G.C.Khilnani
MD, FCCP (USA), MNAMS, FICP,FNCCP
Professor of Medicine and
Chest Physician
All India Institute of Medical Sciences
New-Delhi-110029

National Environmental Health profile and Comparative Health Risk Assessment- Area of Study (Delhi)

Funded by

W.H.O, India

&

Ministry of Environment and Forests,

Government of India

BACKGROUND

- Adverse effects of air pollution have been a cause of concern.
- In studies done so far people with pre-existing cardiopulmonary diseases were most severely affected.
- There is immense public awareness and concern regarding adverse health effects and socioeconomic implications of air pollution.
- While Western world, despite being more industrialized, has been able to contain the problem of air pollution to some extent, the problem in developing countries like India seems to be increasing.

BACKGROUND

- Long term effects of air pollution need to be investigated using epidemiological tools.
- Major sources of air pollution are vehicular exhaust fumes, burning of fossil fuels and industrial waste of many kinds.
- Delhi the capital city of India has the distinction of being one of the ten most polluted cities in the world which is not unexpected as the number of vehicles in Delhi out number the total number of vehicles in Mumbai, Kolkata and Chennai.
- All the workers agree that there is excess morbidity and mortality in patients with pre-existing asthma, chronic obstructive airways disease and ischaemic heart disease. There is compound effect of many air pollutants.
- Presently there are three main sources of air pollution; viz. vehicular exhaust fumes, industrial wastes and combustion of fuels in the house holds.

Objectives

- Environmental epidemiological studies of the city/area with specific reference to:

- -To obtain available environmental monitoring data for air and water.
- -To sample air and water for analyses of compounds for which routine monitoring data is not available.
- -To collect information on actual human exposures for certain pollutants including lead, benzene etc.
- -To collect information on incidence and prevalence rates for specific health end points such as respiratory ailments, infectious diseases, cardiovascular diseases and cancer.
- -To estimate the number and severity of health damage for all the identified pollutants based on dose-response information for the particular compound.

Objectives

- -To develop a summary judgment about the magnitude of health risks posed by each pollutant based on quality, completeness and biases of the underlying data.
- -To estimate the economic costs of health damage for each category of pollutants.
- -To collect information on community perceptions about environmental pollution and health risks.
- -To obtain socioeconomic information about the resident population in the ozone through administration of house hold surveys.

Objectives

-To compare the health and economic risks associated with each environmental problem and rank them accordingly.

- -To provide the framework for the design of an environmental management plan for the area based on the health risk assessment, the economic costs and community perceptions.
- -To strengthen institutional capacity for CRA analyses through administration of training.
- - Estimation of total burden of diseases.
- -Development of environmental health indicator.

Objectives

- -Evolve possible intervention measures.
- -Development of possible policy measures/ action for Driving Force, Pressure, State, Exposure, Effect and Action for their implementation.

The environmental parameters would be assessed in collaboration of the State Pollution Control Board.

This was a joint project which was implemented by us in association with central Pollution Control Board (CPCB) Delhi.

Expected out come

1. A National Health Profile will be prepared for the first time to have a database for the country.
2. Trend of environmental related health degradation would be known and better understood.
3. Appropriate pollution prevention for the protection of environment and health would be addressed.
4. Economic evaluation of the environmental pollution could be worked out.

Areas of Case Study

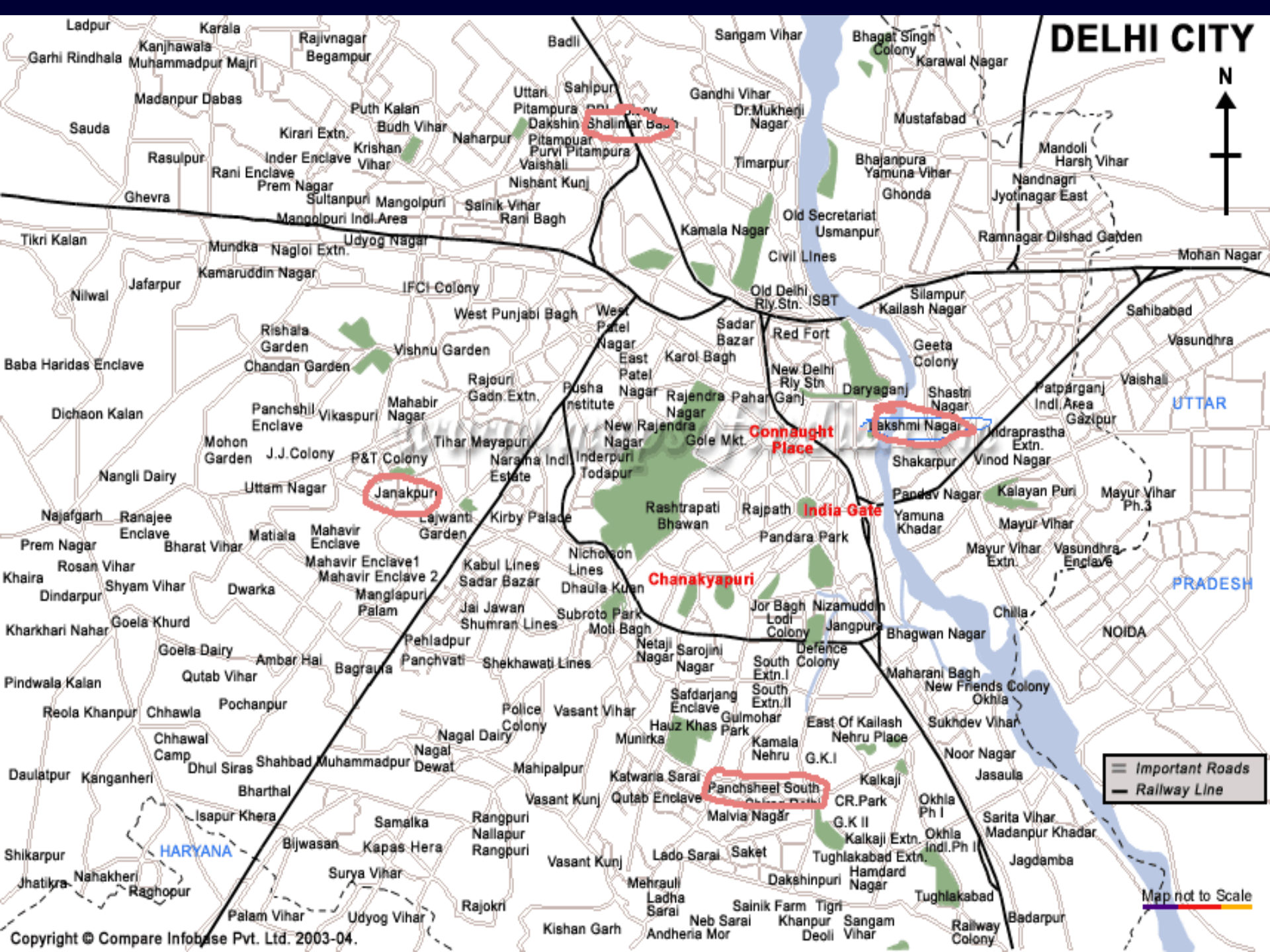
Several field visits were made to identify suitable areas of study along with Central Pollution Control Board team and four areas were selected for study.

- Ramesh Park (Laxmi nagar) East Delhi
- Chanakya place (Janakpuri) West Delhi
- Bharat nagar (Ashok vihar) North Delhi
- ShahpurJaat (Asiad village) South Delhi

Number of subject studied

1.	Janakpuri	West Delhi	1111
2.	Laxmi Nagar	East Delhi	1109
3.	Shah Pur Jatt	South Delhi	1103
4.	Bharat Nagar	North Delhi	1255

Mean Age 27- 83$\pm$ 18.3


DELHI CITY
N
Ladpur
Karala
Rajivnagar
Kanjhawala
Garhi Rindhala
Muhammadpur Majri
Begampur
Badli
Sangam Vihar
Bhagat Singh Colony
Karawal Nagar
Madanpur Dabas
Uttari Pitampura
Sahipur
Gandhi Vihar
Puth Kalan
Dr.Mukherji Nagar
Sauda
Budh Vihar
Kirari Extn.
Naharpur
Dakshin Pitampuar
Mustafabad
Krishan Vihar
Purvi Pitampura
Mandoli
Rasulpur
Inder Enclave
Vaishali
Timarpur
Harsh Vihar
Rani Enclave
Bhajanpura Yamuna Vihar
Prem Nagar
Nishant Kunj
Nandnagri
Ghevra
Sultanpur
Mangolpuri
Ghonda
Jyotinagar East
Mangolpuri Indl.Area
Sainik Vihar
Rani Bagh
Old Secretariat
Kamala Nagar
Usmanpur
Tikri Kalan
Udyog Nagar
Ramnagar Dilshad Garden
Mundka
Nagloi Extn.
Civil Lines
Mohan Nagar
Kamaruddin Nagar
Jafarpur
IFCI Colony
Old Delhi Rly.Stn.
ISBT
Silampur
Nilwal
West Punjabi Bagh
Kailash Nagar
Sahibabad
Sadar Bazar
Red Fort
Rishala Garden
West Patel Nagar
Vasundhra
Vishnu Garden
Karol Bagh
Geeta Colony
Baba Haridas Enclave
Chandan Garden
East Patel Nagar
New Delhi Rly Stn
Rajouri Gadn.Extn.
Daryaganj
Shastri Nagar
Vaishali
Pusha Institute
Rajendra Nagar
Pahar Ganj
Patparganj Indl.Area
Dichaon Kalan
Panchshil Enclave
Vikaspuri
Mahabir Nagar
Gazipur
UTTAR
Laxmi Nagar
New Rajendra Nagar
Connaught Place
Indraprastha Extn.
Mohon Garden
Tihar Mayapuri
Gole Mkt.
Shakarpur
J.J.Colony
P&T Colony
Narsina Indl Estate
Inderpuri
Todapur
Vinod Nagar
Nangli Dairy
Janakpuri
Uttam Nagar
Pandav Nagar
Kalayan Puri
Mayur Vihar Ph.3
Najafgarh
Ranajee Enclave
Lajwanti Garden
Kirby Palace
Rashtrapati Bhawan
Rajpath
India Gate
Yamuna Khadar
Matiala
Mahavir Enclave
Mayur Vihar
Prem Nagar
Bharat Vihar
Pandara Park
Mayur Vihar Extn.
Vasundhra Enclave
Mahavir Enclave1
Nicholson Lines
Rosan Vihar
Kabul Lines
Khaira
Mahavir Enclave 2
Chanakyapuri
PRADESH
Shyam Vihar
Sadar Bazar
Dwarka
Dhaula Kuan
Dindarpur
Manglapuri
Palam
Jor Bagh
Nizamuddin
Chilla
Jai Jawan
Lodi Colony
Jangpura
Goela Khurd
Shumran Lines
Subroto Park
Kharkhari Nahar
Moti Bagh
Bhagwan Nagar
NOIDA
Pehladpur
Netaji Nagar
Sarojini Nagar
Defence Colony
Goela Dairy
Panchvati
Ambar Hai
Shekhawati Lines
South Extn.I
Maharani Bagh
Bagrauna
Qutab Vihar
New Friends Colony
Pindwala Kalan
Safdarjang Enclave
South Extn.II
Okhla
Pochanpur
Police Colony
Vasant Vihar
Gulmohar Park
Sukhdev Vihar
Reola Khanpur
Chhawla
Hauz Khas
East Of Kailash
Nehru Place
Nagal Dairy
Munirka
Chhawal Camp
Kamala Nehru
Noor Nagar
Nagal Dewat
Dhul Siras
Shahbad Muhammadpur
G.K.I
Jasaula
Daulatpur
Kanganheri
Mahipalpur
Katwaria Sarai
Kalkaji
Bharthal
Panchsheel South
Vasant Kunj
Qutab Enclave
CR.Park
Okhla Ph I
Malvia Nagar
Isapur Khera
Rangpuri Nallapur
G.K II
Sarita Vihar
Samalka
Kalkaji Extn.
Okhla Indl.Ph II
Madanpur Khadar
HARYANA
Bijwasan
Kapas Hera
Rangpuri
Shikarpur
Vasant Kunj
Lado Sarai
Saket
Tughlakabad Extn.
Jagdamba
Surya Vihar
Jhatikra
Nahakheri
Mehrauli
Dakshinpuri
Hamdard Nagar
Raghopur
Ladha Sarai
Tughlakabad
Rajokri
Sainik Farm
Tigri
Palam Vihar
Udyog Vihar
Neb Sarai
Khanpur
Sangam Vihar
Badarpur
Kishan Garh
Andheria Mor
Deoli
Railway Colony
Important Roads
Railway Line
Map not to Scale
Copyright © Compare Infobase Pvt. Ltd. 2003-04.

Janakpuri monitoring station

Bharat nagar


गली नं. 12
आई-ब्लॉक (एक्स.)
लक्ष्मी नगर
I-164-170,110,67-A,67,24,23.
I-162-154,115,114,113,112
2005 12 20


Continuous Ambient Air Quality Monitoring Station
Sirifort (Shahpur Jat)
Central Pollution Control Board
Ministry of Environment & Forest
Government of India
cpcb
2005 12 20

Questionnaire Schedule

- GENERAL INFORMATION
- 1. House (Unique) ID: □□□□□□□
- 2. Name of the Respondent:
- 3. Address: House Number:
  Street Name: Locality Name:
  Town/Village: PIN Code:
- 4. Distance from nearest air quality monitoring station (in K. M.) (to be filled by staff)

Questionnaire Schedule

- 1.Total Family Income (per month in Rs.):
- 2. Total Family Members:
- 3. Housing Details:
- 3.1 Type of Locality: 1=Slums,2=Low Income Settlement, 3=High Income Settlement
- 3.2 Type of House: 1=Pucca, 2Semi-Pucca, 3=Katcha
- 3.3 Number of rooms in the house
- 3.4 Ownership Status:1=Owner,2 =Tenant
- 3.5 Number of years residing in the present place

Questionnaire Schedule

- 3.6 Movable Assets owned at the household level:
- (a) Desert Cooler
  (b) Radio
- c) TV
- (d) Refrigerator
- (e) Scooter
- (f) Car/Jeep
- (g) Tractor
- (h) Telephone
- i) Mobile

Questionnaire Schedule

Part II : assessment of environmental quality

- **A: Air Pollution:**
- **1. Indoor air Pollution :**
- 1.1 Where is the kitchen located? I=Indoor, 2=Outdoor ☐
- 1.2 If indoor, is the ventilation in the house: 1=Good, 2 =Moderate, 3 =Bed ☐
- 1.3 Is the Kitchen well separated from other rooms in the house: 1= Yes, 2=No
- 1.4 How many hours do you spend in the kitchen for cooking/boiling water ☐☐
- 1.5 Members involved in cooling: (specify) Member's ID):
- How many members stay at home during the day (specify member's ID): _____

1.2 Is cooking smoke a problem is your house : 1= Yes , 2= No ☐

- 1.3 Have you ever changed the fuel :

1= yes , 2 = No.☐

- 1.4 If yes, specify fuel used earlier

(N.A. =9): _____

- 1.5 Has the shift in fuel cost you any additional expenditure :1=Yes, 2=No. N.A. =9 ☐
- 1.6 If yes, specify amount, in Rs.

(N.A. =9): ☐☐☐☐☐☐

- **2. Vehicular Air Pollution**
- 2..1 How wide is the road adjacent to the household?
  _____
- 2.2 How would you rate the vehicular traffic outside your residence? ☐
- 1= Heavy, 2=Moderate, 3= Light
- 2.3 What kind of vehicles piles the most on the rod outside the house? ☐
- A= Heavy – duty trucks, 2= Buses, 3+ Passenger cars, 4= Autorickshaws, 5=Tow wheelers
- 2.4 Do vehicles, other than those belonging to the residents, are parked in front of the house? 1= Yes, 2= No
- 2.5 Are there windows facing the roadside? 1= Yes, 2= No 2.6 Do you keep the windows facing the roadside : 1= Mostly closed, 2 = Mostly Open
- **Industrial Air Pollution**
- 3.1 Is there an industry close to your residence: 1=Yes, 2 = No
- 3.2 If you specify type of industry: _____
- 3.3 Approximate distance of industry from your residence (in Km.):
- 3.4 Do you have any implements in your house to protect yourself from industrial pollution (For e.g., air conditioners) : 1=Yes, 2 = No ☐
- 3.5 Amounts spent on such implements (in Rs): ☐☐☐☐☐

- 4 **Commuting Data**
- 3.1 Do you mostly travel on congested roads? 1=Yes, 2 = No ☐
- 3.2 Do you use any protective equipment during travel: 1=Yes, 2 = No ☐
- 3.3 If Yes, specify (N.A. =9): _____
- 3.4 Cost of protective equipment used (in Rs):
- 3.1 Do you take any diversions to avoid vehicular emissions: 1=Yes, 2 = No ☐
- 3.2 If yes,
- a) What is the extra distance you travel (in Km): ☐☐☐
- b) What is extra time involved due to additional distance involved(hh/mm):☐☐ ☐☐
- c) What is the extra cost of the travel involved (in RS): ☐☐☐☐☐

- **D. Household perception of Environmental problem in the locality**
- **Environmental Problem**
- **Ranking (0=No Problem: 1= Problem; 2= Major Problem)**
- Industrial Air Pollution
- Indoor Air Pollution
- Vehicular Air Pollution
- Ground water Pollution
- Pollution resulting from inundation during rains
- Vehicular Noise Pollution
- Solid Waste Pollution

- **Part – III**
- **Health assessment for adults (20 years of more)**
- **House ID ☐☐☐☐☐☐**

- **Parta : general information**
- **Member ID**
- **Code**
- Proxy/ Direct Interview
- 1= Proxy. 2= Direct
- Member's Name
- Full Name
- Age
- (in years)
- Sex
- M = 1, f= 2
- 1. Smoking habits
- 1, N = 2
- 2. If yes, type of tobacco smoke
- Cigarette = 1, bidi=2 hukka =3, Others =4

3. Smoking history
- Frequency (per day)
- uration (in years)

4. Alcohol habits
- Y=1, N=25. If yes frequency & duration
- Frequency (per day)
- uration (in years)

- **respiratory assessment – respiratory symptoms**
-
- **Member ID**
- **Cough**
- 1. Do you cough in the morning ?
- Y= 1, N=2

2. Do you cough on most days for as much as 3 months of the year?

- Y=1, N=2, N.A. =9

3. For how many years have you had this cough?

- Specify, (N.A.=9)
- **Sputum / Phlegm.**
- 1. Do you bring up phlegm in the morning ?
- Y=1, N=2
- Do you bring up phlegm on most day for as much as 3 months of the year ?
- Y=1, N=2, N.A. =9

. For how many years have you had phlegm ?

- Specify, (N.A.=9)
- **Breathlessness**
- 1. Do you get breathlessness while walking on ground level ?
- Y=1, N=2
- **Wheezing**
- 1. Do you have noisy breathing ?
- Y = 1, N=2
- 2. How often do you experience attacks of wheezing?
- Record Frequency N.A.=9
- 3. At what age wheezing first occurred ?
- Record age, N.A. =9
- **Hemoptysis**
- 1. Have you ever coughed blood ?Y=1, N=2
- 2. If Yes, at what age ?
- Record age, N.A.= 9

part b -2 cardiovascular assessment

Member ID

1. Have you ever had pain or discomfort in your chest ? If No, go to Question No. 8

Y=1, N=2

2. Do you get this pain or discomfort when you walk uphill or walk fast?

Y=1, N=2, N.A. =9

3. Do you get it when you walk at an ordinary pace on the level ?

Y=1, N=2, N.A. =9

What do you do if you get it while you are walking ?

Stop =1, Slowdown =2

Carry on as before=3

5. Does it go away when you stop ?

Y=1, N=2 N. A. = 9

6. How soon does it go away ?

More than 10 mts = 1

10 mts or less =2

7. Where do you get this pain or discomfort (mark X on the diagram) ?

8. Do feel it anywhere else ?

Y=1, N=2

9. If yes where else ?

Specify, (N.A.=9)

10. Have you ever had a severe pain across the front of the chest lasting half an hour or more ?

Y=1, N=2

11. Have you every been told that you had high blood pressure (B.P.)?

Y=1, N=2

12. Were you stared on treatment for high B.P. ?

Y=1, N=2 N. A. =9

13. Were you ever told that you had heart trouble ?

Y=1, N=2

14. What did the doctor say it was ?

Specify, (N.A. =9)

15. Did you have stoke ?

Y=1, N=2

Gastrointestinal assessment (feco-oral disease)

Member Id

1. Do you experience frequent loss of appetites ?
Y =1, N=2

2. Do you experience Frequent vomiting
Y =1, N=2

a) with blood
Y =1, N=2 N.A.=9

b) without blood
Y =1, N=2, N.A.=9

c) Accompanied by pain in stomach
Y =1, N=2, N.A. =9

3. Do you pass loose stools frequently:
Y =1, N=2

a) Watery stools
Y =1, N=2, N.A. =9

b) with phlegm

water/solid waste related vector borne diseases

- **Member Id**

1. Have you suffered from any of the following diseases ?

a) Malaria

Y =1, N=2,

b) Dengue

Y =1, N=2,

c) Kala Azar

Y =1, N=2,

skin problems

Member Id

1. Do you have boils ?

Y =1, N=2

a) With pus

Y =1, N=2, N.A.=9

b) Without pus

Y =1, N=2 N. A. =9

2. Do you experience itching or redness of skin?

Y =1, N=2

3. Any other problems associated with the skin?

Y =1, N=2

4. Do You suffer from foot drop or wrist drop ?

eye problems

Member Id

1. Do you experience irritation of the eye?

Y =1, N=2

a) With redness

Y =1, N=2, N.A. =9

b) With watery discharge

Y =1, N=2, N.A. =9

2. Have you experienced any loss of vision?

Y =1, N=2

3. If yes, what was the disease ?

Y =1, N=2

- **obstetrical problems (only for ever married females)**
-

- **Member Id**
-
-
-
- 1. Number of Live births
- Specify Details
-
-
-
- 2. Number of Still births
- Specify Details
-
-
-
- 3. Number of Miscarriages
- Specify Details
-
-
-
- 4. Number of Premature birth
- Specify Details
-
-
-

Miscellaneous

Member Id

Record incidence of any of the following health conditions

1. Mottling of teeth (Flourosis)
Y=1, N=2

2. Dental caries
Y=1, N=2

3. Mental Retardation
Y=1, N=2

4. Kidney problems
Y=1, N=2

5. Cancer
Y=1, N=2

6. Others
Specify Details

Illnesses in last three months

Member Id

1. During the past three months have you had any illness?

Y=1, N=2

2. What was the illness ?

If yes, specify details

3. Number of days unable to do work due to this illness?

4. Whether seen by a doctor ?

Y=1, N=2

5. Number of doctor visits for this problem in past three months ?

If Yes, Specify details

Health assessment for children (Less than 20 years) .House ID □□□□□□□

Member ID
Code

Name
Full Name

Sex
M=1, F=2

Age
Exact no. of yers

A General Health status

1. How would you rate the child's health compared to other children of his/her age?

Excellent =1, Good =2, Fair =3, Poor=4

2. Was the child premature?

Y=1, N=2

3. Did the child stay in the hospital after birth?

Y=1, N=2

Member ID

- **Code**
- **C Cough**
- 1. Does this child usually cough first thing in the morning?
- Y=1, N=2
- If yes has this cough been present for as much as three month in a year ?
- Y=1, N=2
- 3. Does the child cough at other times of the days/
- Y=1, N=2
- 4. If yes has this cough been present for as much as three months in a year?
- Y=1, N=2, N.A. =9
- 5. Does the child usually seem congested in the chest or bring up phlegm with colds?
- Y=1, N=2, N.A.=9
- 6. If yes has this congestion or phlegm been present for as much as three months in a year?
- 1. During the past three months have you had any illness?
- Y=1, N=2

Air pollution Data (CPCB)

- Parameters:
  - SO_2
  - NO_2
  - SPM
  - PM_{10}

Main Outcome Variables

H/o Cough	Exertional dyspnoea
Bringing phlegm	Hypertension
Breathlessness	Stroke
Wheezing	Hematuria
Hemoptysis	Anorexia
Chest Pain/Discomfort	Pain Abdomen
	Diarrhea

Level of air pollutants (CPCB)

Pollution Level	Monthly Mean Concentration Range (Microgram/m^3)					
	Industrial			Residential		
	SO_2 & NO_2	SPM	PM_{10}	SO_2 & NO_2	SPM	PM_{10}
Low (L)	0-40	0-180	0-60	0-30	0-70	0-30
Moderate (M)	40-80	180-360	60-120	30-60	70-140	30-60
High (H)	80-120	360-540	120-180	60-90	140-210	60-90
Critical (C)	120	540	180	90	210	90

SO_2

PARAMETERS /LOCATIONS	SO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Janakpuri (R)	Min	Max	Mean	Percentage exceedence
April	9	12	10	0
May	9	11	10	0
June	-	-	-	-
july	9	14	11	0

NO_2

PARAMETERS /LOCATIONS	NO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Janakpuri (R)	Min	Max	Mean	Percentage exceedence
April	38	51	47	0
May	31	48	40	0
June	-	-	-	-
july	37	51	43	0

SPM

PARAMETERS /LOCATIONS	**SPM** (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Janakpuri (R)	Min	Max	Mean	Percentage exceedence
April	347	673	505	100
May	291	410	343	100
June	-	-	-	-
july	282	542	435	100

PM_{10}

PARAMETERS /LOCATIONS	PM_{10} (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Janakpuri (R)	Min	Max	Mean	Percentage exceedence
April	199	321	249	100
May	56	174	118	67
June	-	-	-	-
july	115	248	196	100

SO_2

PARAMETERS /LOCATIONS	SO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
ITO (R)	Min	Max	Mean	Percentage exceedence
Sept	4	11	6	0
Oct	4	10	6	0
Nov	5	17	9	0
Dec	5	11	8	0

NO_2

PARAMETERS /LOCATIONS	NO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
ITO (R)	Min	Max	Mean	Percentage exceedence
Sept	48	93	74	40
Oct	69	123	101	90
Nov	60	138	98	77
Dec	64	124	97	81

SPM

PARAMETERS /LOCATIONS	**SPM** (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
ITO (R)	Min	Max	Mean	Percentage exceedence
Sept	196	648	341	97
Oct	181	688	452	94
Nov	421	1107	667	100
Dec	411	1020	622	100

PM_{10}

PARAMETERS /LOCATIONS	PM_{10} (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
ITO (R)	Min	Max	Mean	Percentage exceedence
Sept	97	305	179	97
Oct	88	393	242	97
Nov	83	896	297	97
Dec	196	571	338	100

SO_2

PARAMETERS /LOCATIONS	SO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Siri Fort (R)	Min	Max	Mean	Percentage exceedence
Jan	5	9	7	0
Feb	5	8	6	0
March	6	12	8	0
April	8	9	9	0

NO_2

PARAMETERS /LOCATIONS	NO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Siri Fort (R)	Min	Max	Mean	Percentage exceedence
Jan	26	43	35	0
Feb	24	38	33	0
March	26	48	34	0
April	29	40	37	0

SPM

PARAMETERS /LOCATIONS	SPM (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Siri Fort (R)	Min	Max	Mean	Percentage exceedence
Jan	141	369	241	86
Feb	218	276	241	100
March	204	468	365	100
April	238	572	397	100

PM_{10}

PARAMETERS /LOCATIONS	PM_{10} (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Siri Fort (R)	Min	Max	Mean	Percentage exceedence
Jan	72	167	105	57
Feb	65	120	89	20
March	99	191	136	86
April	105	130	119	100

SO_2

PARAMETERS /LOCATIONS	SO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Ashok Vihar (R)	Min	Max	Mean	Percentage exceedence
Aug	4	6	5	0
Sept	4	6	5	0
Oct	4	7	6	0
Nov	8	11	9	0
Dec	8	10	9	0

NO_2

PARAMETERS /LOCATIONS	NO_2 (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Ashok Vihar (R)	Min	Max	Mean	Percentage exceedence
Aug	22	31	27	0
Sept	25	39	33	0
Oct	29	53	40	0
Nov	39	49	45	0
Dec	41	49	44	0

SPM

PARAMETERS /LOCATIONS	**SPM** (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Ashok Vihar (R)	Min	Max	Mean	Percentage exceedence
Aug	164	492	276	67
Sept	100	615	297	60
Oct	292	615	478	100
Nov	387	464	433	100
Dec	290	461	355	100

PM_{10}

PARAMETERS/ LOCATIONS	PM_{10} (Microgram/cubic m^3) (24 HOURLY AVERAGE)			
Ashok Vihar (R)	Min	Max	Mean	Percentage exceedence
Aug	34	156	85	17
Sept	47	90	76	0
Oct	48	221	135	83
Nov	144	181	163	100
Dec	134	207	174	100

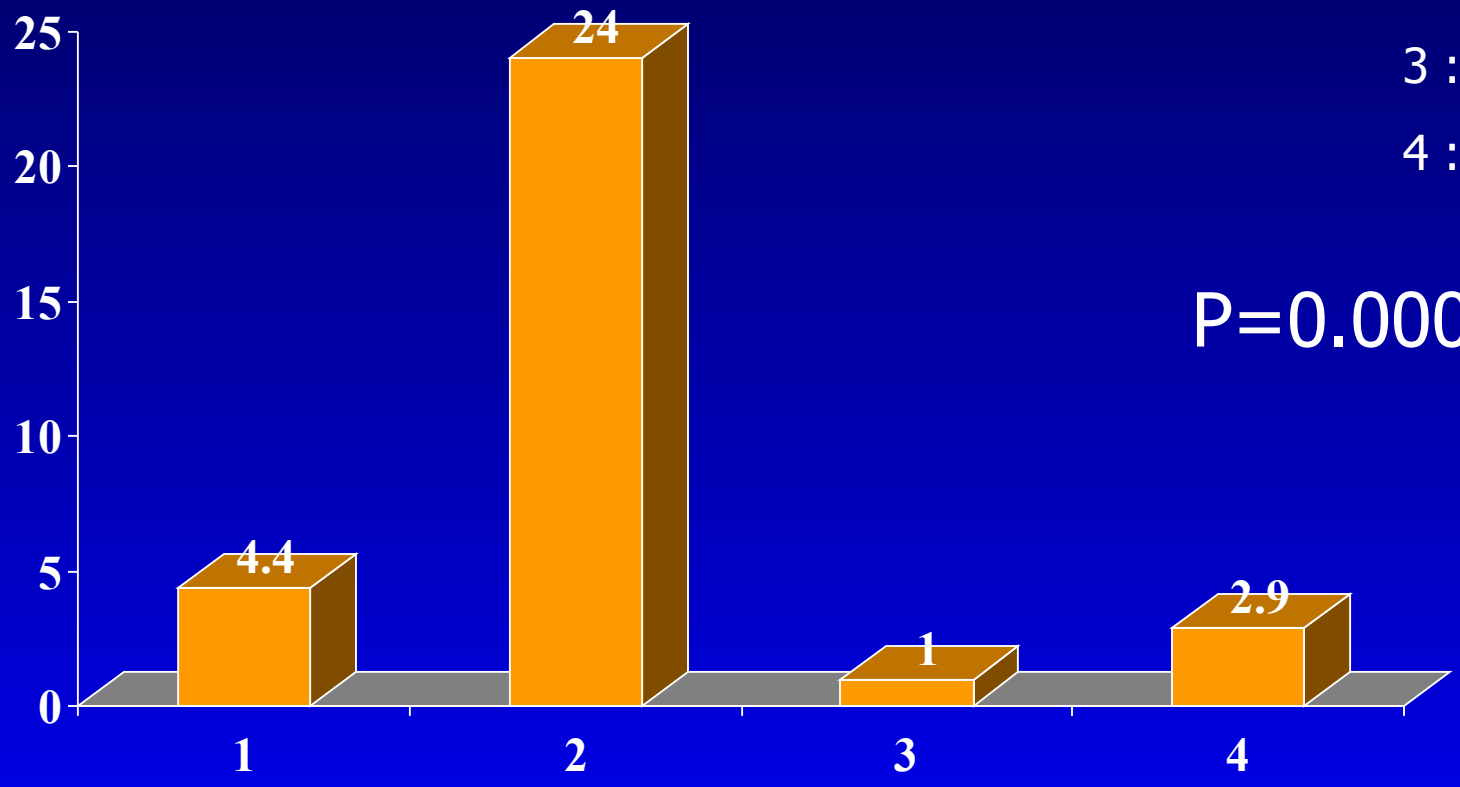
Child cough

1 : 0-30

2 : 31-60

3 : 61-90

4 : >90

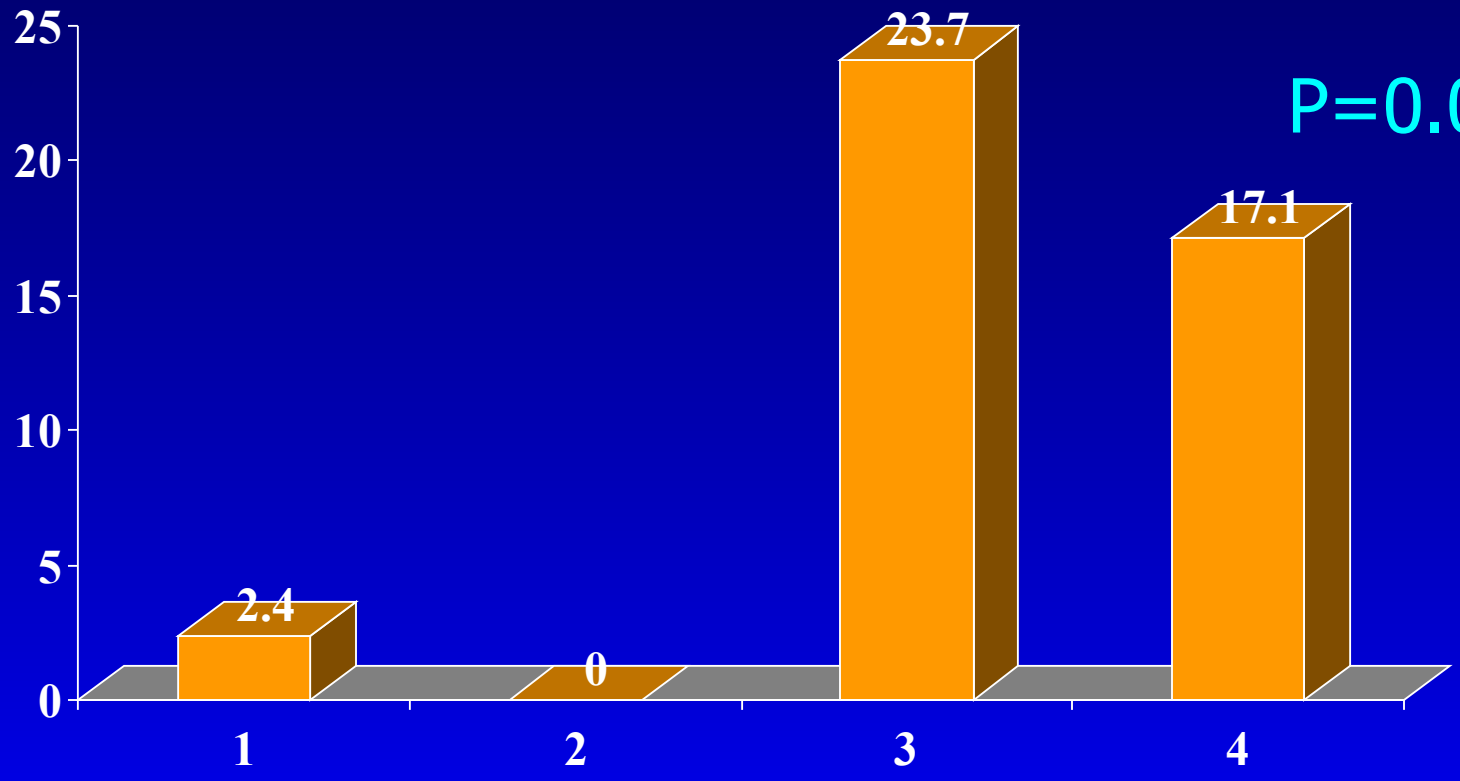


P=0.000

Level of Pollutant-NO_2

Child cough

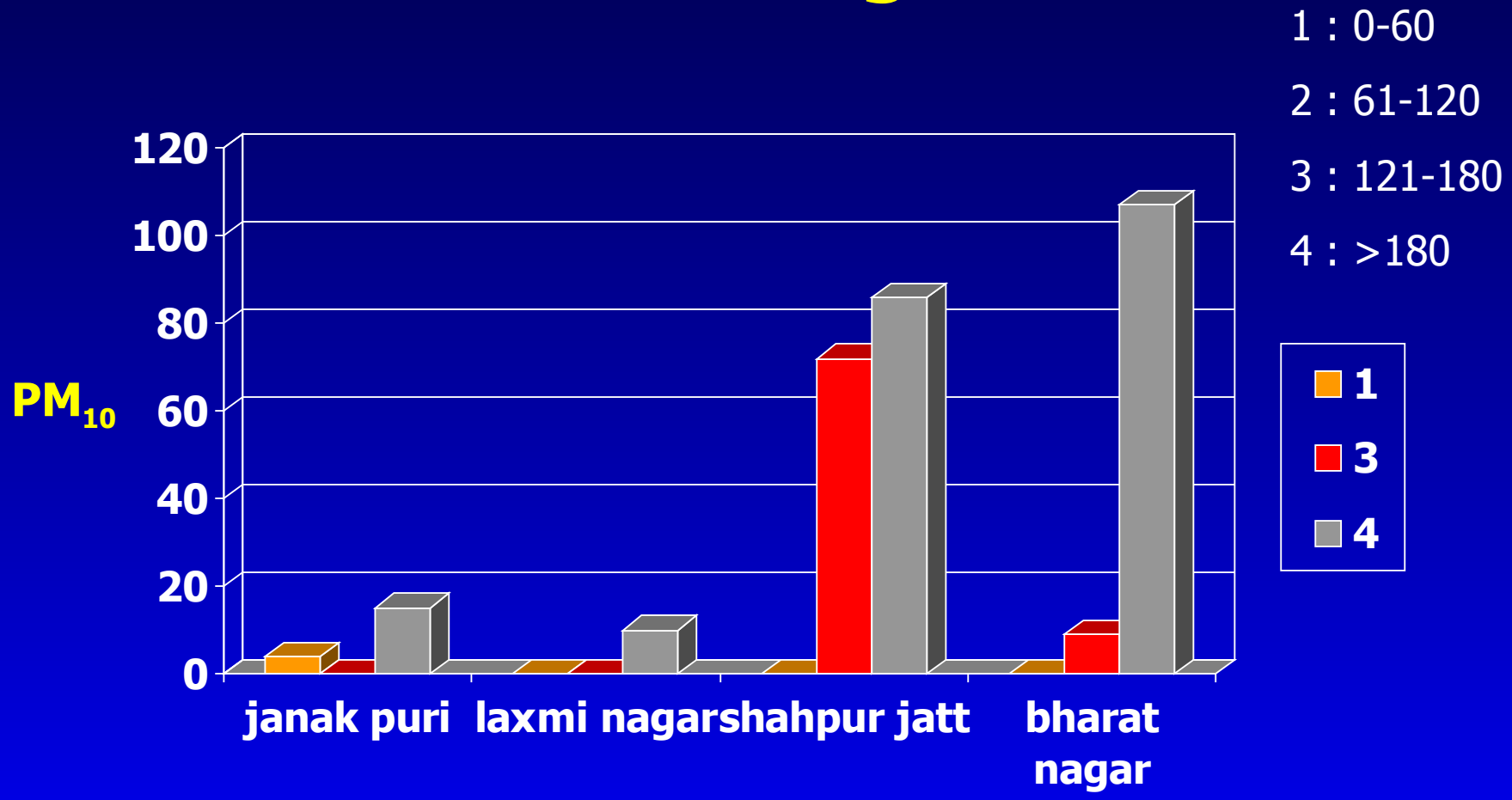
1 : 0-60
2 : 61-120
3 : 121-180
4 : >180



P=0.010

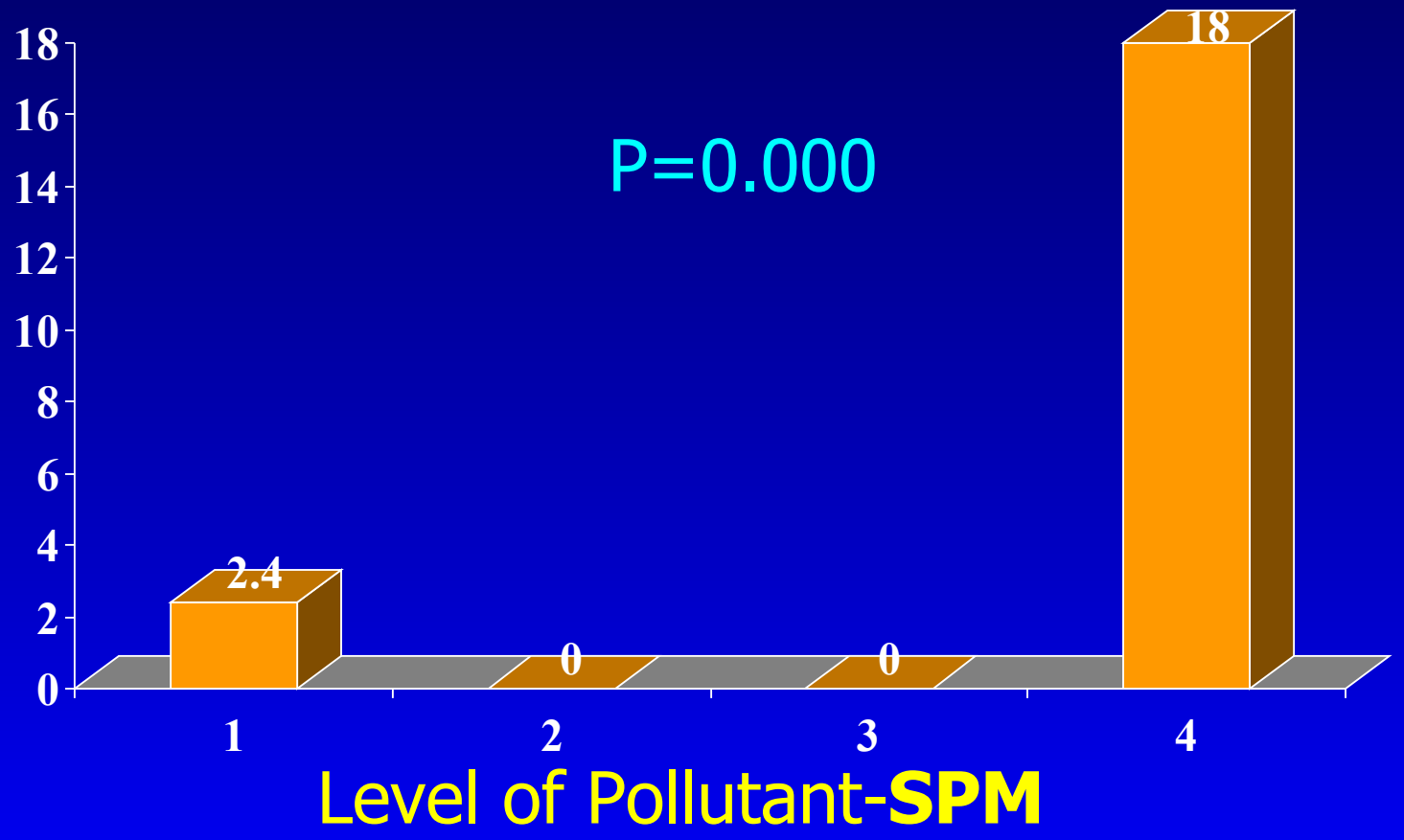
Level of Pollutant-$\mathbf{PM_{10}}$

Child cough

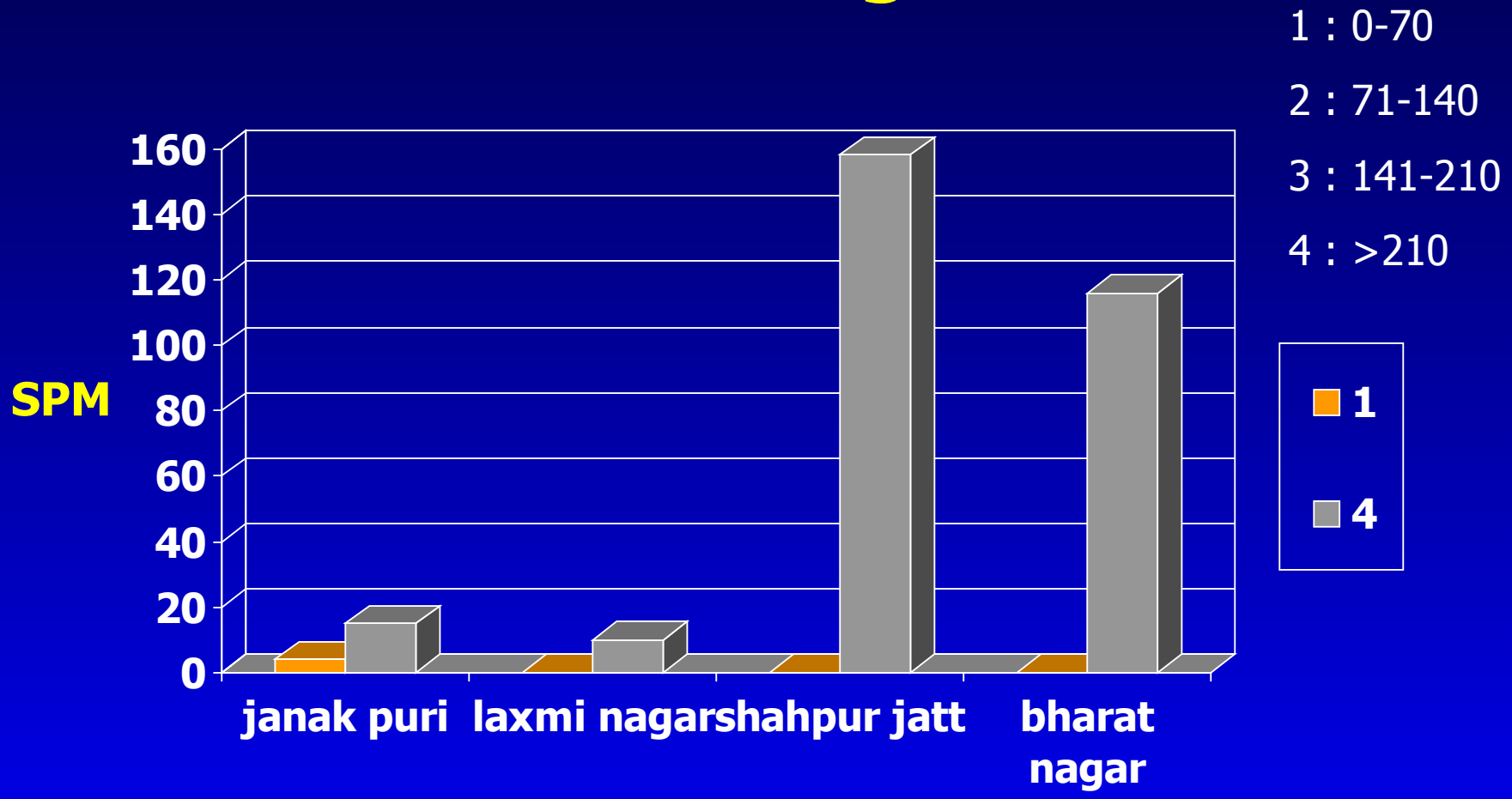

1 : 0-60
2 : 61-120
3 : 121-180
4 : >180
PM10
120
100
80
60
40
20
0
janak puri
laxmi nagar
shahpur jatt
bharat nagar
1
3
4

Child cough

1 : 0-70
2 : 71-140
3 : 141-210
4 : >210



Child cough


1 : 0-70
2 : 71-140
3 : 141-210
4 : >210
SPM
160
140
120
100
80
60
40
20
0
janak puri
laxmi nagar
shahpur jatt
bharat nagar
1
4

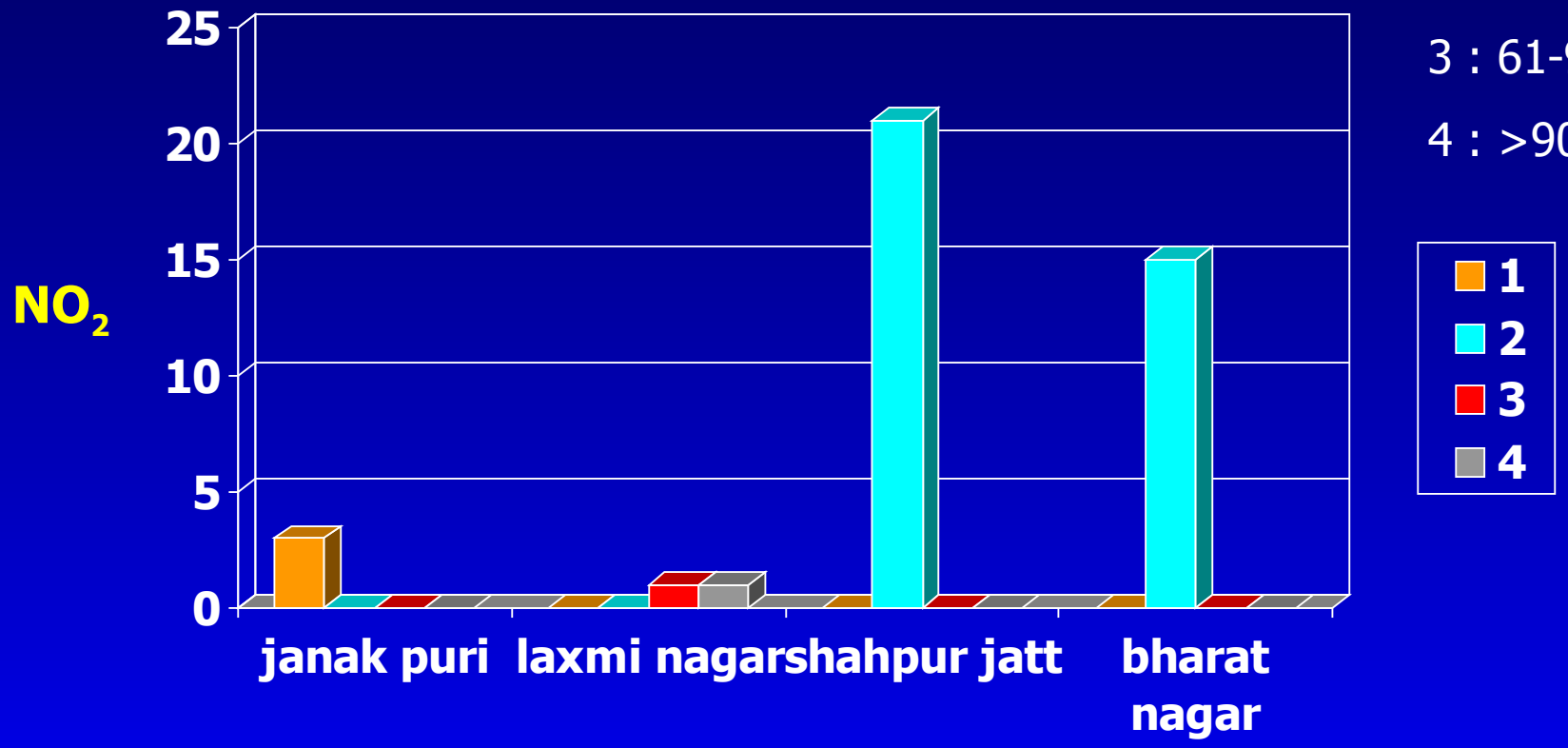
Child chest congestion

1 : 0-30

2 : 31-60

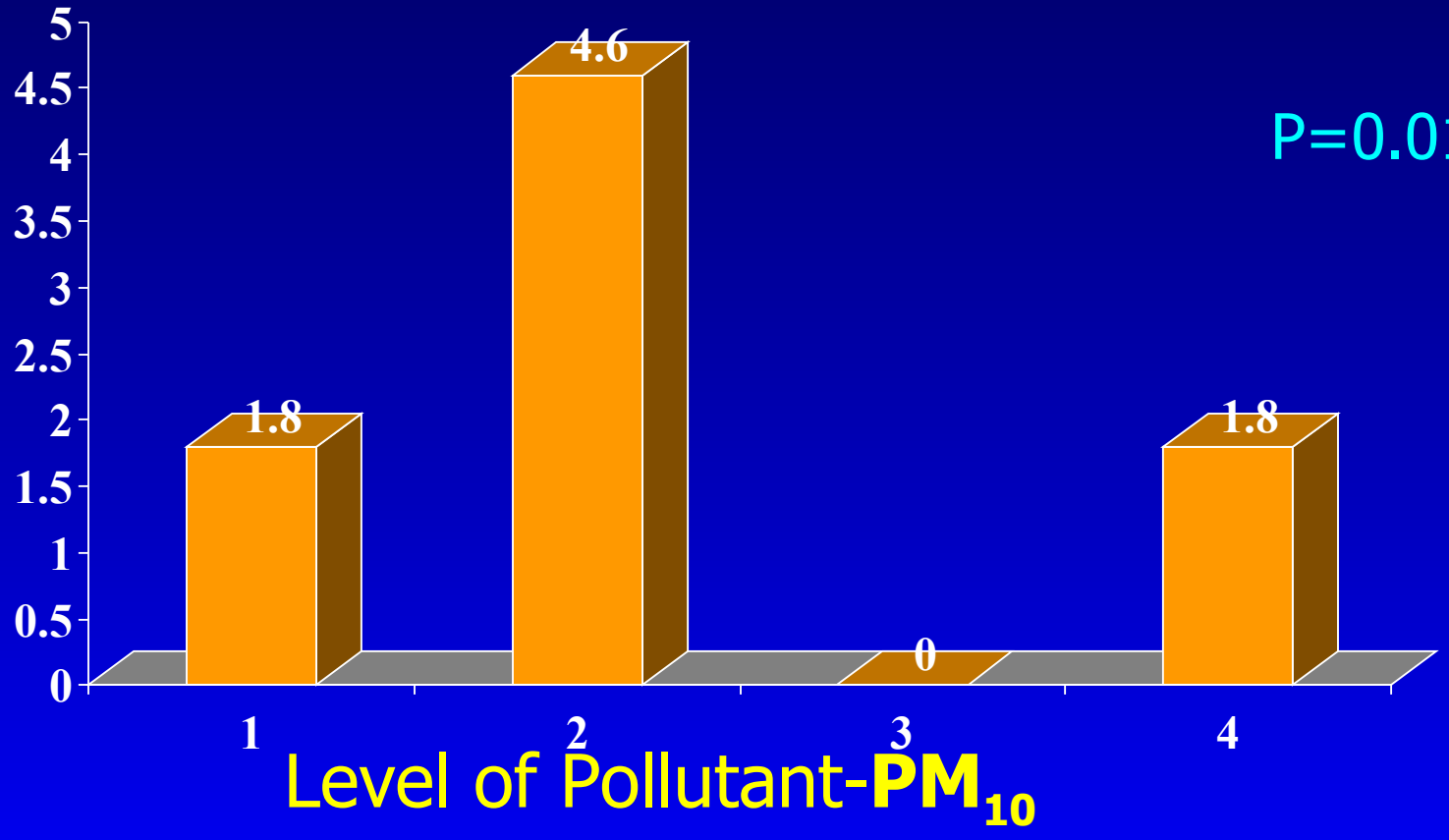
3 : 61-90

4 : >90



Child chest congestion

1 : 0-60
2 : 61-120
3 : 121-180
4 : >180



P=0.010

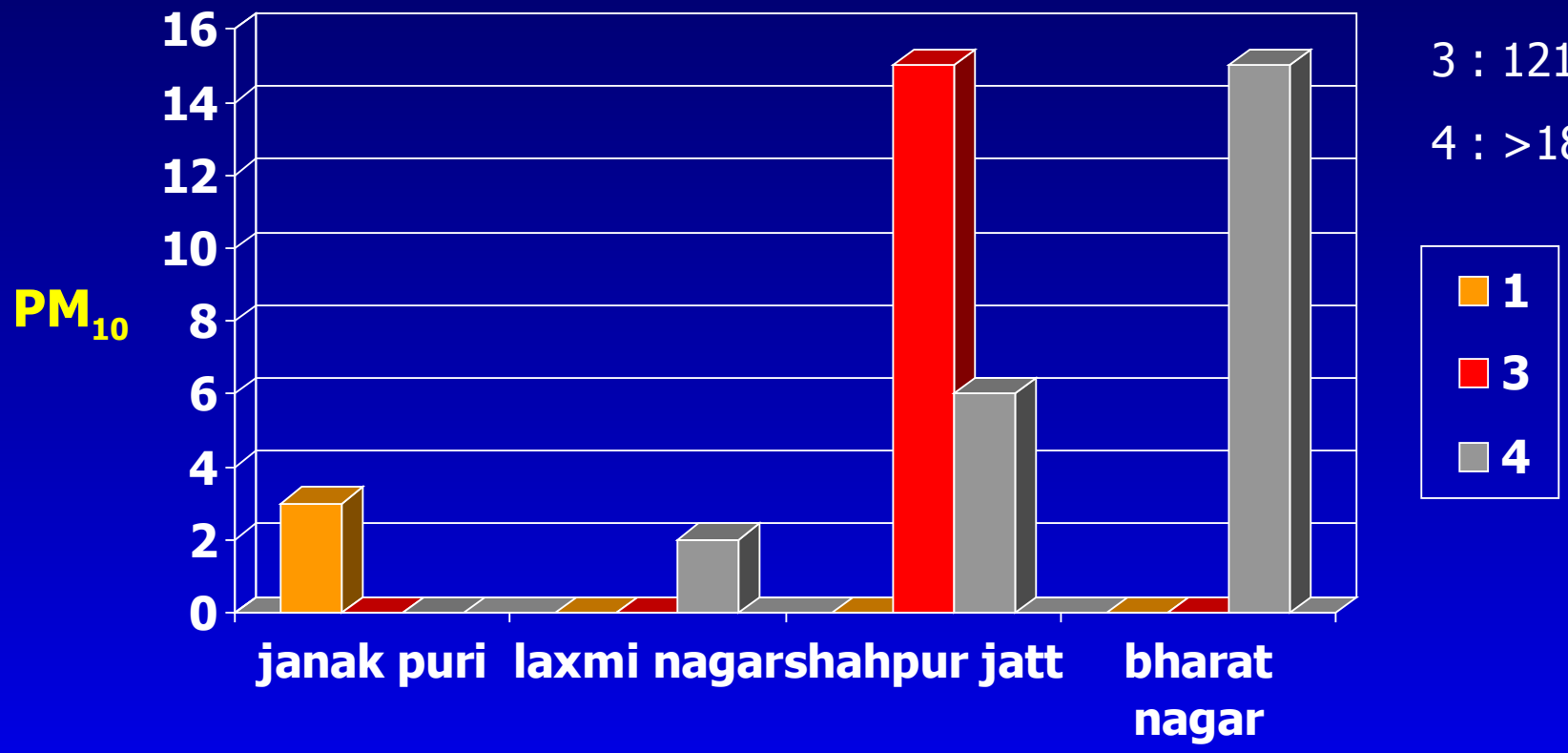
Child chest congestion

1 : 0-60

2 : 61-120

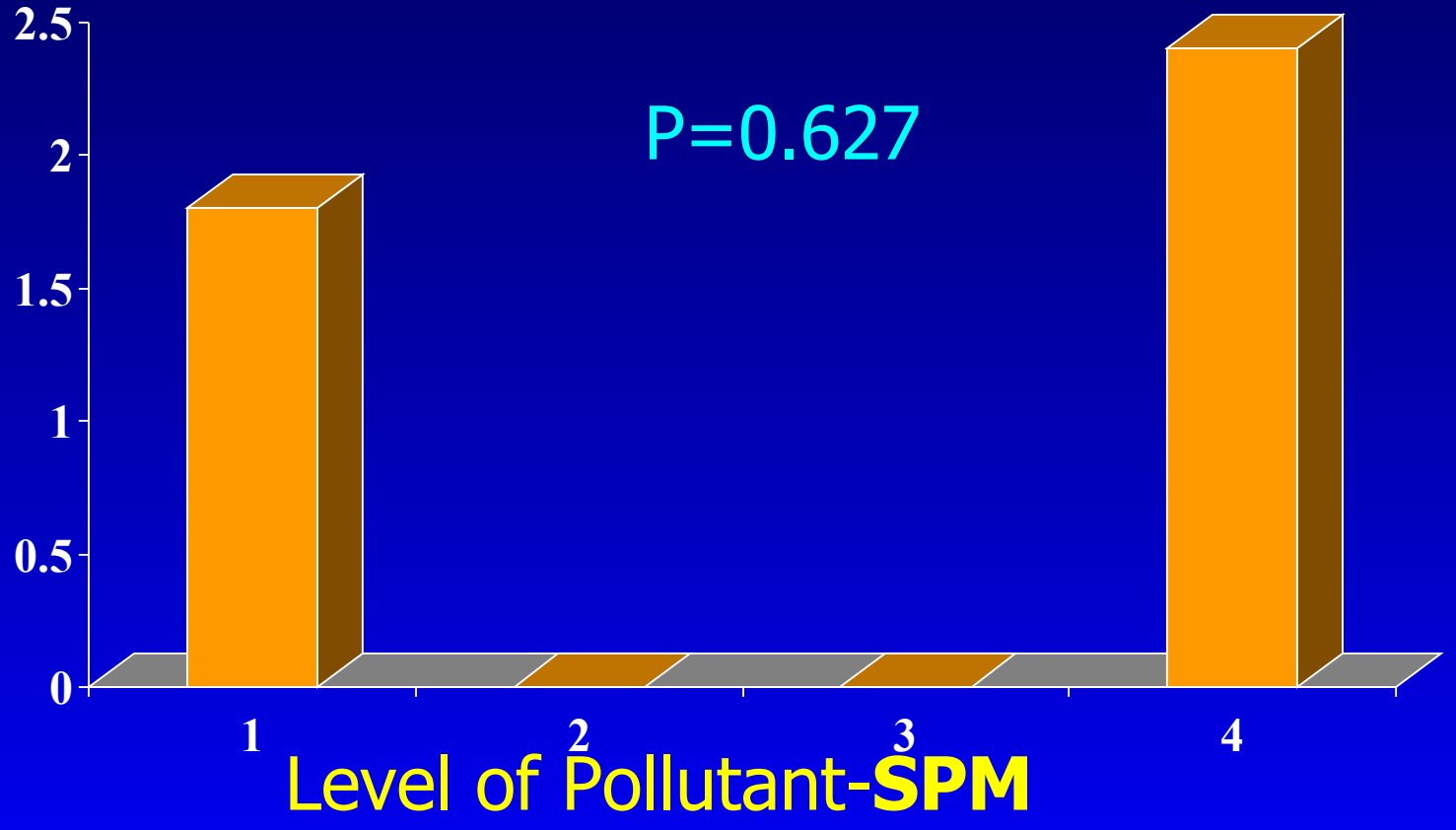
3 : 121-180

4 : >180



Child chest congestion

1 : 0-70
2 : 71-140
3 : 141-210
4 : >210



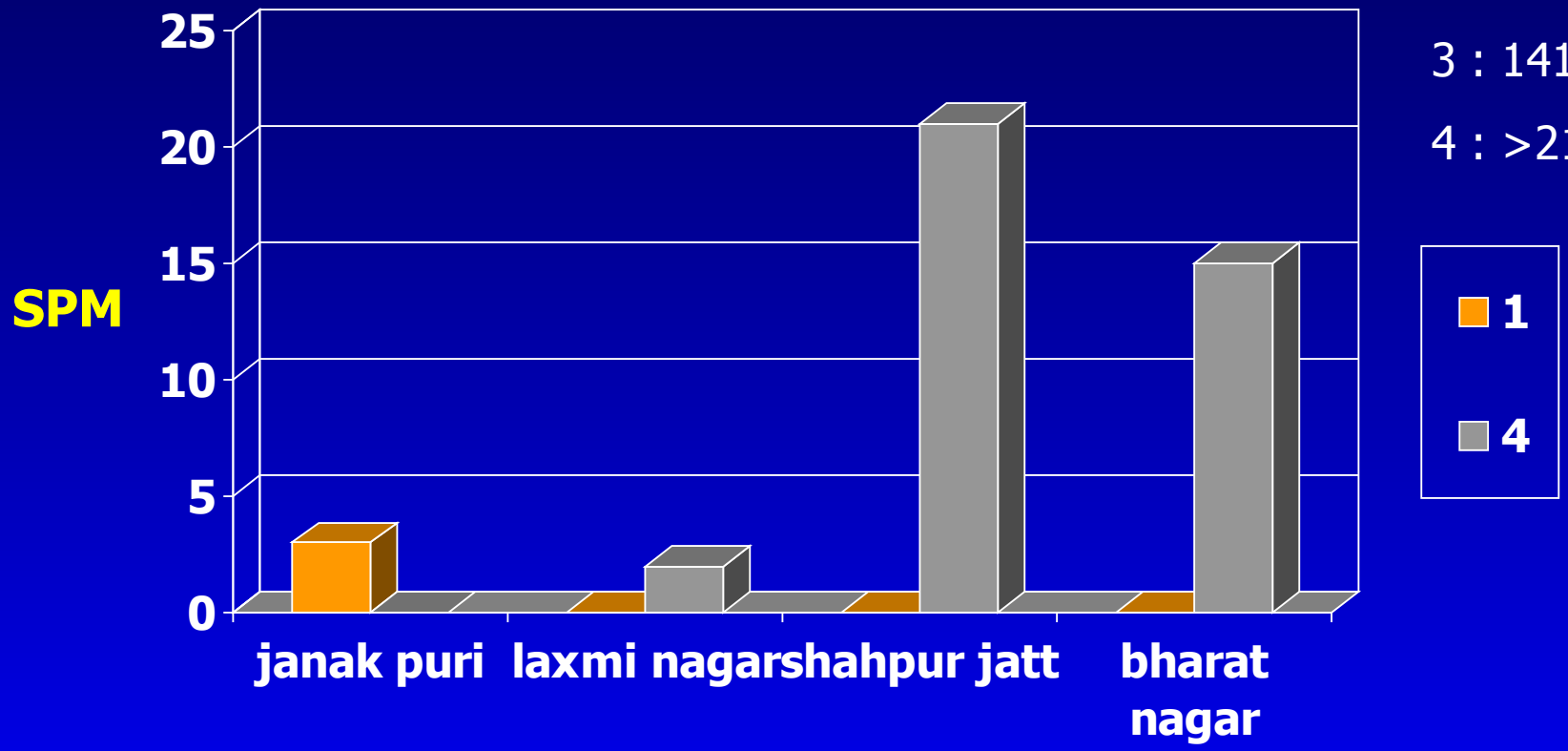
Child chest congestion

1 : 0-70

2 : 71-140

3 : 141-210

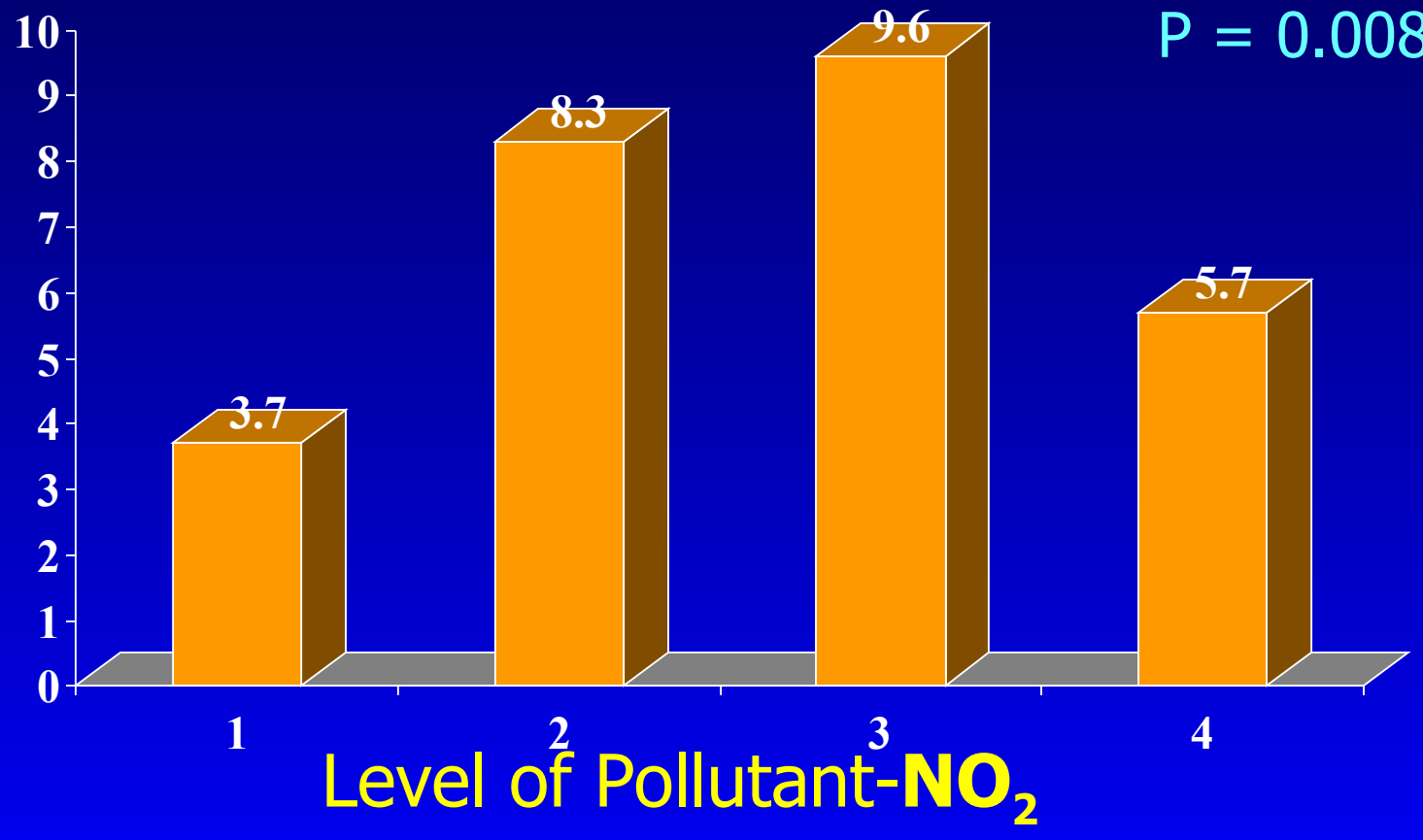
4 : >210



Hypertension

1 : 0-30
2 : 31-60
3 : 61-90
4 : >90

P = 0.008



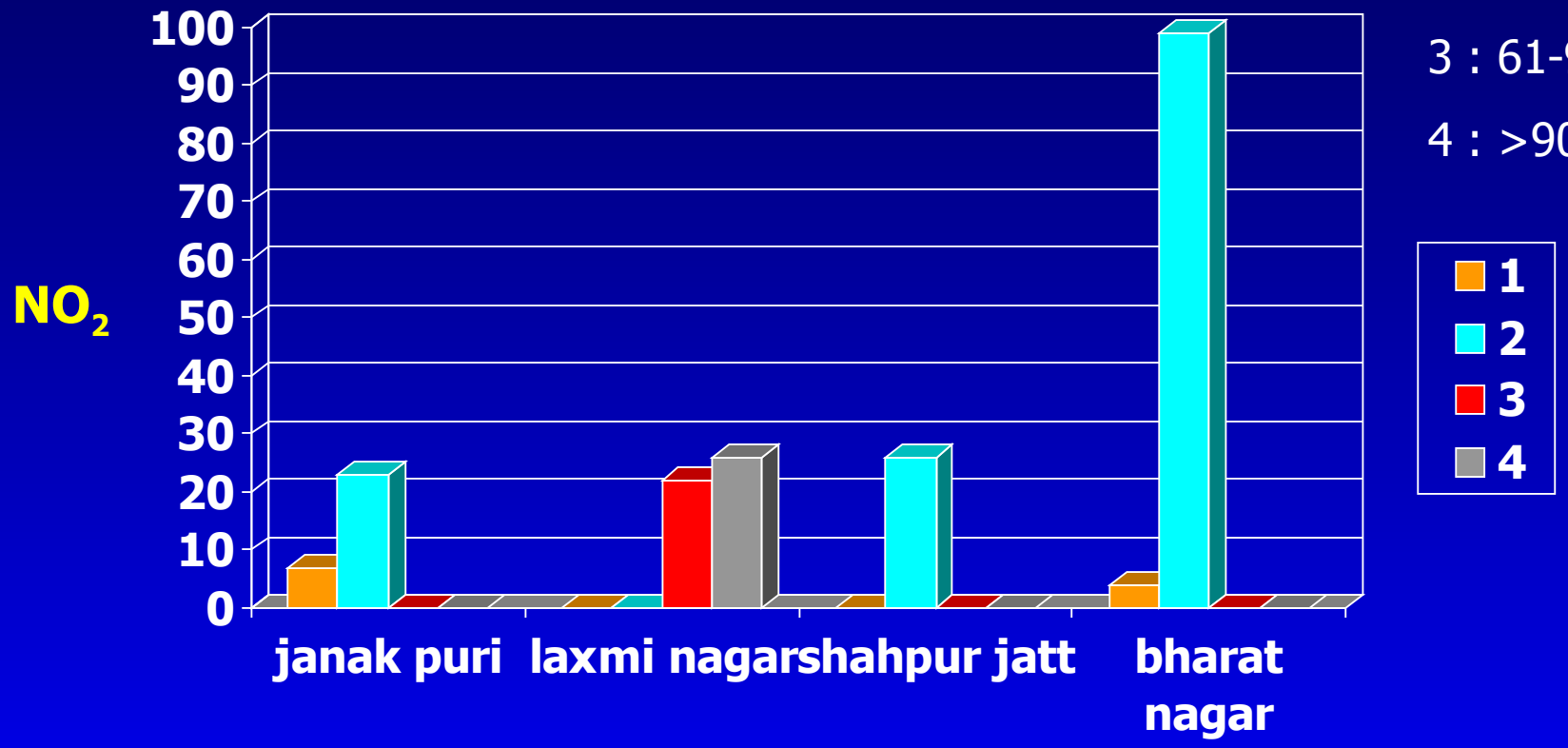
Hypertension

1 : 0-30

2 : 31-60

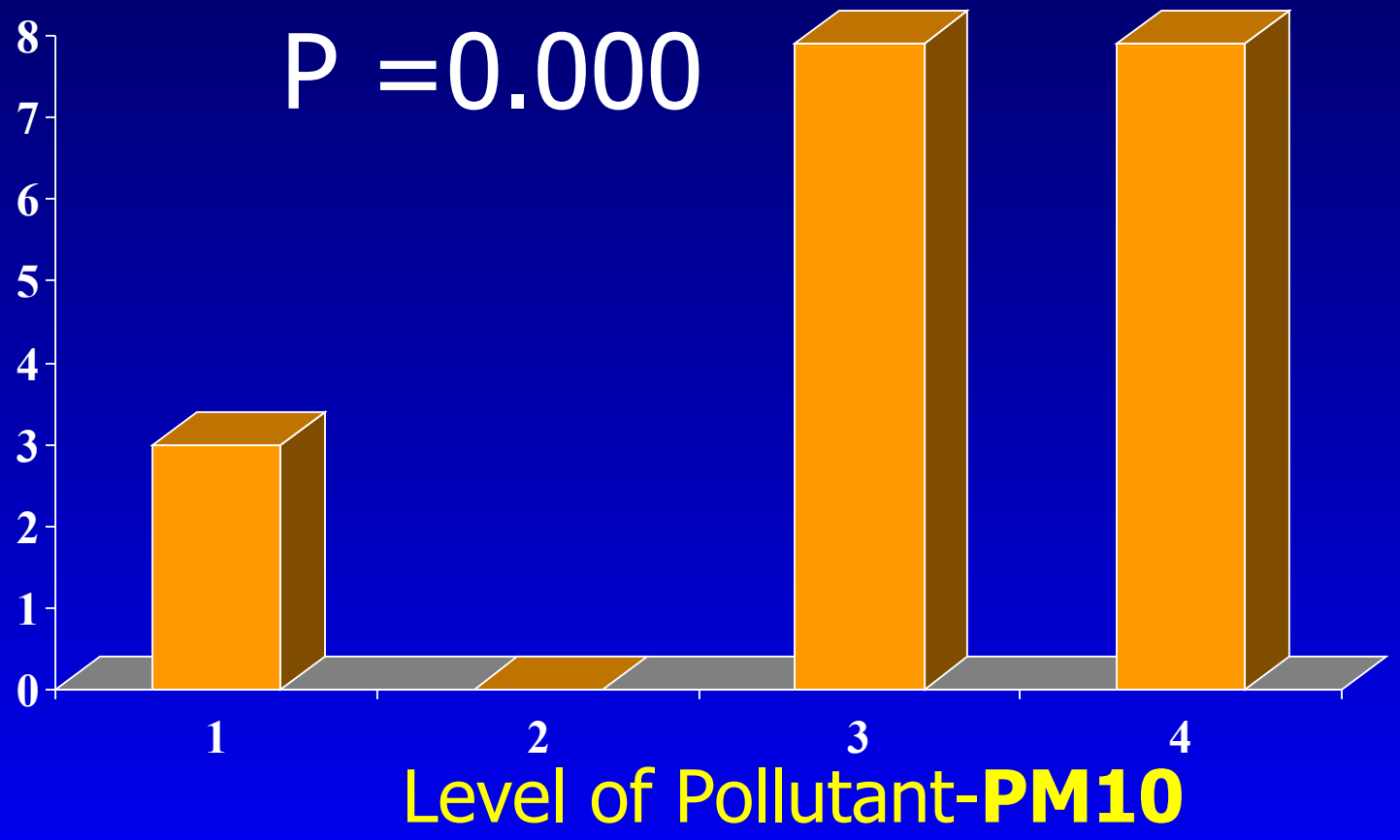
3 : 61-90

4 : >90

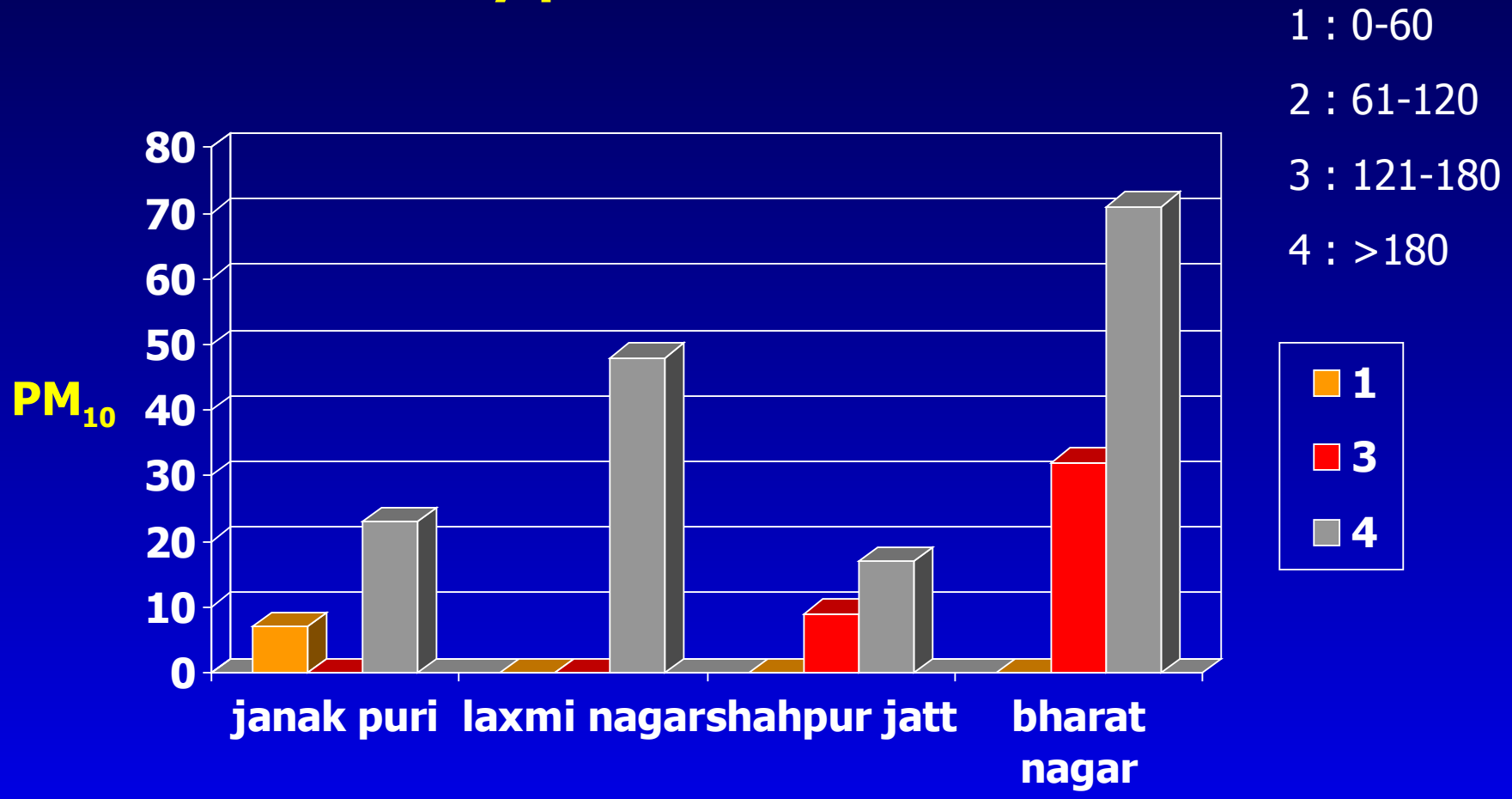


Hypertension

1 : 0-60
2 : 61-120
3 : 121-180
4 : >180

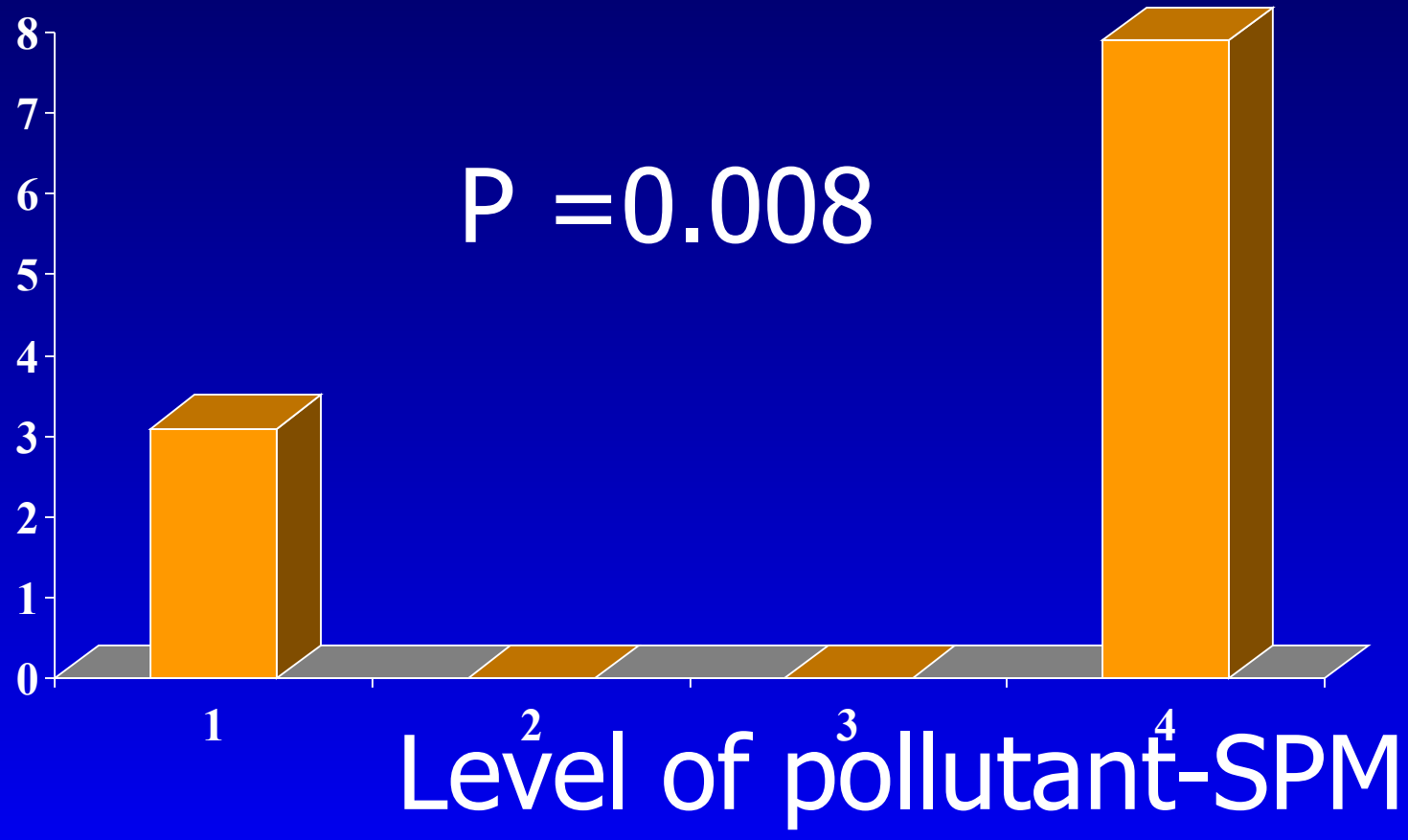


Hypertension

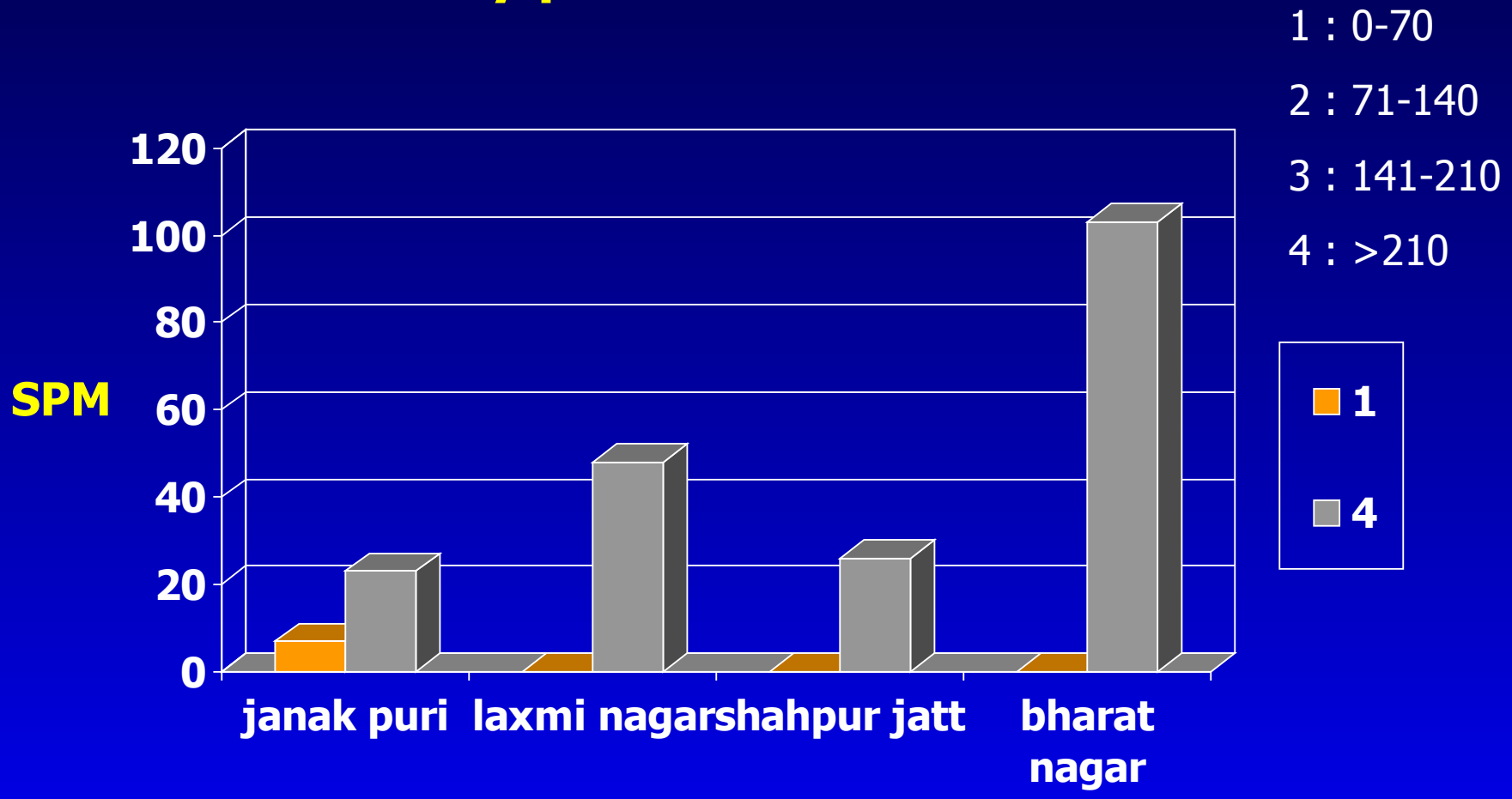


Hypertension

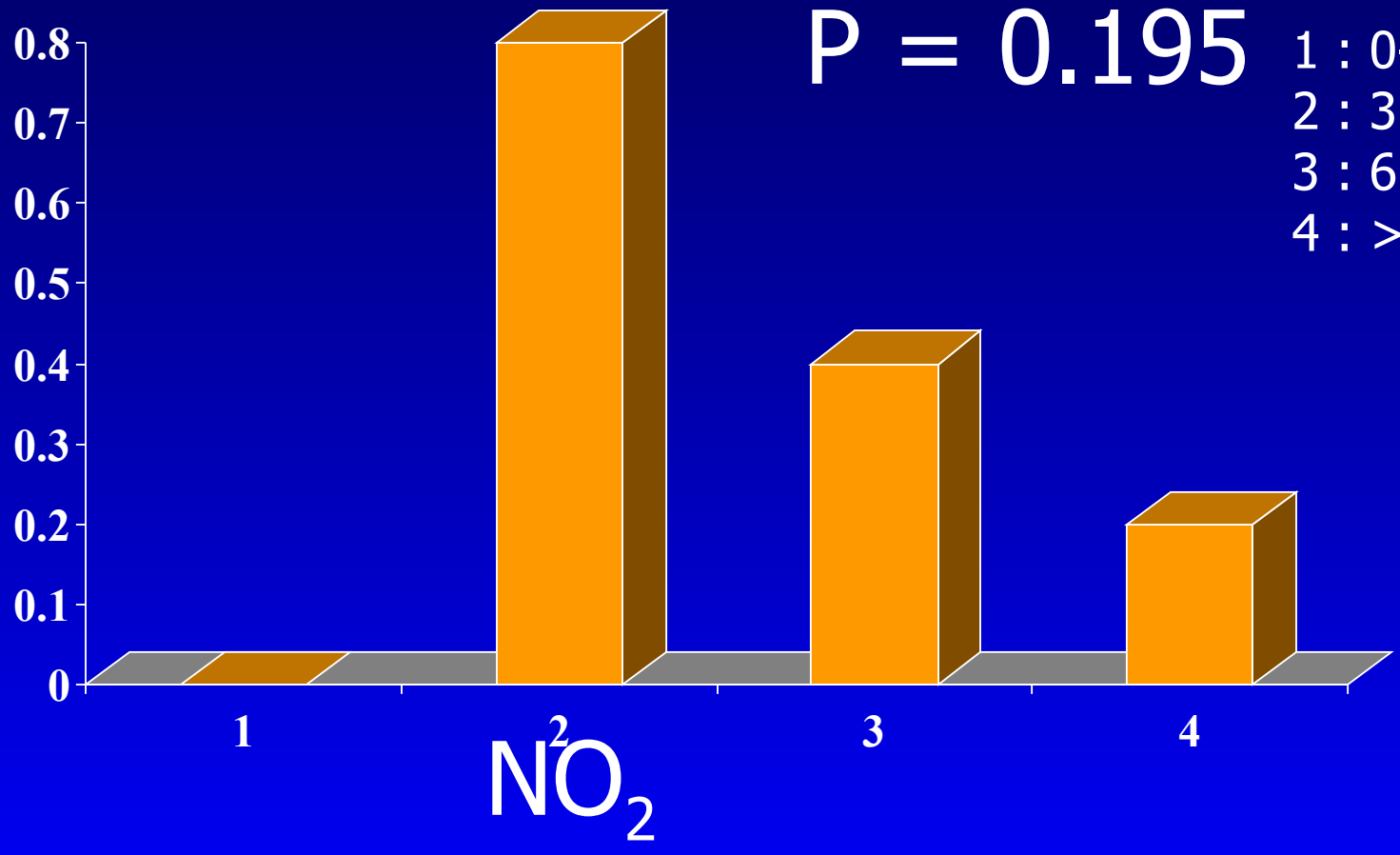
1 : 0-70
2 : 71-140
3 : 141-210
4 : >210



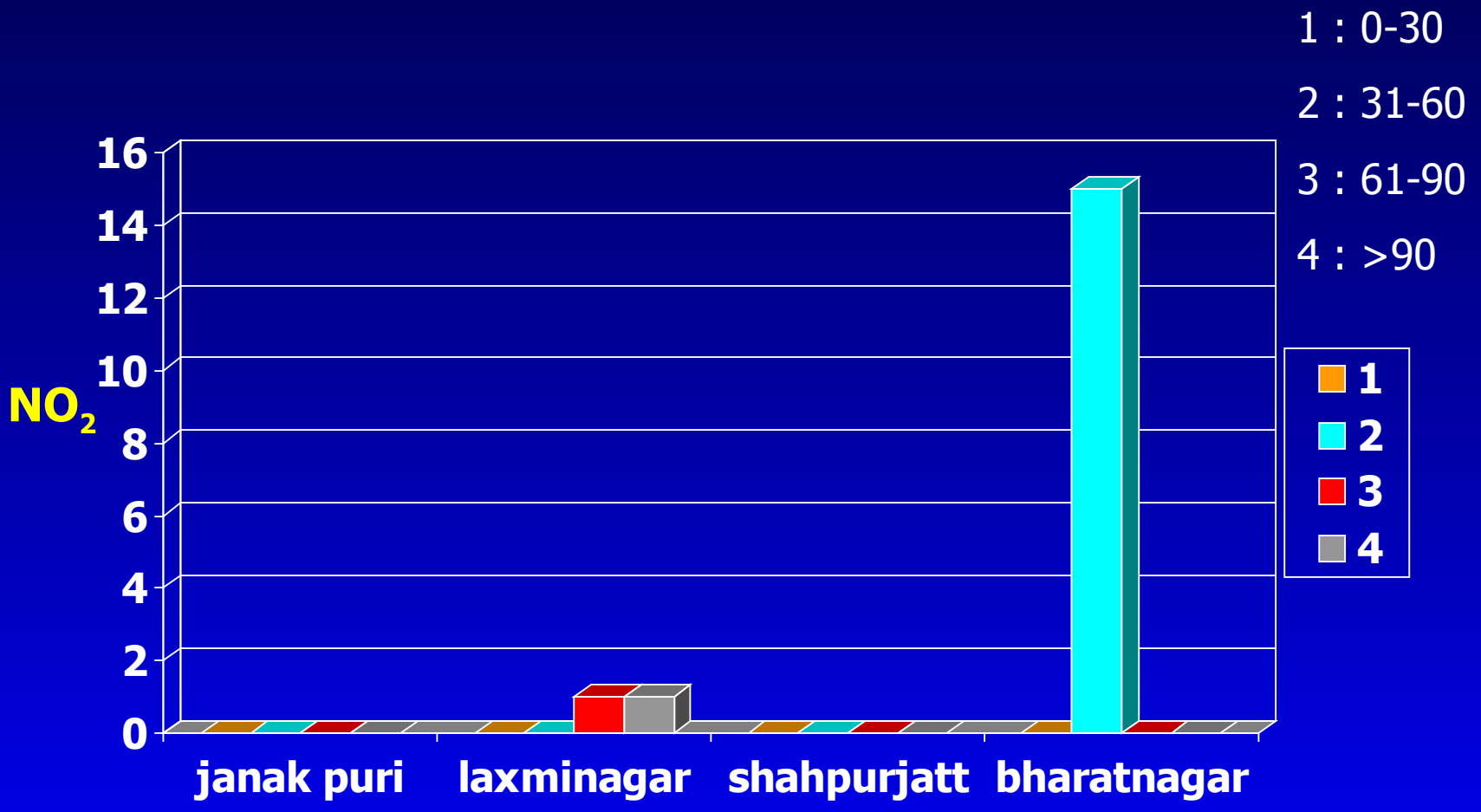
Hypertension



Heart disease



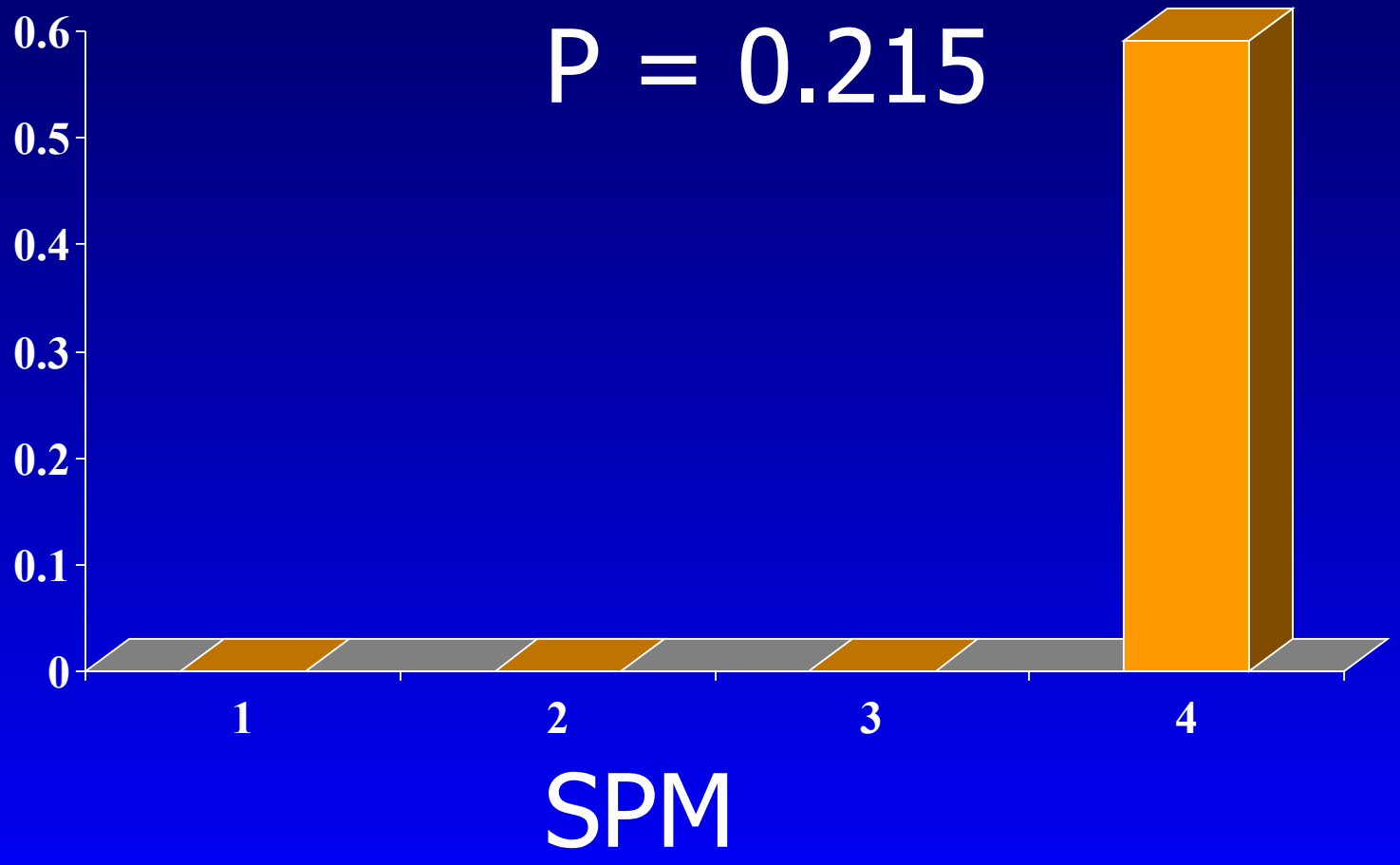
Heart disease



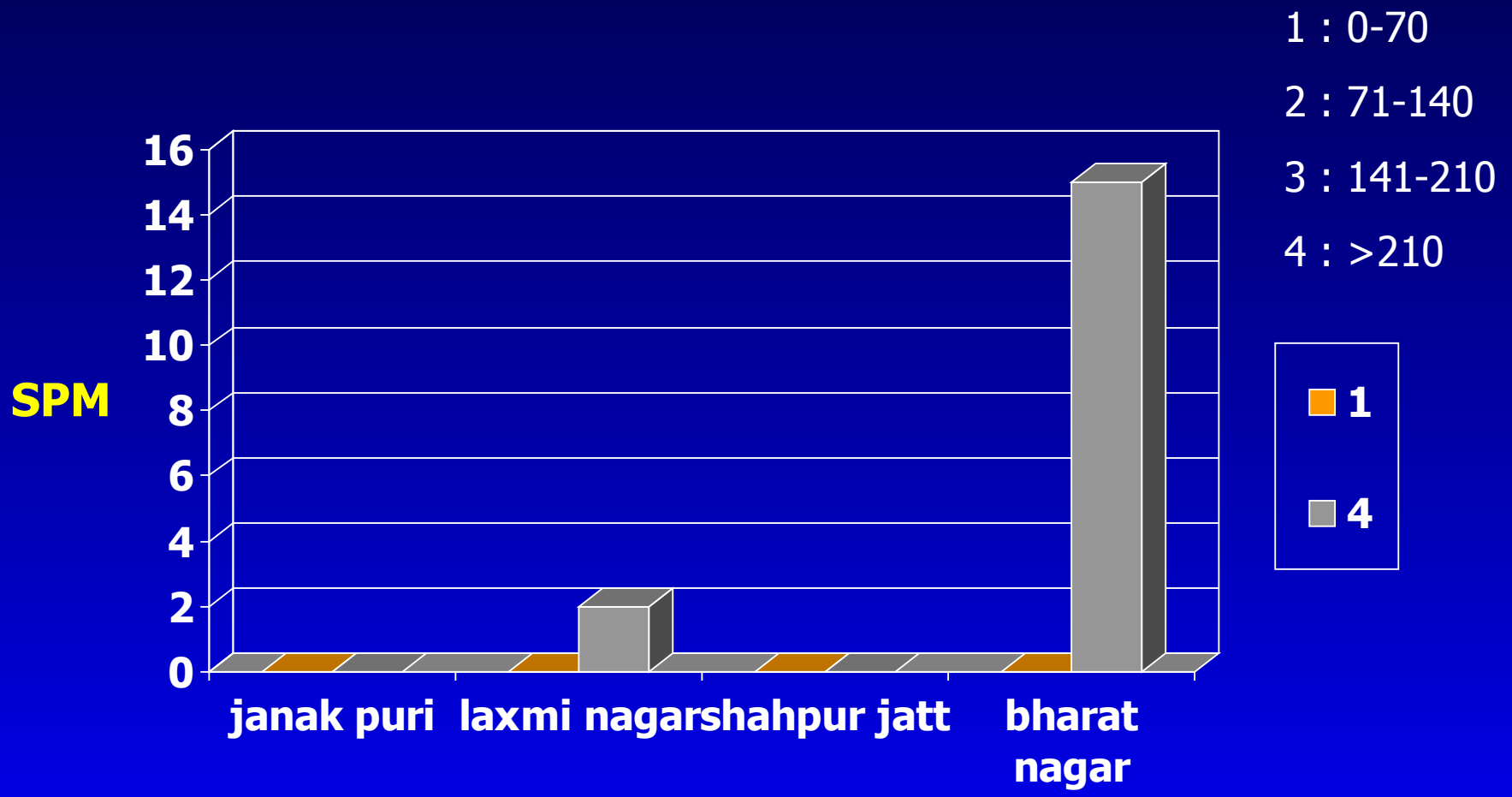
Heart disease

1 : 0-70
2 : 71-140
3 : 141-210
4 : >210

P = 0.215



Heart disease




2005 12 20

Thank you