

# Air Pollution and Health

What is needed for more health impact studies in India

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# Human Health

Clean Air

Safe Food

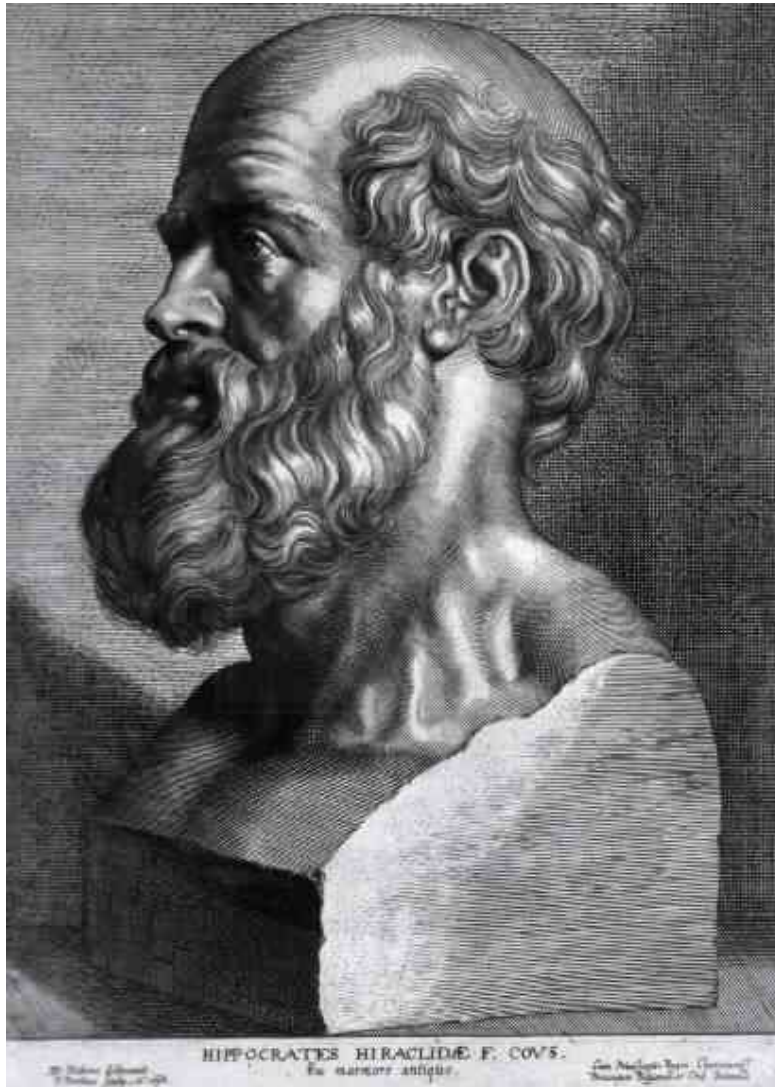
Safe Water

Adequate Housing

Safe Working Places

Safe Streets

# Environmental Health



Air, Water and  
Places

Hippocrates  
(460 - 370 BC)

# Adverse Effects of Air Pollution

## London Smog

- Acute Respiratory Infections
- Chronic Respiratory Diseases
- Cardiovascular Diseases
- Low Birth Weight
- Cataract

# Are Health Effects of Air Pollution Similar in Developing World?

- Socio-economic conditions – poor nutrition
- Demographics- younger
- Climates - tropical
- Air pollutants- level/ mixtures/ fuels

# Air Pollution and Morbidity

Mandi Gobindgarh Study

# Study Design

- Cross Sectional Survey: 1999-2001
  - Mandi Gobindgarh & Morinda
- Air Quality Monitoring: Twice a Week
  - High Volume Sampler: SPM, NO<sub>x</sub>, SO<sub>2</sub>
- Sample Household Survey: 4000 Adults
  - Socio-demographics, Symptoms, Height, Weight, BP, Spirometry, ECG

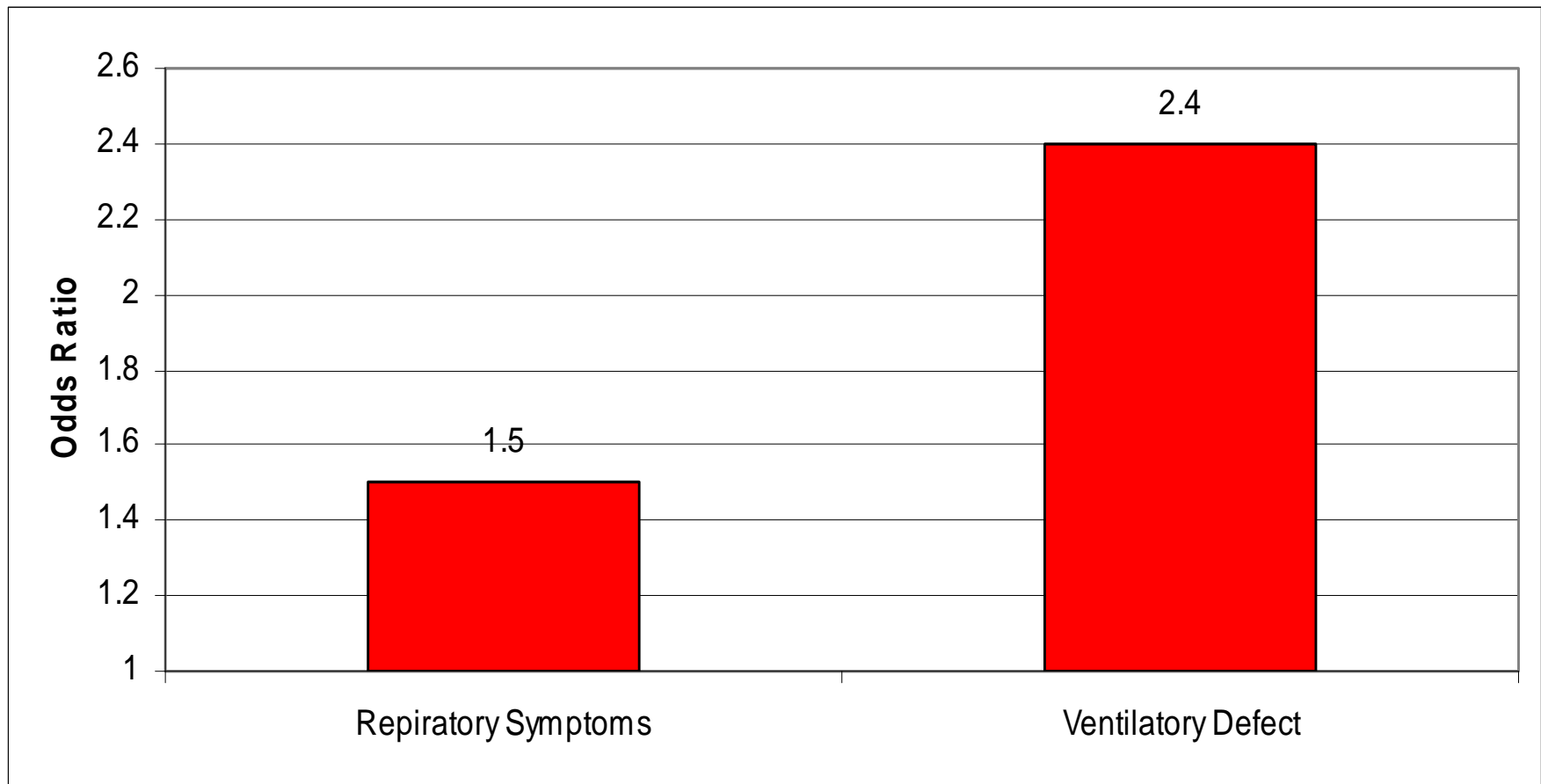
# Ambient Air Quality

Microgram/ cubic meter	Mandi Gobindgarh	Morinda
SPM	890.3	291.3
NOx	27.4	7.4
SO2	29.6	8.9



# Air Pollution Risk

## Mandi Gobindgarh



Logistic Regression- Adjusted for age, sex, social economic status, smoking, kitchen fuel

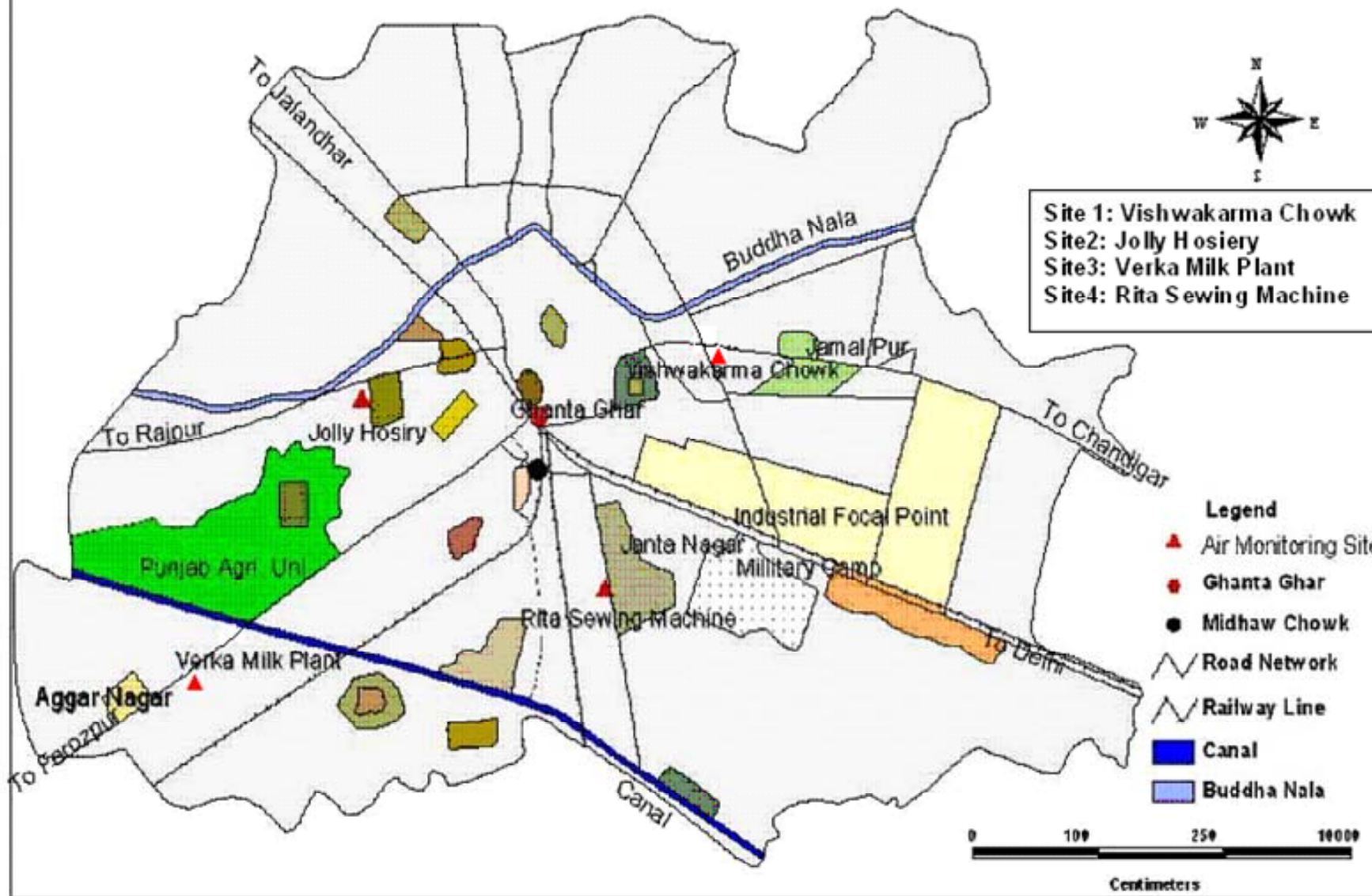
# Air Pollution and Mortality

## Ludhiana Study

# Study Design

- Time Series- 2002, 2003, 2004
- Air Quality- RSPM, NO<sub>x</sub>, SO<sub>2</sub>
- Meteorological- Temp. Humidity, Visibility
- Mortality- Age, Sex, Address, Cause
- Relationship of RSPM/ Visibility with mortality with after taking into account the effect of temperature & humidity

# Map of Ludhiana City



# Air Quality Monitoring Days

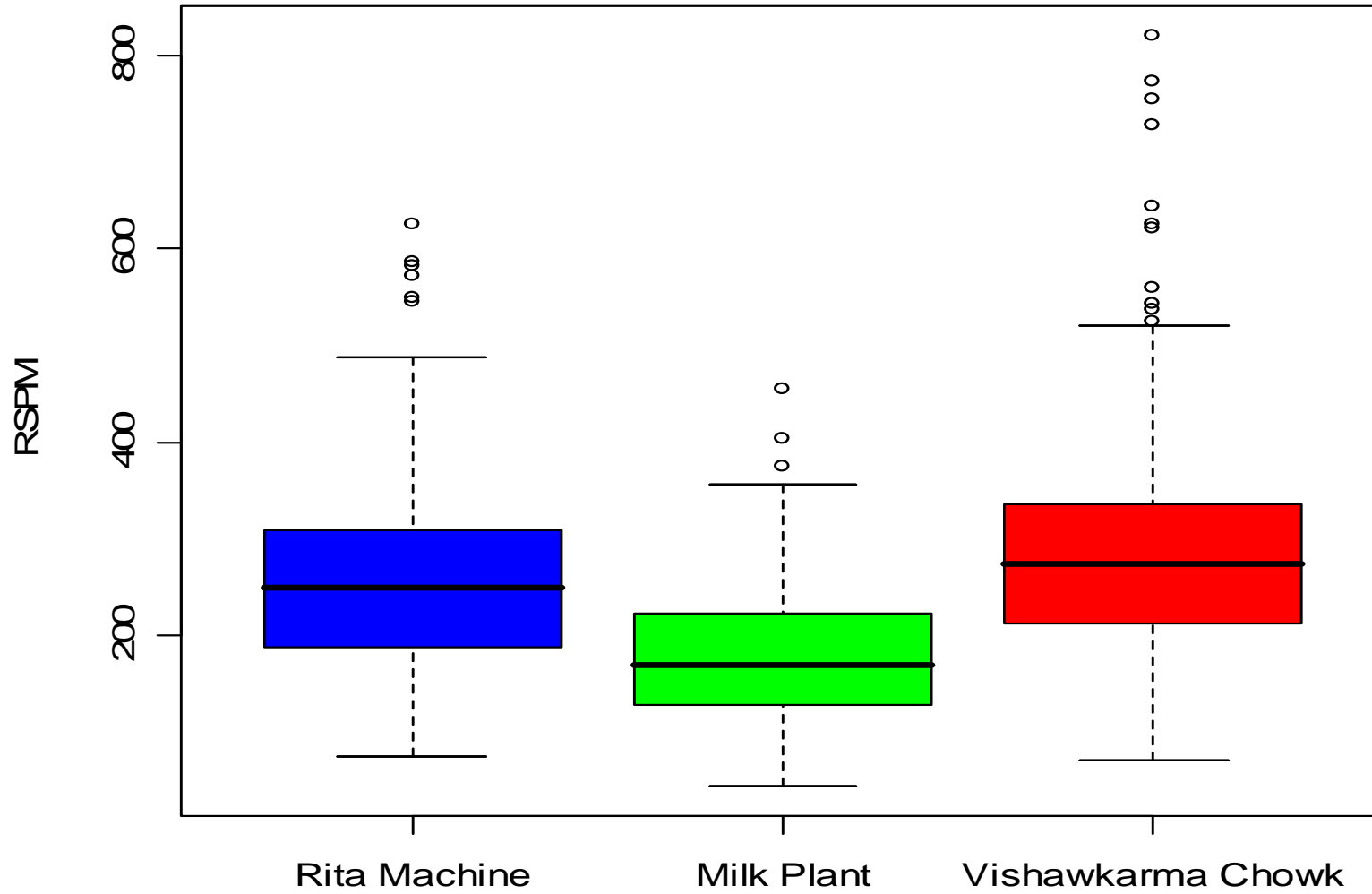
Site	Site Name	2002	2003	2004	Overall
Site 1	Vishawkarma Chowk	114	88	138	448
Site 2	Jolly Hosiery	103	73*	0*	176
Site 3	Verka Milk Plant	126	86	119	331
Site 4	Rita Sewing Machine	128	104	100	332

\* Monitoring stopped in middle of 2003

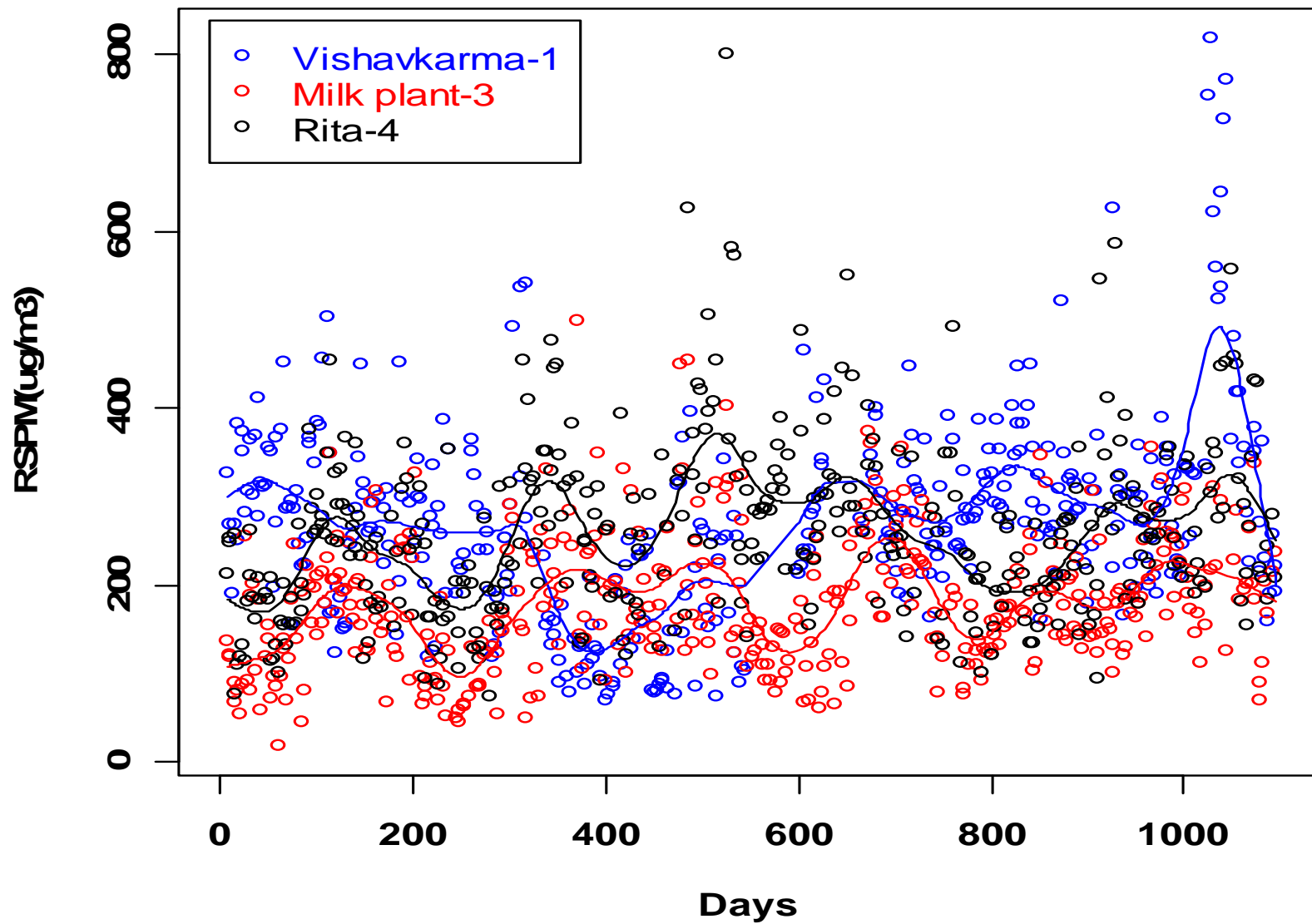
# Air Quality Monitoring

Site	Type	Days of monitoring						
		Mon	Tue	Wed	Thurs	Fri	Sat	Sun
Site 1	Commercial	X	√	X	√	X	√	X
Site 2	Commercial	X	√	X	√	X	√	X
Site 3	Residential	√	X	√	X	√	X	X
Site 4	Industrial	√	X	√	X	√	X	X

**Box Plot for RSPM (All Sites), 2002-04**

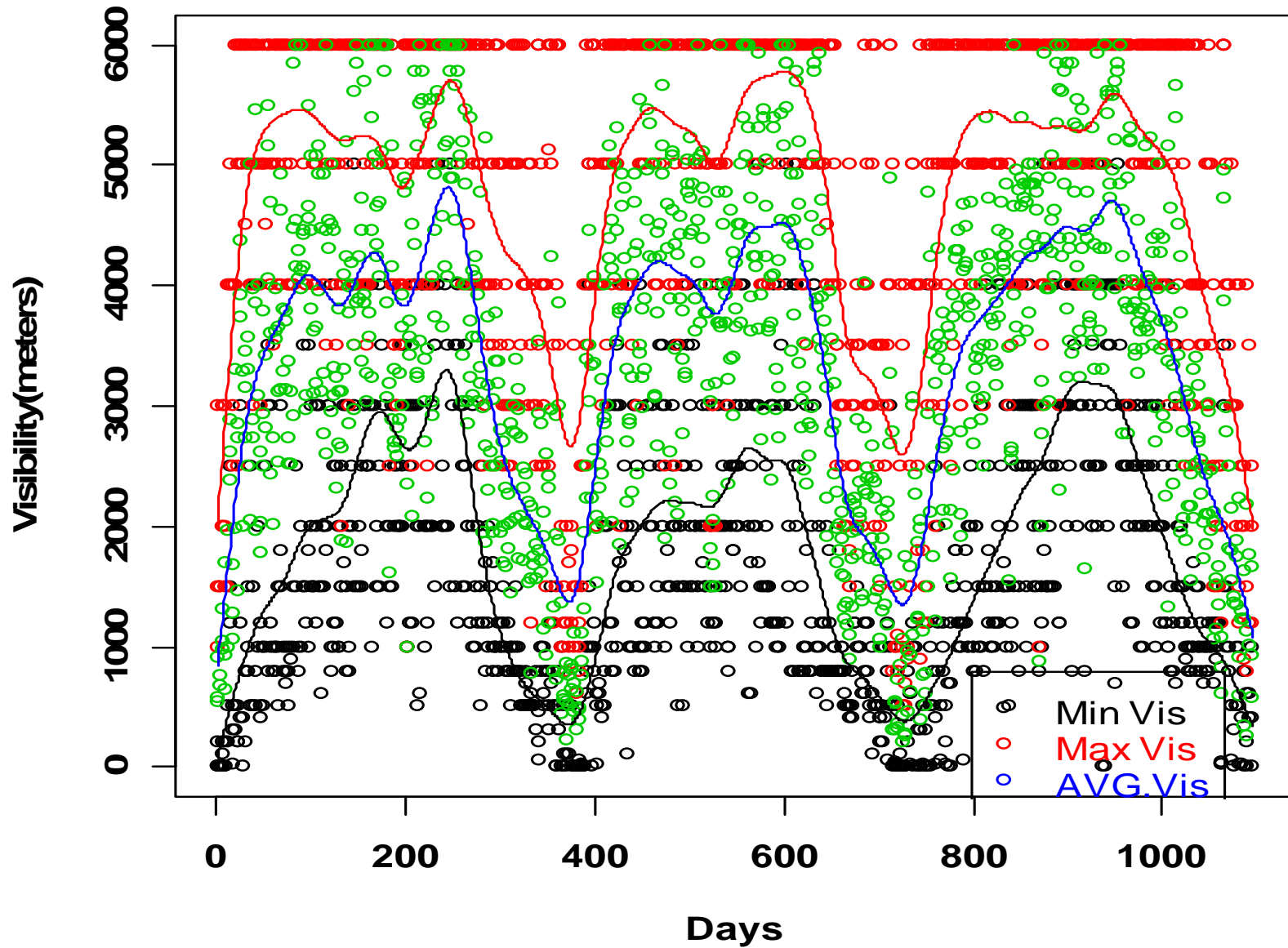


**Sitewise Plot of RSPM(2002-04),df=20**

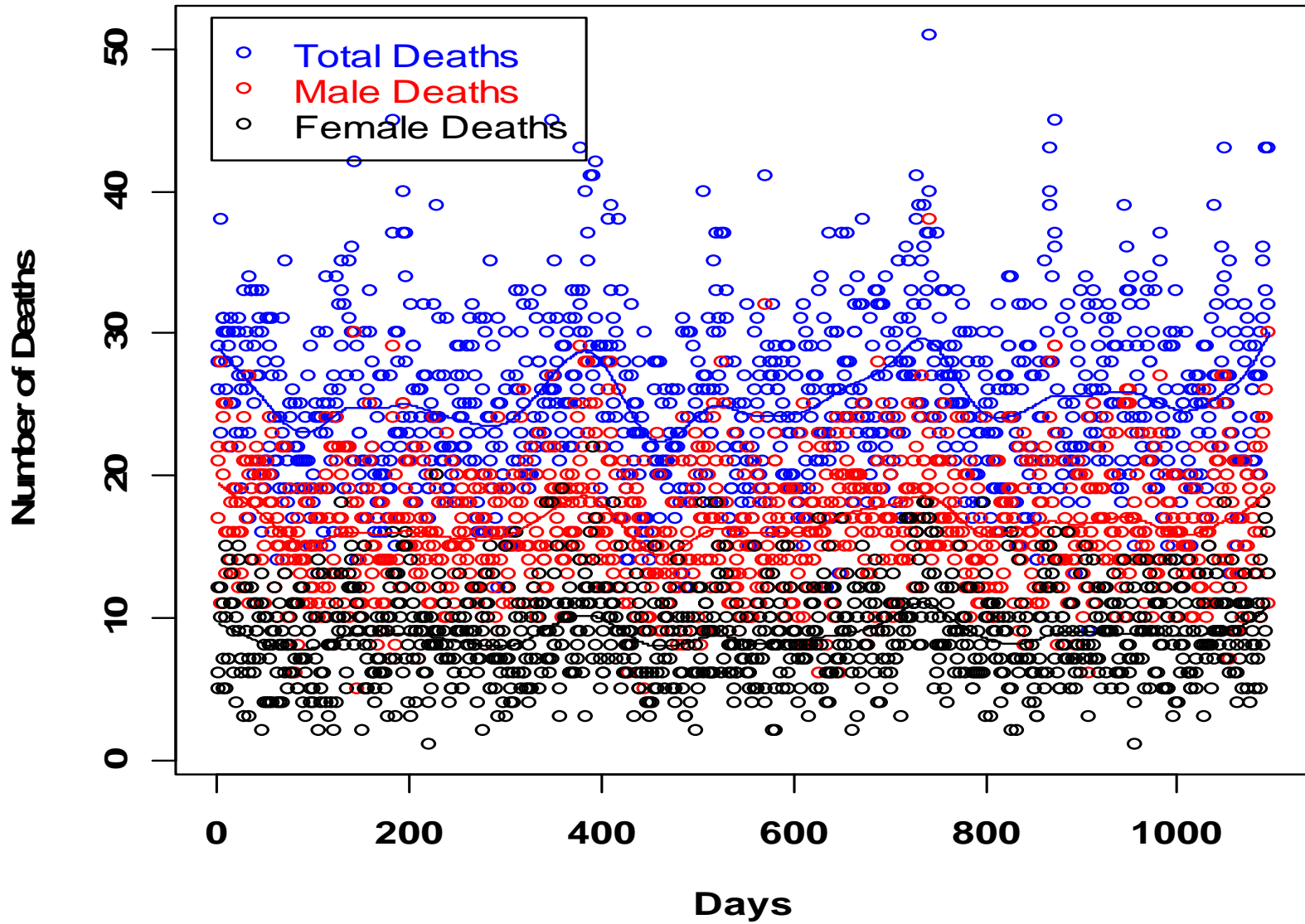




### Smooth Plot of Visibility,df=20



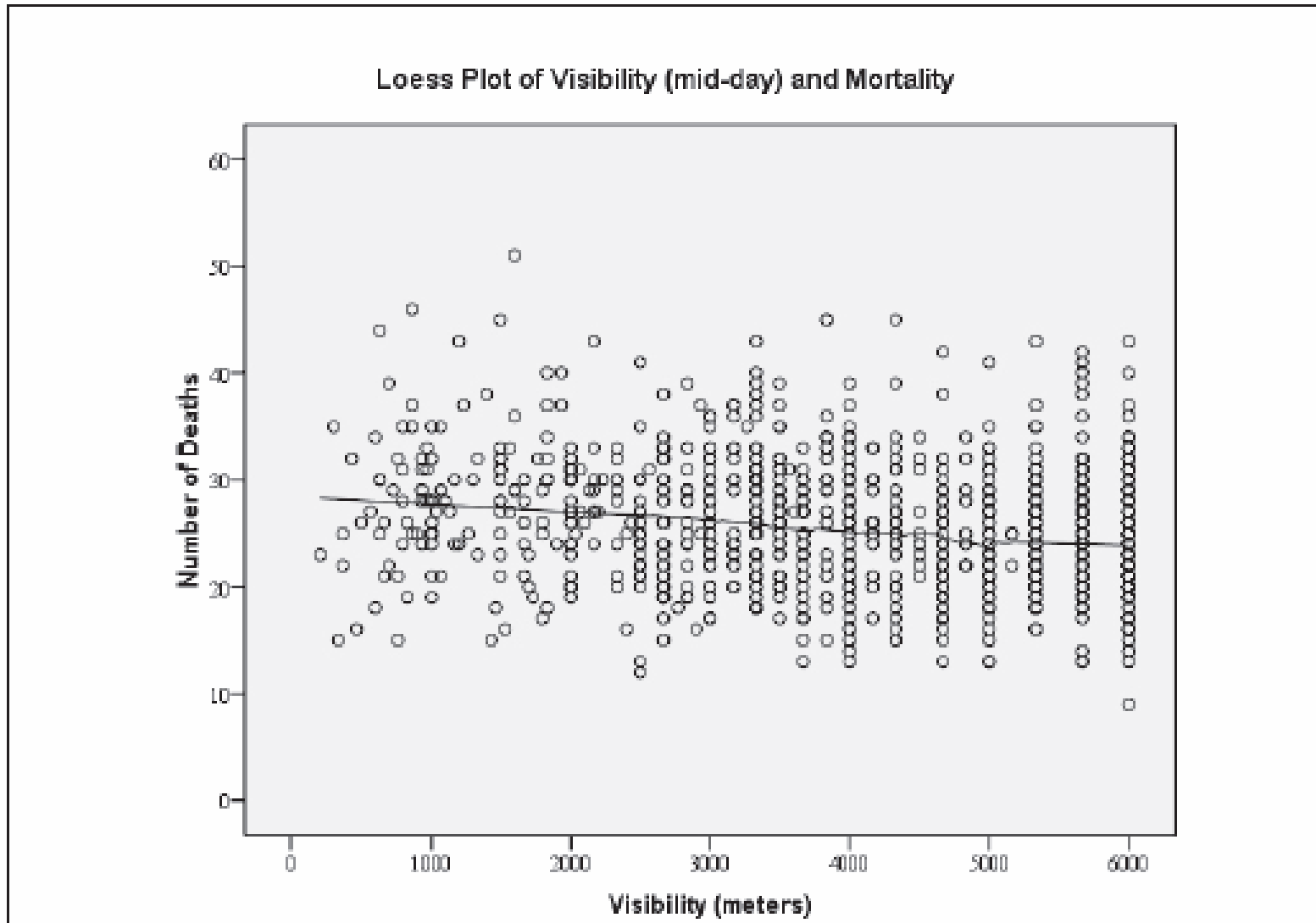
# Daily number of deaths(2002-04),df=20



# Association of RSPM/ Visibility with Mortality

- Time Series:
  - RSPM, Visibility, Temperature, Humidity, Deaths
- Generalized Additive Model (GAM) with Natural Spline Smoother (3-6 degree of freedom)
- Quasi Poisson Function- Daily Mortality and RSPM/Visibility adjusted for the effect of temperature & humidity

# Air Quality & Mortality



# Association of Air Quality with Mortality

- Visibility (proxy for air pollution)
  - 2.4% rise in mortality for every 1000 meter decrease in visibility ( $p < 0.001$ )

# Conclusion

Air pollution adversely affects human health in subtropical climatic conditions of northern India

# Limitations

- Air Quality of City
  - RSPM rather than PM2.5
  - large number of missing days
  - Lack of log books for quality assessment
  - Semi quantitative visibility measurement
- Death Registration
  - lack of computerization of data
  - incomplete death recording
  - cause of death data not available

# The Way Forward

- Better exposure monitoring techniques
- Regular monitoring for all criteria pollutants
- Health effects of persistent pollutants and emerging pollutants
- Effects of vulnerable populations
- Long term epidemiological & toxicological studies



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