Comparison of a 10-year cumulative age standardized incidence rate of lung cancer among metropolitan cities in Korea

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Background

According to the annual report of cancer statistics in South Korea in 2014, **lung cancer** is common in both males and females in Korea, and each metropolitan region shows different incidence rates. **Smoking** is known to be the most common cause of lung cancer making up about 80% of the cause. Others include genetic factors, history of respiratory infection, diet, occupational and environmental factors and so on. **We hypothesized that regional difference of lung cancer incidence may come from the environmental and occupational difference of each region.**

Aim

- To calculate the risk of lung cancer in each target area
- Look for the cause of regional difference in lung cancer risk

Methods

- Study subjects :1 January 2000 – 31 December 2009
- Korea National Cancer Incidence Database (KNCIDB)
- **C33, C34 based on ICD-10, 7 metropolitan cities**
- **Assessment of Occupational and environmental hazards**
- data of pollutant release and transfer register (PRTR)
- annual report of ambient air quality in Korea
- **smoking rate** : to adjust in analysis
- Analysis : comparison of lung cancer risk
- ANOVA: to compare concentration of pollutants
- Standardized Rate Ration (SRR): to compare risk of lung cancer among target regions
- Adjusted SRR (aSRR): smoking rate adjusted SRR, ratio of 10-year cumulative age-standardized incidence rate (ASR) of lung cancer from 2000 to 2009 in each 7 region versus that of total South Korea (reference region)

$$SRR^{*} = \frac{ASR_1(\text{age-standardized incidence rate of target area})}{ASR_2(\text{age-standardized incidence rate of reference area})}$$

*SRR: relative ratio of standardized rate for ASR1 versus ASR_2

Results

From the result, the **total amount of carcinogenic substance emission** was highest from 2001 to 2009 in **Ulsan** which means that the city with the highest environmental risk factors was Ulsan. Also, from 2000 to 2009, Ulsan showed the **highest ASR of the lung cancer** in all adults, males and females. Similarly, SRR and aSRR were significantly higher in both males and females in Ulsan.

Figure 1. The release of air pollutant (classified as IARC group 1, 2A, 2B) of metropolitan cities of Korea during 2001~2009

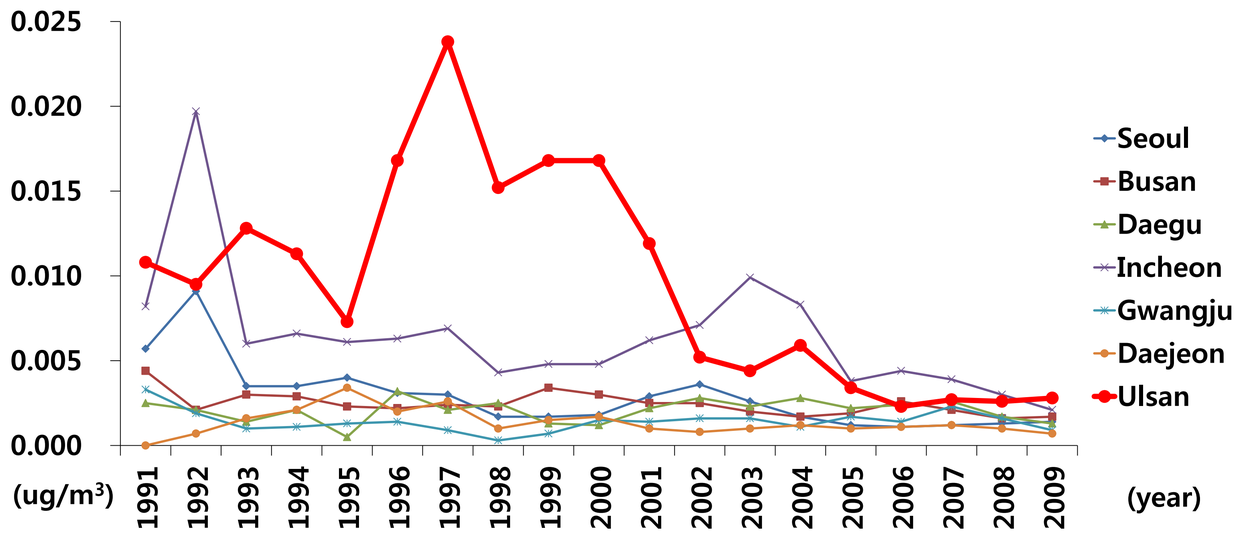

Figure 2. Annual averaged ambient concentration of cadmium during 1991~2009

Table 1. Annual emissions of heavy metals among metropolitan cities during 2001~2009

	Region	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean
Asbestos	Daegu	3,627	5,919	537	96	62	39	-	-	-	1,142
Arsenic	Ulsan	-	-	-	-	24	31	29	36	22	16
Chromium	Busan	475	748	456	1,697	2,329	341	127	153	434	751
	Daegu	-	-	2	63	133	302	105	84	78	85
	Incheon	-	-	9	612	668	2,403	1,391	454	637	686
	Gwangju	-	-	-	-	2	7	33	29	9	9
	Daejeon	-	-	-	16	16	227	841	765	278	238
	Ulsan	-	-	1	45	103	56	6	95	10	35
Nickel	Seoul	-	-	-	212	245	338	63	437	222	169
	Busan	-	2	-	184	221	84	61	70	75	77
	Daegu	-	-	-	524	237	177	189	239	31	155
	Incheon	-	1,362	21	7,173	7,207	272	328	246	177	1,865
	Gwangju	-	-	-	136	128	139	433	455	316	179
	Ulsan	-	-	-	16	30	38	18	11	1	13

Table 2. ASR, SRR, and aSRR of lung cancer among metropolitan cities in Korea during 2000~2009

	Region	Number	ASR*	SRR*	aSRR*	95% CI*
Male	Nation	120,265	50.1	1.000	1.000	
	Seoul	19,291	42.3	0.845	0.684	0.675-0.695
	Busan	8,425	46.9	0.937	1.208	1.181-1.237
	Daegu	5,858	52.7	1.053	1.114	1.084-1.145
	Incheon	5,154	48.7	0.972	1.087	1.056-1.118
	Gwangju	2,667	47.2	0.943	0.657	0.632-0.682
	Daejeon	2,770	47.3	0.945	0.898	0.865-0.933
	Ulsan	1,982	56.6	1.131	1.487	1.415-1.565
Female	Nation	45,629	13.7	1.000	1.000	
	Seoul	8,151	13.3	0.974	0.978	0.955-1.002
	Busan	3,278	13.2	0.962	0.961	0.928-0.995
	Daegu	2,355	14.7	1.075	1.064	1.018-1.110
	Incheon	2,013	13.6	0.995	0.998	0.953-1.044
	Gwangju	1,140	13.9	1.017	0.990	0.931-1.051
	Daejeon	1,064	13.0	0.953	0.954	0.898-1.013
	Ulsan	764	14.8	1.079	1.080	1.002-1.164

Abbreviation. ASR, age standardized ratio; SRR, standardized rate ratio; aSRR, adjusted standardized rate ratio; 95% CI, 95% confidence interval

Conclusions

By comparing the lung cancer risk, region with higher environmental risk factors, such as Ulsan, showed significantly elevated lung cancer risk. Based on the result of this study, it can be concluded that the **environmental factor** may have an impact on the lung cancer development. Furthermore, in this study, 10 year cumulative incidence, age-standardization and smoking rate adjustment were all taken into account which made the validity of this study higher than that of previous studies. Thus, it can be used as good reference data for the future study of cancer in Korea.

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