheses

- Living near a hazardous waste site poses a risk of exposure to the chemicals contained therein.
- Exposure can be from ingestion, inhalation or dermal absorption.
- The major route of exposure from living near a hazardous waste site is likely to be inhalation, since ingestion patterns (i.e., consumption of contaminated fish) are not determined by where you live.
- Inhalation of organic pollutants, including persistent organic pollutants (POPs) such as PCBs, is likely to be more of a problem than metals, which are not very volatile.
- Exposure to POPs increases risk for several chronic diseases not usually considered to have an environmental origin.

Zip Codes Grouped by Exposure Status



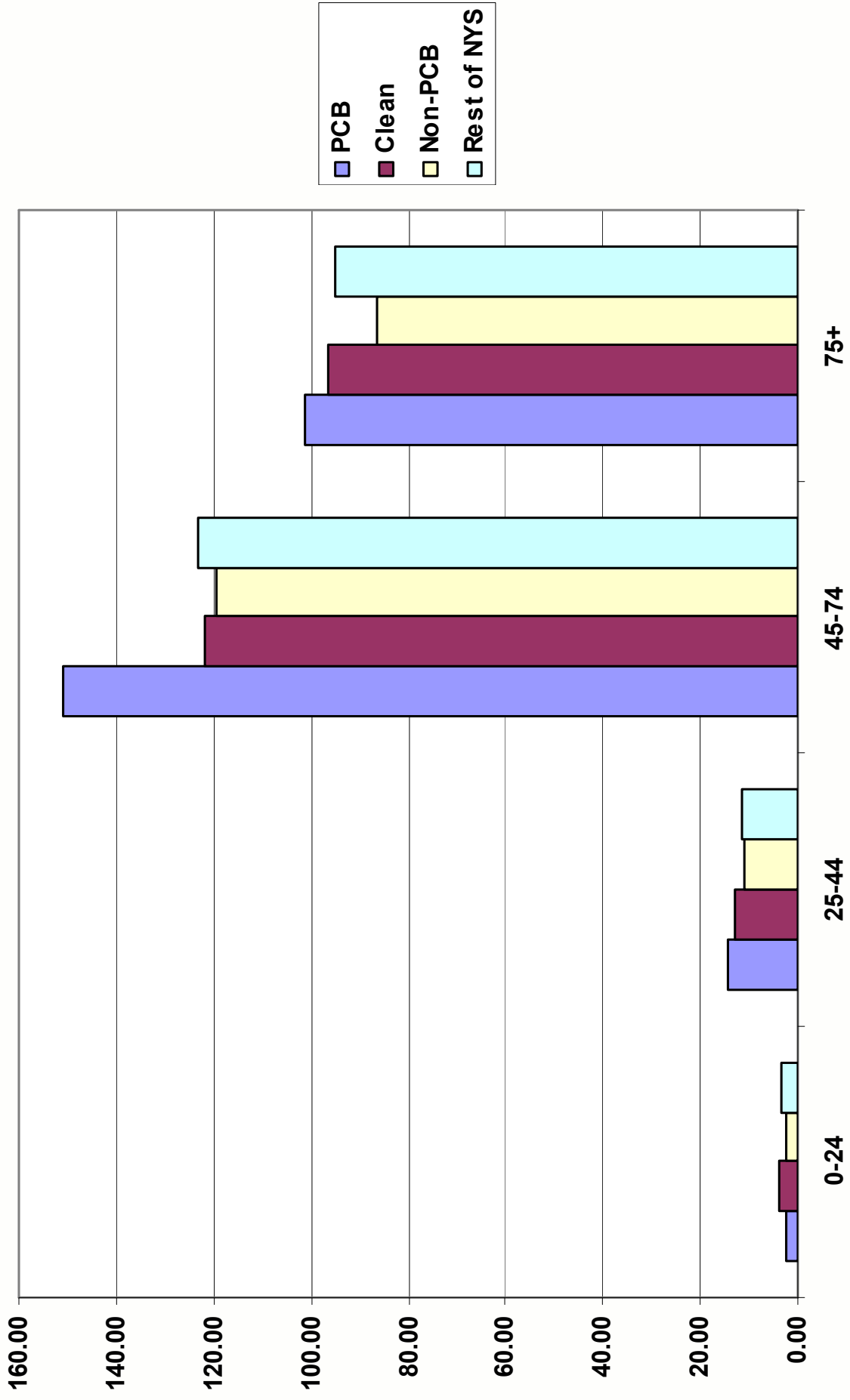
Health Data:

The NYSDOH records all diseases (up to 15) identified in every hospital inpatient by ICD-9 International Classification of Diseases. We used data for 1993-2000.

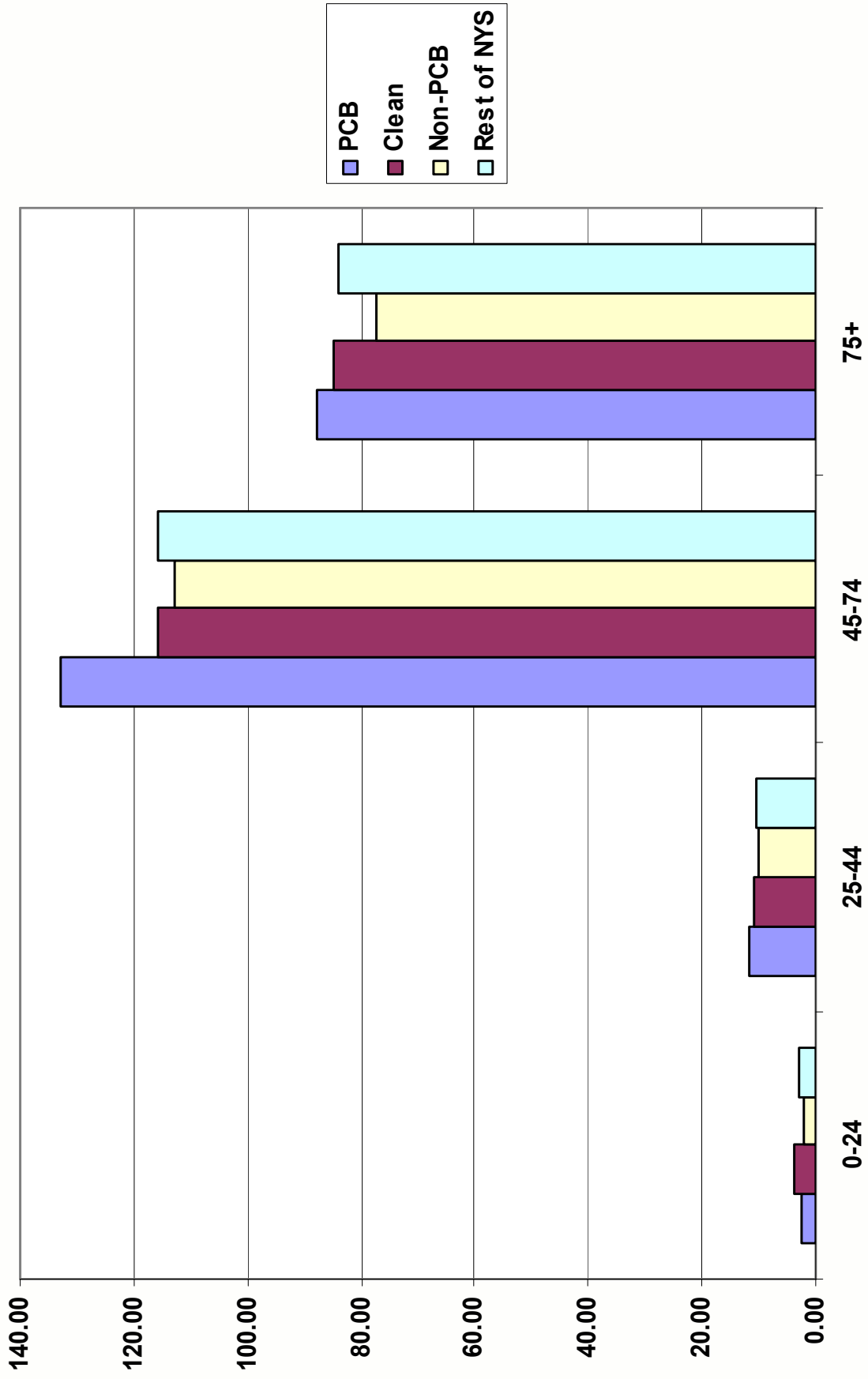
SES and Behavioral Data was Derived from Two Sources:

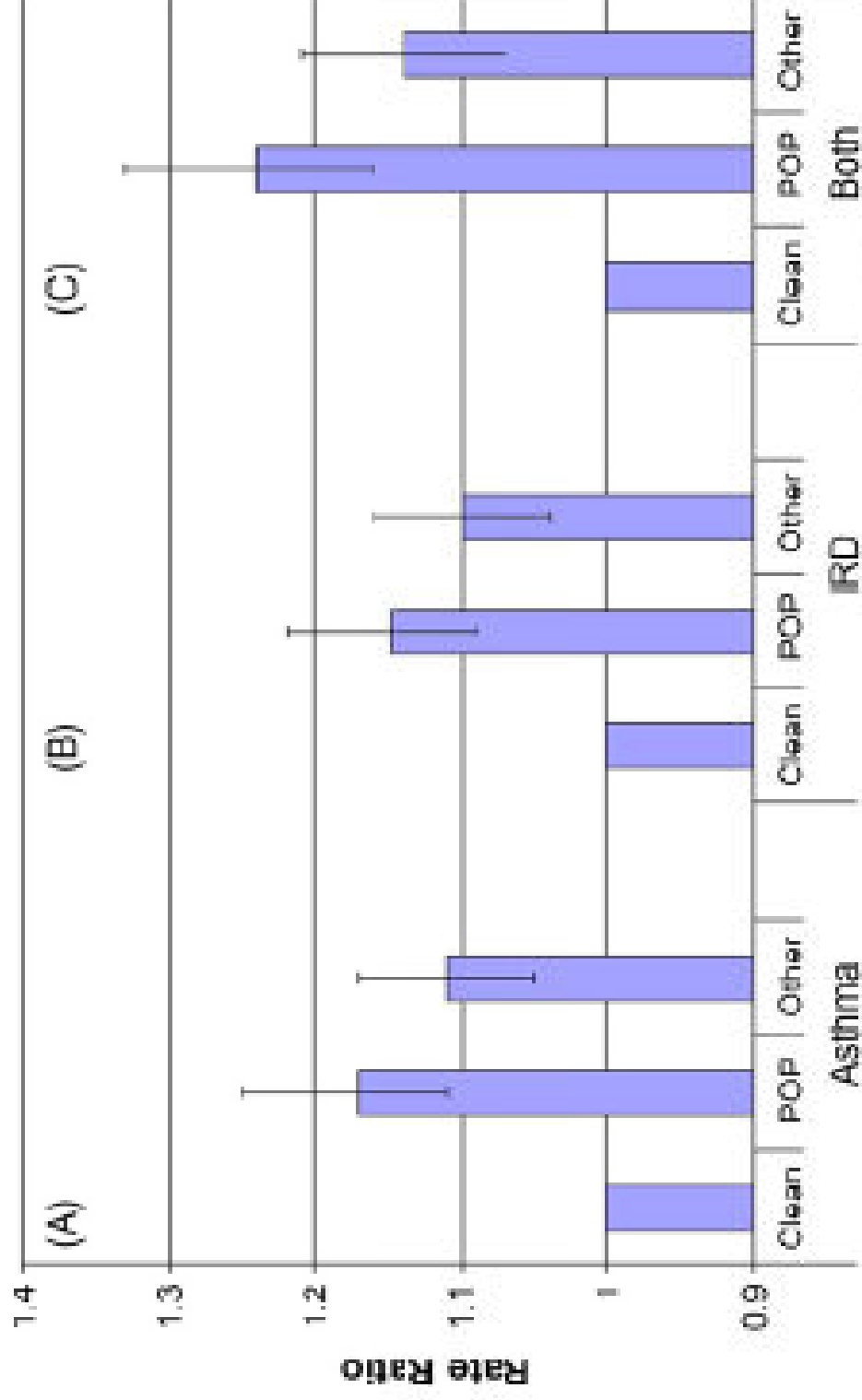
1. Average family income was obtained by zip code from the 1990 and 2000 US census.
2. Behavioral data currently available only at a county level, was obtained from the Behavioral Risk Factor Surveillance System of CDC and NYSDOH.

Chronic bronchitis, females



Chronic bronchitis, males





Hospital discharge rate ratios for asthma (A), infectious respiratory disease (IRD) (B) and both (C) in relation to residence in 'clean', 'POPs', and 'other' zip codes

Table 1 Rate ratio for hospitalization for asthma and infectious respiratory diseases in children

Parameter	Asthma	Asthma only	Infectious	Infectious only	Both
Clean	1.00				
POF	1.12*	1.12*	1.13*	1.11*	1.15*
Other	1.10*	1.09*	1.12*	1.11*	1.13*
IQ MHI	1.00				
2Q MHI	0.81*	0.82*	0.83*	0.84*	0.79*
2Q MHI	0.64*	0.68*	0.66*	0.71*	0.57*
4Q MHI	0.61*	0.68*	0.66*	0.72*	0.50*
Rural	1.00				
Urban	1.22*	1.28*	1.06	0.98	1.04
Caucasian	1.00				
African-American	2.45*	2.59*	1.71*	1.49*	2.26*
Males	1.00				
Female	0.60*	0.55*	0.76*	0.80*	0.67*
Age < 1	1.00				
Age = 1-2	1.11*	1.30*	0.32*	0.24*	0.92*
Age = 3-4	0.69*	0.89*	0.14*	0.10*	0.49*
Age = 5	0.55*	0.73*	0.11*	0.07*	0.36*
Age = 6	0.45*	0.63*	0.08*	0.06*	0.27*
Age = 7-9	0.36*	0.55*	0.05*	0.04*	0.18*

The rate ratio for hospitalization was split into the following groups: (1) asthma, (2) asthma without concurrent infectious respiratory disease (asthma only), (3) infectious respiratory disease, (4) infectious respiratory disease without concurrent asthma (infectious only) and (5) both asthma and infectious respiratory disease (both) and was in relation to residence in 'POPs', 'other' or 'lean' zip codes, quartiles (Q) of medium household income (MHI) from lowest to highest, urban/rural, race and age. For each category the reference group is indicated in bold. Values indicated by * are statistically significantly different from the reference at the 5% level.

Conclusions

- Simply living near to a hazardous waste site increases the risk of respiratory disease.
- Children are most vulnerable.
- Risk is greater around sites containing persistent organic pollutants.
- This suggests that the route of exposure is inhalation of these semivolatile compounds.

Health Concerns from 9/11

- Physical injury
- Psychological trauma
- Inhalation of dust
- Exposure to contaminants in dust

Contaminants of Concern

- Particulate air pollution – respiratory disease, asthma, low birth weight
- Lead – IQ deficits, behavioral changes, anemia
- Asbestos – asbestosis, lung cancer, mesothelioma
- PAHs – Cancer, respiratory disease, low birth weight, neurobehavioral effects
- Dioxins, furans, PCBs – IQ deficits, behavioral changes, cancer, diabetes, heart disease
- Volatile organic compounds – CNS changes, respiratory disease, cancer, anemia

What to Look for in Children Post 9/11

- Low birth weight.
- Asthma.
- Respiratory infections.
- Learning disabilities or disruptive behavior.
- Anemia.
- Regular health care to catch early cancer.

Hospitalization for Respiratory Disease Before and After 9/11

- Accessed SPARCS data for 1994-2004 by zip code.
- Calculated ORs for asthma (ICD-9 493), COPD (ICD-9 490-492, 494, 496) and acute respiratory diseases (ICD-9 460-466) after adjustment for gender, age and median household income.
- Compared working age persons (ages 20-54) to non-working population (ages <19-55+).

COPD:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	1.48 (1.19-1.85)	1.34 (1.19-1.51)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	1.24 (0.61-2.55)	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	1.46 (1.11-1.94)	1.26 (1.12-1.43)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	1.53 (1.15-2.04)	1.38 (1.19-1.62)
Brooklyn (10 zip codes)	1.49 (1.19-1.87)	1.42 (1.20-1.68)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	1.54 (1.06-2.250)	1.55 (1.22-1.96)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	1.42 (1.14-1.770)	1.30 (1.07-1.58)
Staten Island (12 zip codes)	1.70 (1.46-1.97)	1.48 (1.34-1.64)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	1.63 (1.33-2.00)	1.34 (1.14-1.57)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	1.76 (1.47-2.11)	1.60 (1.46-1.76)
All selected areas (44 zip codes)	1.56 (1.37-1.76)	1.41 (1.30-1.52)
Other NYC	1.40 (1.27-1.54)	1.35 (1.26-1.45)

Jan1999-Aug2001 vs. Jan1996-Dec1998

COPD:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	0.89 (0.71-1.12)	1.03 (0.91-1.16)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	1.28 (0.55-2.95)	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	0.93 (0.69-1.250)	1.03 (0.91-1.18)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	0.80 (0.59-1.07)	0.99 (0.85-1.17)
Brooklyn (10 zip codes)	0.84 (0.66-1.06)	1.17 (0.99-1.390)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	0.87 (0.59-1.28)	1.14 (0.89-1.45)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	0.81 (0.64-1.01)	1.20 (0.98-1.47)
Staten Island (12 zip codes)	1.07 (0.91-1.25)	1.01 (0.91-1.12)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	0.99 (0.80-1.23)	0.97 (0.83-1.14)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	1.16 (0.94-1.42)	1.06 (0.96-1.17)
All selected areas (44 zip codes)	0.93 (0.82-1.06)	1.06 (0.98-1.15)
Other NYC	1.01 (0.91-1.11)	1.09 (1.02-1.17)

COPD:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	0.97 (0.77-1.21)	1.09 (0.97-1.23)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	1.44 (0.60-3.44)	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	0.87 (0.65-1.16)	1.02 (0.89-1.16)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	0.98 (0.74-1.31)	1.13 (0.97-1.33)
Brooklyn (10 zip codes)	1.02 (0.81-1.28)	1.03 (0.87-1.23)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	0.91 (0.62-1.33)	0.87 (0.68-1.11)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	1.15 (0.92-1.44)	1.24 (1.01-1.53)
Staten Island (12 zip codes)	1.10 (0.94-1.30)	1.18 (1.06-1.31)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	1.27 (1.02-1.59)	1.16 (0.98-1.36)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	0.93 (0.76-1.15)	1.20 (1.09-1.33)
All selected areas (44 zip codes)	1.02 (0.90-1.16)	1.10 (1.02-1.20)
Other NYC	1.13 (1.03-1.25)	1.13 (1.05-1.22)

Acute Respiratory Diseases:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	1.38 (1.10-1.72)	1.20 (1.04-1.38)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	-	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	1.31 (0.96-1.79)	1.17 (0.98-1.39)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	1.41 (1.04-1.90)	1.25 (1.02-1.52)
Brooklyn (10 zip codes)	1.19 (0.91-1.56)	1.34 (1.07-1.68)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	1.26 (0.82-1.93)	1.55 (1.09-2.21)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	1.10 (0.85-1.41)	1.12 (0.93-1.34)
Staten Island (12 zip codes)	1.28 (1.06-1.55)	1.33 (1.20-1.48)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	1.23 (0.98-1.55)	1.24 (1.10-1.41)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	-	1.45 (1.24-1.69)
All selected areas (44 zip codes)	1.28 (1.10-1.48)	1.31 (1.18-1.45)
Other NYC	1.19 (1.07-1.31)	1.30 (1.23-1.37)

Acute Respiratory Diseases:

	Working population (20-54 years)	Working population (20-54 years)
Manhattan (22 zip codes)	0.76 (0.61-0.96)	0.97 (0.84-1.12)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	-	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	0.71 (0.52-0.97)	1.09 (0.90-1.31)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	0.81 (0.60-1.10)	0.86 (0.71-1.06)
Brooklyn (10 zip codes)	1.13 (0.86-1.48)	1.36 (1.08-1.72)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	1.32 (0.85-2.04)	1.61 (1.12-2.32)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	0.95 (0.74-1.22)	1.12 (0.92-1.35)
Staten Island (12 zip codes)	0.93 (0.77-1.13)	0.95 (0.85-1.06)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	0.91 (0.72-1.16)	0.93 (0.82-1.06)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	-	0.97 (0.82-1.14)
All selected areas (44 zip codes)	0.93 (0.80-1.08)	1.08 (0.98-1.20)
Other NYC	0.94 (0.85-1.04)	1.04 (0.99-1.10)

Acute Respiratory Diseases:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	0.78 (0.63-0.96)	1.00 (0.87-1.16)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	-	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	0.78 (0.59-1.03)	0.90 (0.75-1.08)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	0.72 (0.54-0.96)	1.11 (0.91-1.35)
Brooklyn (10 zip codes)	0.81 (0.61-1.06)	0.67 (0.53-0.85)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	0.72 (0.47-1.12)	0.60 (0.42-0.86)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	0.90 (0.71-1.15)	0.73 (0.61-0.87)
Staten Island (12 zip codes)	0.91 (0.75-1.09)	1.02 (0.91-1.13)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	0.92 (0.74-1.16)	1.03 (0.90-1.17)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	-	1.02 (0.86-1.20)
All selected areas (44 zip codes)	0.82 (0.71-0.95)	0.88 (0.79-0.98)
Other NYC	0.95 (0.86-1.05)	0.93 (0.88-0.99)

Asthma:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	1.66 (1.23-2.24)	1.61 (1.38-1.88)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	1.60 (0.91-2.81)	2.11 (1.21-3.70)
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	1.61 (1.09-2.36)	1.61 (1.28-2.02)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	1.69 (1.33-2.16)	1.58 (1.37-1.83)
Brooklyn (10 zip codes)	1.46 (1.13-1.90)	1.48 (1.18-1.87)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	1.59 (1.07-2.37)	1.54 (1.05-2.25)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	1.33 (1.14-1.55)	1.43 (1.20-1.70)
Staten Island (12 zip codes)	1.61 (1.39-1.87)	1.53 (1.34-1.76)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	1.57 (1.35-1.83)	1.51 (1.28-1.77)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	1.63 (1.37-1.95)	1.56 (1.28-1.89)
All selected areas (44 zip codes)	1.59 (1.33-1.91)	1.54 (1.38-1.73)
Other NYC	1.57 (1.44-1.71)	1.50 (1.41-1.60)

Asthma:

	Working population (20-54 years)	Working population (20-54 years)
Manhattan (22 zip codes)	1.18 (0.89-1.56)	1.13 (0.97-1.32)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	1.18 (0.73-1.92)	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	1.16 (0.80-1.66)	1.38 (1.16-1.65)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	1.14 (0.88-1.48)	1.02 (0.88-1.19)
Brooklyn (10 zip codes)	1.48 (1.16-1.88)	1.36 (1.07-1.72)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	1.47 (1.01-2.16)	1.57 (1.09-2.26)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	1.46 (1.25-1.69)	1.17 (0.93-1.47)
Staten Island (12 zip codes)	1.23 (1.09-1.39)	1.07 (0.94-1.22)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	1.23 (1.05-1.43)	0.95 (0.82-1.11)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	-	1.21 (1.01-1.45)
All selected areas (44 zip codes)	1.27 (1.07-1.50)	1.18 (1.05-1.32)
Other NYC	1.18 (1.08-1.29)	1.04 (0.97-1.11)

Asthma:

	Working population (20-54 years)	Non-Working population (<19 and 55+ years)
Manhattan (22 zip codes)	1.20 (0.94-1.53)	1.07 (0.93-1.23)
Lower Manhattan (10004, 10005, 10006, 10007, 10038, 10280)	1.26 (0.78-2.06)	-
Union Square-Lower East Side (10002, 10003, 10009) Greenwich Village – Soho (10012, 10013, 10014)	1.03 (0.75-1.42)	0.86 (0.73-1.01)
Gramercy Park – Murray Hill (10010, 10016, 10017, 10022) Chelsea – Clinton (10001, 10011, 10018, 10019, 10020, 10036)	1.18 (0.89-1.55)	1.26 (1.07-1.48)
Brooklyn (10 zip codes)	0.89 (0.70-1.14)	0.79 (0.62-1.00)
Greenpoint (11211, 11222) Williamsburg – Bushwick (11206, 11221, 11237)	0.82 (0.54-1.25)	0.70 (0.48-1.02)
Downtown – Heights – Slope (11201, 11205, 11215, 11217, 11231)	0.96 (0.80-1.16)	0.89 (0.74-1.06)
Staten Island (12 zip codes)	1.40 (1.24-1.58)	1.41 (1.24-1.60)
Port Richmond (10302, 10303, 10310) Stapleton – St. George (10301, 10304, 10305) Willewbrook (10314)	1.47 (1.28-1.70)	1.41 (1.20-1.65)
South Beach – Tottenville (10306, 10307, 10308, 10309, 10312)	1.28 (1.12-1.47)	1.41 (1.18-1.69)
All selected areas (44 zip codes)	1.16 (0.98-1.36)	1.05 (0.94-1.17)
Other NYC	1.09 (0.00-1.20)	1.04 (0.98-1.11)

Limitations

- We only record hospitalizations, not outpatient or physician visits.
- We cannot distinguish multiple hospitalizations by one person from hospitalizations of different persons.
- We cannot account for persons moving.
- We know only zip code of residence, not of school or employment.

Conclusions

- In spite of these limitations we see a striking pattern of increased respiratory disease after 9/11.
- Respiratory disease hospitalization is increased in all of NYC, not just lower Manhattan.
- There is no clear difference between hospitalization rates in working and non-working populations, which includes children.

Summary

- These preliminary observations suggest that the respiratory health of the residents of all of New York City has been more adversely altered than usually appreciated.