

Press Release

May 13, 2014

## **FY2012 Annual Report of Environmental Health Surveillance for Air Pollution (Notice)**

The Ministry of the Environment (MOE) has been implementing environmental health surveillance for air pollution every year since 1996 in response to the amendment of the Pollution related Health Damage Compensation Law (amendment to the Law Concerning Special Measures for the Relief of Pollution related Health Damage) of 1988. It aims to regularly and continuously observe the correlation between the health conditions of local populations and air pollution, and to take measures as necessary. The results of the FY2012 surveillance have been compiled and are presented below.

### 1. Overview of the Surveillance Result

The FY2012 surveillance targeted 3-year-old children (hereinafter, “3-year-old survey”) and first-year primary school children (hereinafter, “6-year-old survey”) as in previous years. A cross-sectional analysis was performed using the results of these surveys (FY2012), and a longitudinal analysis was performed using the integrated results of 3-year-old surveys from FY1996 to FY2012 and 6-year-old surveys from FY2004 to FY2012. Additionally, a follow-up analysis was performed on 6-year-old respondents who also responded to the 3-year-old survey conducted in FY2008 and FY2009.

The 3-year-old survey targeted approximately 87,000 3-year-old children in 37 regions throughout Japan (73,000 respondents), and the 6-year-old survey targeted approximately 83,000 6-year-old children in 38 regions throughout Japan (71,000 respondents).

Among the respiratory symptoms surveyed, the results of analyses relating to asthma were such that in both the 3-year-old and 6-year-old surveys, there was no indication that higher air pollutant concentrations led to higher asthma prevalence, neither in terms of respiratory symptom prevalence at each background concentration level for each subject group nor in the correlation between average background concentration and respiratory symptom prevalence in each survey area for each subject group. An examination of odds ratios showed no significant correlation between air pollutants and asthma prevalence, either. The correlation between air pollutant concentrations and yearly changes in respiratory symptom prevalence was also examined, but the result showed no regions where air pollution may have caused an increase in asthma prevalence. A similar examination was conducted in regard to incidence rate (excluding an analysis of yearly changes), but again, no significant correlation was found between the two.

With respect to symptoms other than asthma, the frequency of catching a cold (more than five times) tended to increase with higher air pollutant concentrations (NO<sub>2</sub>, NO<sub>x</sub>), but the same trend was not observed with cases of wheezing (both associated and not associated with a cold).

## 2. Future Issues

A significant correlation between air pollution (SPM) and asthma has been observed in some previous surveys of 3-year-olds and 6-year-olds, but as with the surveys conducted year before last and last year, no significant correlation was observed in this year's survey. The result still cannot be seen as indicating a certain trend, but careful observations will be continued.

In response to an increasing social interest in the environmental quality standards for PM2.5 that were promulgated in September 2009, a continuous surveillance system is currently being developed, so based on the progress of its development, consideration will be given to including PM2.5 among the air pollutants that are observed in this survey, such as by estimating its background concentration in an experimental manner. Consideration will also be given to photochemical oxidants, which are causing concerns about possible health effects.

Meanwhile, as it has been pointed out in the report on the Epidemiologic Studies on Health Effects of Localized Air Pollution in Japan (SORA Project ; an initial letter of "Study On Respiratory disease and Automobile exhaust") that the scientific findings and results accumulated by the SORA Project should be utilized fully for even more effective surveillance, a working group has been established under the Council for Environmental Health Surveillance and Health Effects of Air Pollution in Japan in FY2012. The working group is presently pursuing its agenda, and will continue to engage in its activities hereafter.

### Attached materials

- FY2012 Annual Report of Environmental Health Surveillance for Air Pollution [PDF 460KB]
- <Reference> FY2012 Survey areas [PDF351KB]

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# FY2012 Annual Report of Environmental Health Surveillance for Air Pollution

## 1. Method

In both the 3-year-old survey and the 6-year-old survey, a health survey and exposure assessment were conducted as shown below, to analyze and assess the correlation between the concentration of air pollutants and prevalence of asthma and other respiratory symptoms.

In the follow-up analysis, the correlation between air pollutant concentration and asthma incidence was analyzed and assessed. Among the subjects of the FY2012 6-year-old survey implemented in 37 survey areas where a follow-up analysis was feasible, the analysis targeted those who also responded to a 3-year-old survey held in FY2008 and FY2009. Children who did not have asthma at the time of the 3-year-old survey but displayed asthma symptoms later at the time of the 6-year-old survey were deemed to have developed asthma.

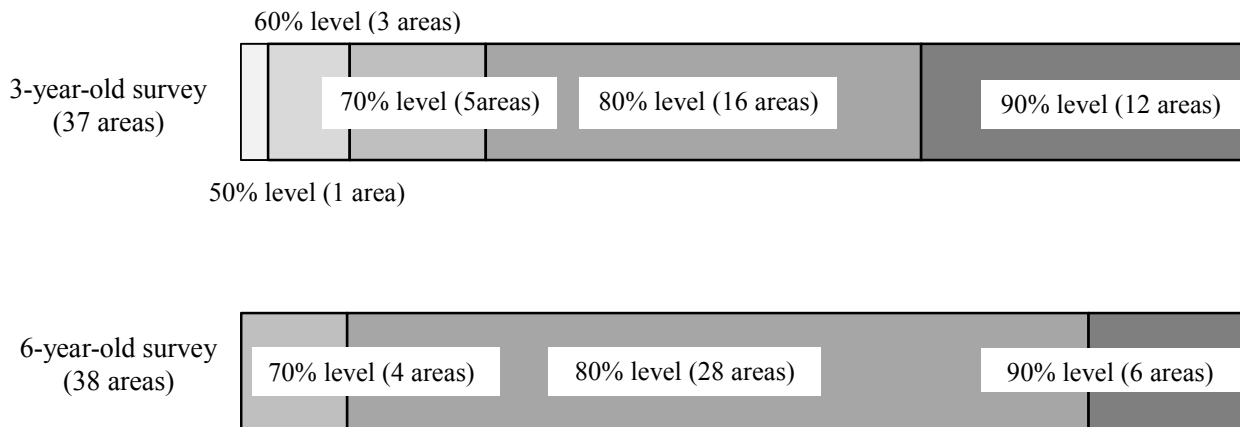
	3-year-old survey	6-year-old survey
Health survey	ATS-DLD simplified questionnaires (MOE version) were sent to all households with 3-year-old children in the survey areas. They were filled out by the children's parents and collected by staff of 37 local municipalities.	ATS-DLD simplified questionnaires (MOE version) were sent to all households with first-grade children who attend a public primary school in a school district that includes the survey area of the 3-year-old survey. They were filled out by the children's parents and collected by staff of 38 local municipalities.
Exposure assessment	Using the three-year average of annual average concentrations of NO <sub>2</sub> , NO <sub>x</sub> , SO <sub>2</sub> and SPM at ambient air pollution monitoring stations in and surrounding the study areas between FY2009 and FY2011, the concentration of these pollutants at residential points of all study subjects was estimated.	

## 2. Results

### (1) Number of children surveyed and response rate

The 3-year-old survey targeted 87,389 children and obtained 73,079 responses, corresponding to a response rate of 83.62%. The 6-year-old survey targeted 82,767 children and obtained 71,195 responses, corresponding to a response rate of 86.02%.

Response rate and number of areas



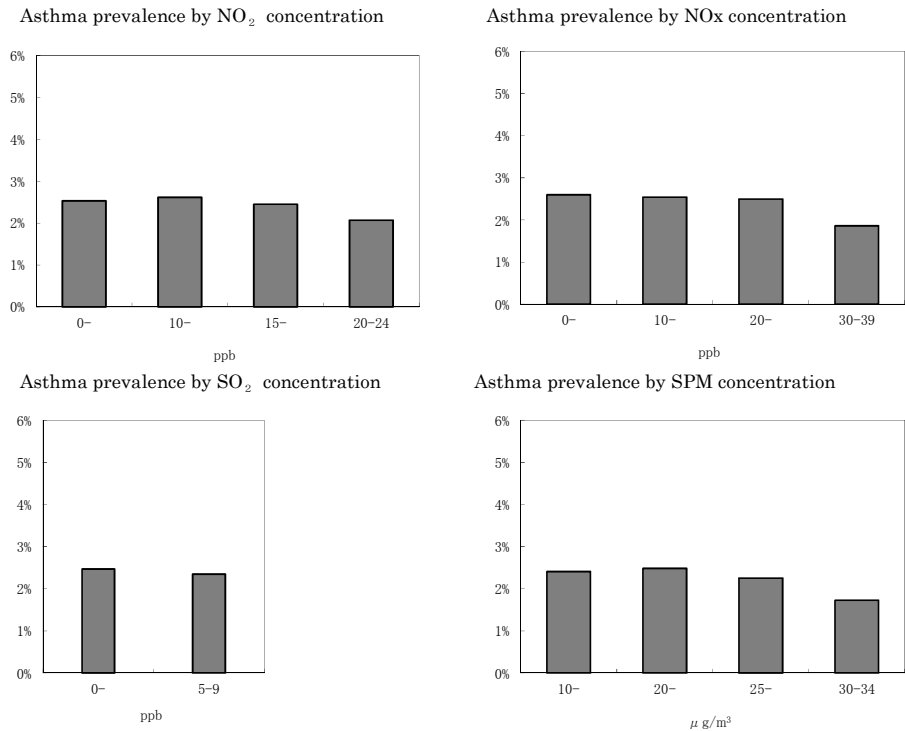
The follow-up analysis targeted 46,881 children, corresponding to 66.93% of the 70,042 respondents of the 6-year-old survey implemented in areas where a follow-up analysis was feasible.

**(2) Results of the cross-sectional analysis of the 3-year-old survey and 6-year-old survey**

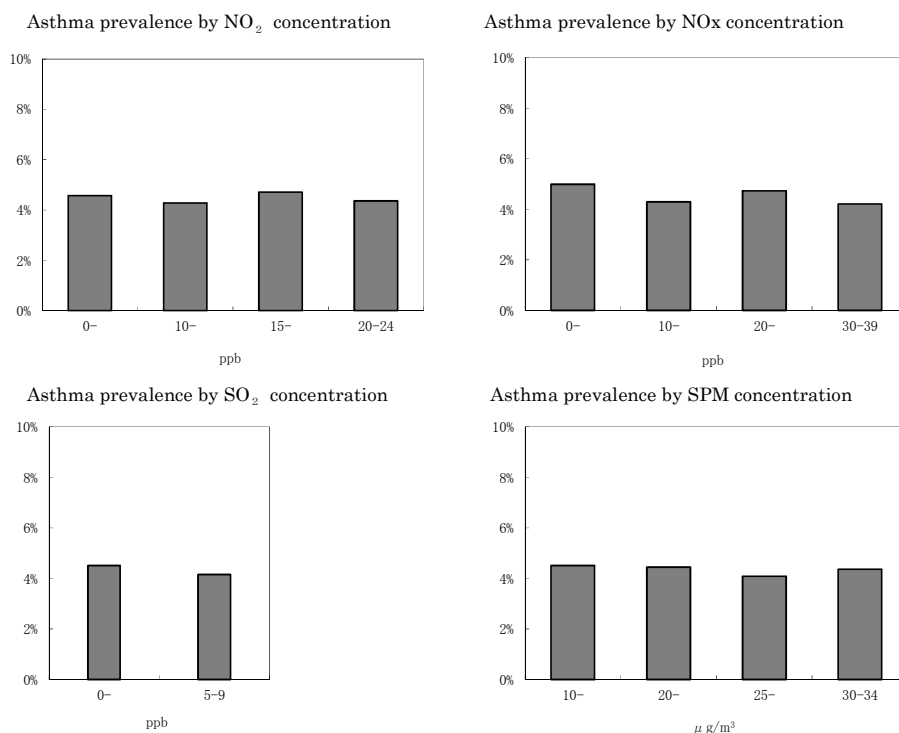
**1) Prevalence of respiratory symptoms at each background concentration level for each subject group**

The prevalence of respiratory symptoms was analyzed by background concentration level of air pollutants with respect to each subject group, but neither the 3-year-old survey nor the 6-year-old survey indicated a tendency for asthma prevalence to be higher in areas with higher background concentration levels.

**3-year-old survey**



**6-year-old survey**



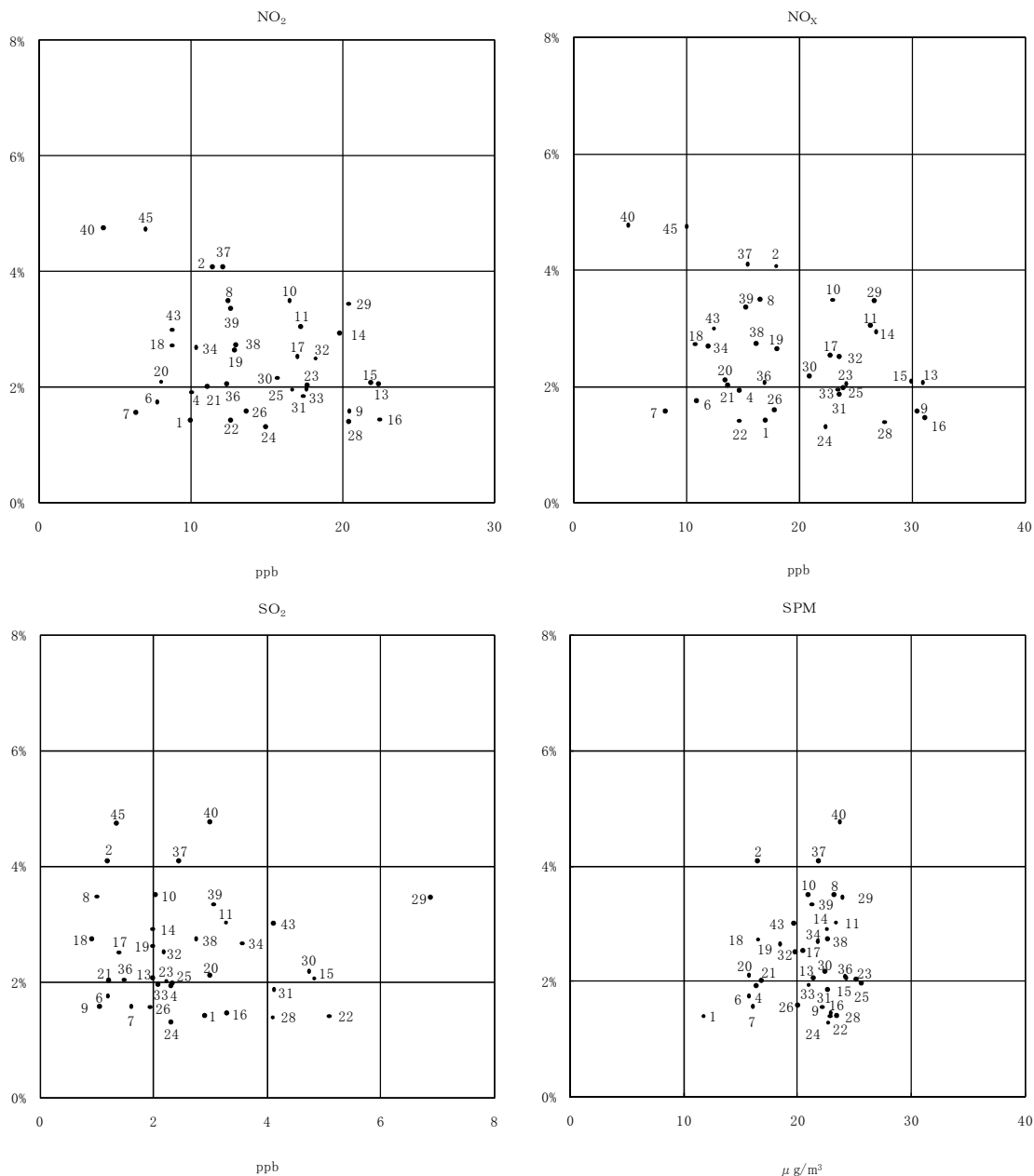
(Note) Background SPM concentration in Naha city was treated as missing, as SPM measurement results for FY2009 – 2011 could not be obtained from the Naha monitoring station (also applies to survey results shown below).

## 2) Average background concentration and respiratory symptom prevalence in each survey area for each subject group

The correlation between average background concentration and the prevalence of respiratory symptoms was analyzed by survey area with respect to each subject group, but neither the 3-year-old survey nor 6-year-old survey indicated a tendency for asthma prevalence to be higher in areas with higher air pollutant concentrations.

### 3-year-old survey

Correlation between air pollutant concentration and asthma prevalence (adjusted rates) – All subjects (boys + girls)

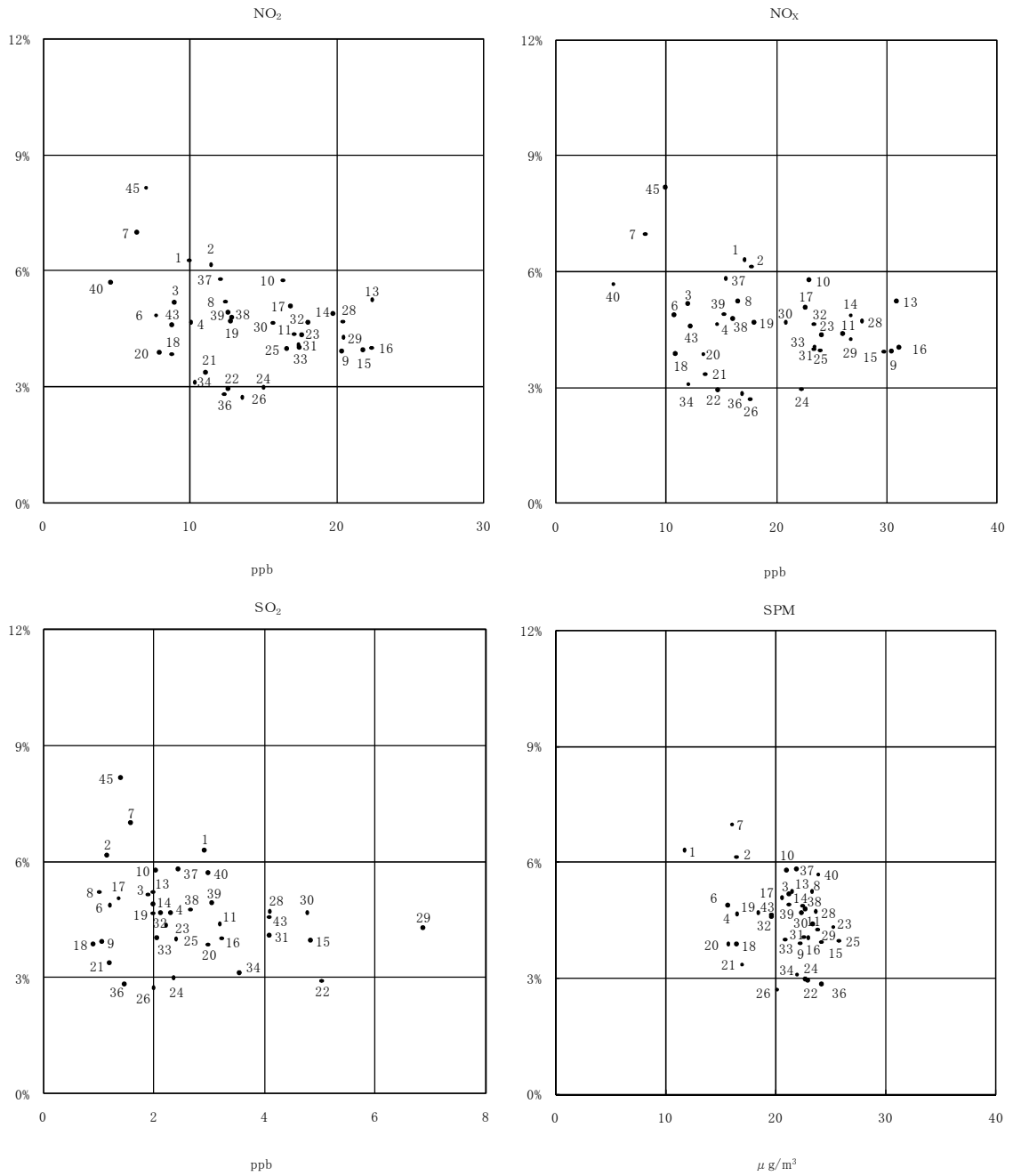


\*1 Numbers in the graph indicate survey areas. See <Reference> FY2012 Survey areas.

\*2 The adjusted rates are the prevalence of asthma after factoring in the allergic history of all subjects by the composition ratio of each type of allergy.

## 6-year-old survey

Correlation between air pollutant concentration and asthma prevalence (adjusted rates) –  
All subjects (boys + girls)



\*1 Numbers in the graph indicate survey areas. See <Reference> FY2012 Survey areas.

\*2 The adjusted rates are the prevalence of asthma after factoring in the allergic history of all subjects by the composition ratio of each type of allergy.

### 3) Study of factors influencing asthma prevalence

In the 3-year-old survey, the study indicated that the following factors contribute to the prevalence of asthma symptoms: gender (male), smoking habits of family members at home (mother), the presence of pets (present), daytime caretaker (nursery center), and allergic history of subject and parents (positive history). In the 6-year-old survey, the influencing factors were: gender (boys), smoking habits of family members (mother and other members), the presence of pets (present), method of feeding during the first 3 months after birth (milk only), and allergic history of the subject and parents (positive history).

Odds Ratios of Factors Influencing Asthma Prevalence

		3-year-old survey		6-year-old survey	
NO <sub>2</sub>	per 10ppb	0.90	*	0.93	
NO <sub>x</sub>	per 10ppb	0.93	*	0.96	
SO <sub>2</sub>	per 10ppb	1.12		0.81	
SPM	per 10μg/m <sup>3</sup>	1.10		0.94	
Gender	male	1.63~1.64	*	1.63	*
	female	1.00		1.00	
Smoking habits of family members	mother	1.62~1.68	*	1.55~1.57	*
	other member	1.07~1.10		1.24~1.25	*
	no smoker	1.00		1.00	
Housing structure	wooden with wooden frame	1.31~1.39		1.21~1.28	
	wooden with metal frame	0.92~0.98		0.97~1.02	
	reinforced concrete	1.00		1.00	
Heating method	no exhaust system	1.06~1.09		0.95~0.97	
	exhaust system	1.00		1.00	
Dwelling period	since birth	1.02~1.04		since birth	0.84
	more than 1 year	1.11~1.13		more than 3 years	0.81~0.82
	less than 1 year	1.00		less than 3 years	1.00
Pets	Yes	1.23~1.25	*	1.10~1.12	*
	No	1.00		1.00	
Daytime caretaker	Nursery center	1.49~1.52	*		
	Others	1.00			
Feeding during the first 3 months after birth	milk only	1.08~1.10		1.23	*
	breast feeding & milk	0.92		1.04~1.05	
	breast feeding only	1.00		1.00	
History of allergies (subject)	Yes	1.95~1.97	*	2.22~2.25	*
	No	1.00		1.00	
History of allergies (parents)	Yes	2.34~2.40	*	2.33~2.35	*
	No	1.00		1.00	

\* All odds ratios estimated for each air pollutant (NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, SPM) are statistically significant (P<0.05)

(Note 1) The numerical ranges shown in the above chart indicate the range between the minimum and maximum odds ratios that have been estimated for each air pollutant (NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, SPM).

(Note 2) To examine the correlation between asthma prevalence and major factors (items between “gender” and “history of allergies (parents)” above) in detail, odds ratios were estimated by logistic regression analysis using the major factors and air pollutant concentrations as explanatory variables.



### **(3) Longitudinal and comprehensive analysis of 3-year-old survey data\***

In the longitudinal analysis of data from FY1997 to FY2012, a number of survey areas showed an increase or decrease in asthma prevalence during that time period. In areas where asthma prevalence increased, no increases in the concentration of air pollutants were observed, but careful observations of any correlation between asthma prevalence and air pollution needs to be continued.

The result of comprehensive analysis of integrated data from FY1997 to FY2012 was also the same as the cross-sectional analysis. Neither the prevalence of respiratory symptoms at each background concentration level for each subject group, the correlation between average background concentration and respiratory symptom prevalence in each survey area for each subject group, nor the study of factors influencing such symptoms showed a tendency for asthma prevalence to be higher at higher air pollutant concentrations, as with the cross-sectional analysis

\* The data on asthma prevalence obtained in FY1996, the first year of the survey, was simply used as reference in the longitudinal and comprehensive analyses, because it showed values that were distinctly lower than data from other years.

### **(4) Longitudinal and comprehensive analysis of 6-year-old survey data**

In the longitudinal analysis of data from FY2004 to FY2012, a number of survey areas showed an increase or decrease in asthma prevalence during that time period. In areas where asthma prevalence increased, no increases in the concentration of air pollutants were observed, but careful observations of any correlation between asthma prevalence and air pollution needs to be continued.

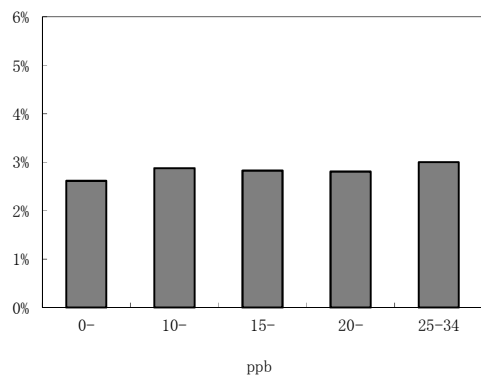
In the comprehensive analysis of integrated data from FY2004 to FY2012, the examination of the odd ratio yielded a ratio of 1.04 for asthma-related SPM (per increase of  $10\mu\text{g}/\text{m}^3$ ), but neither the prevalence of respiratory symptoms at each background concentration level for each subject group, nor the correlation between average background concentration and respiratory symptom prevalence in each survey area for each subject group showed a tendency for asthma prevalence to be higher at higher air pollutant concentrations.

## (5) Results of the follow-up analysis

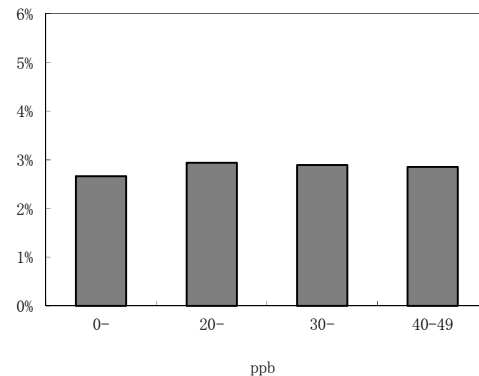
### 1) Asthma incidence at each background concentration level

Asthma incidence was analyzed by background concentration of air pollutants with respect to each subject group, but it did not necessarily tend to be higher at higher air pollutant concentrations.

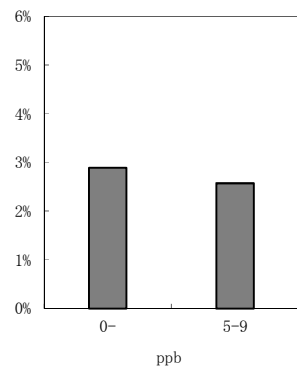
Asthma prevalence by NO<sub>2</sub> concentration



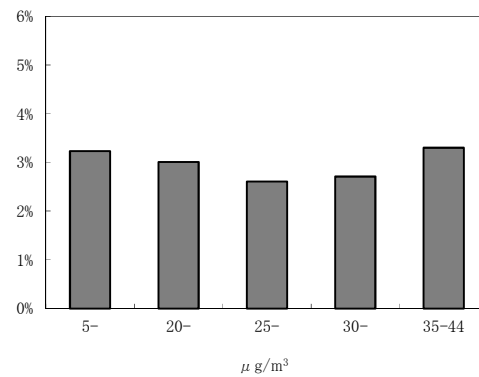
Asthma prevalence by NOx concentration



Asthma prevalence by SO<sub>2</sub> concentration



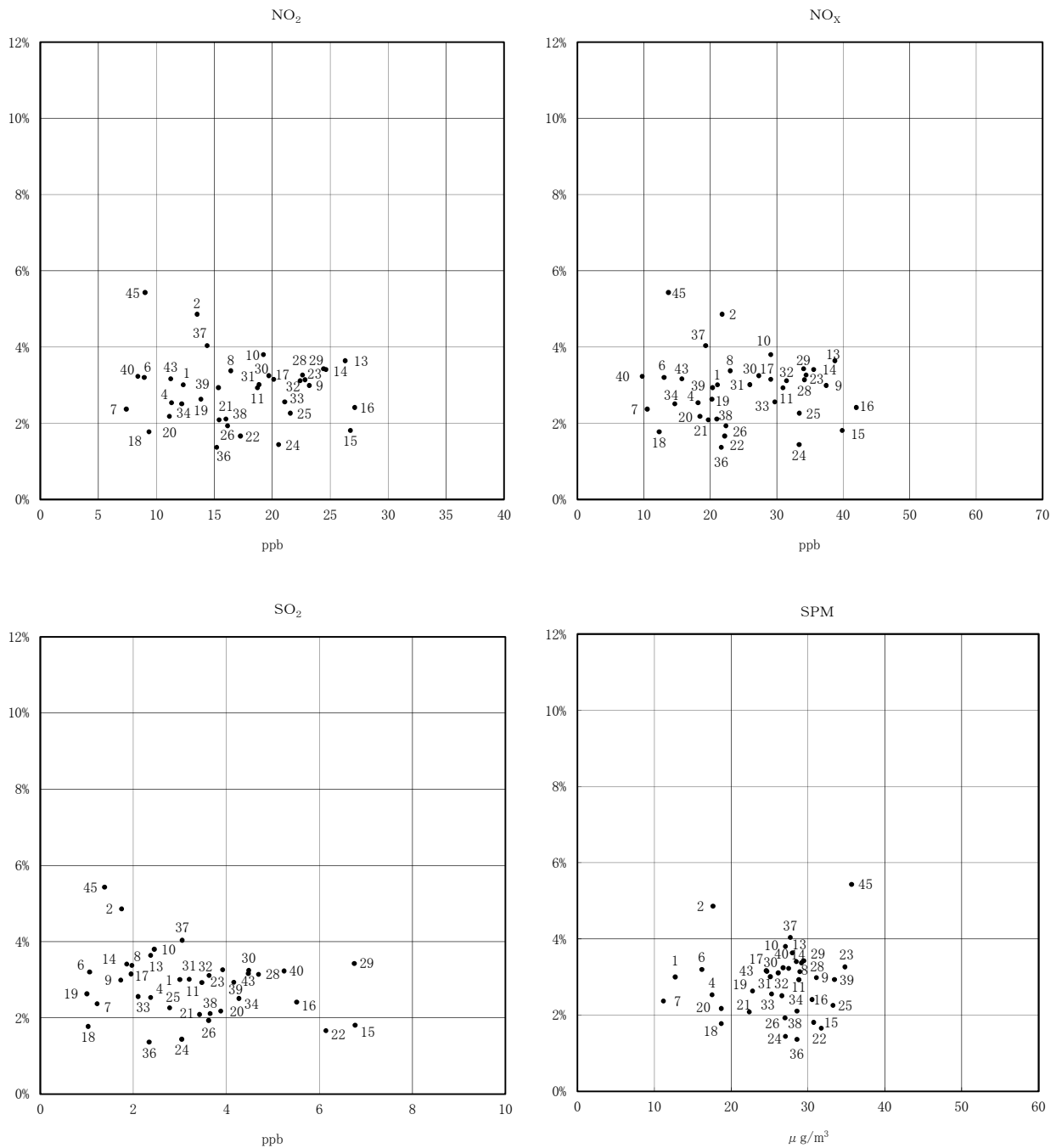
Asthma prevalence by SPM concentration



## 2) Average background concentration and asthma incidence in each survey area

The correlation between average background concentration and asthma incidence was analyzed by survey area with respect to each subject group, but asthma incidence did not tend to be higher in areas with higher air pollutant concentrations compared to areas with lower concentrations. In fact, some areas with low air pollutant concentrations had the same or higher incidence of asthma compared to areas with high air pollutant concentrations.

Correlation between air pollutant concentration and asthma incidence (adjusted rates) –  
All subjects (boys + girls)



\*1 Numbers in the graph indicate survey areas. See <Reference> FY2012 Survey areas..

\*2 The adjusted rates are the incidence of asthma after factoring in the allergic history of all subjects of the 3-year-old survey by the composition ratio of each type of allergy and the average of the follow-up analysis

\*3 The background concentration level for each subject group in each survey area was taken from the background concentration level measured at the time of the 3-year-old survey.

### 3) Study of factors influencing asthma incidence

The study indicated that the following factors contribute to the incidence of asthma: gender (male), smoking habits of family members (mother and other members), housing structure (wooden with wooden frame), the presence of pets (present), and allergic history of the subject and parents (positive history). However, it did not show any clear correlation between high air pollutant concentrations and high incidence rates.

Odds Ratios of Factors Influencing Asthma Incidence

NO <sub>2</sub>	per 10ppb	0.95	
NO <sub>x</sub>	per 10ppb	0.99	
SO <sub>2</sub>	per 10ppb	0.65	*
SPM	per 10μg/m <sup>3</sup>	0.96	
Gender	male	1.56	*
	female	1.00	
Smoking habits of family members	mother	1.33~1.35	*
	other member	1.18~1.19	*
	no smoker	1.00	
Housing structure	wooden with wooden frame	1.45~1.47	*
	wooden with metal frame	0.93~0.94	
	reinforced concrete	1.00	
Heating method	no exhaust system	0.93~0.94	
	exhaust system	1.00	
Address change	Change of address	1.08~1.09	
	Same address	1.00	
Pets	Yes	1.24	*
	No	1.00	
Daytime caretaker	Nursery center	0.92~0.93	
	Others	1.00	
Feeding during the first 3 months after birth	milk only	1.04~1.05	
	breast feeding & milk	0.97~0.98	
	breast feeding only	1.00	
History of allergies (subject)	Yes	1.91~1.92	*
	No	1.00	
History of allergies (parents)	Yes	1.91~1.92	*
	No	1.00	

\*All odds ratios estimated for each air pollutant (NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, SPM) are statistically significant (P<0.05)

(Note 1) The numerical ranges shown in the above chart indicate the range between the minimum and maximum odds ratios that have been estimated for each air pollutant (NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, SPM).

(Note 2) To examine the correlation between asthma prevalence and major factors (items between “gender” and “history of allergies (parents)” above) in detail, odds ratios were estimated by logistic regression analysis using the major factors and air pollutant concentrations as explanatory variables