

# Current Status of Pneumoconiosis Patients in Korea

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This study identifies the number of pneumoconiosis patients after eliminating deceased patients between 2003 and 2008 as of January 1st and estimates it for the next five years. From 2003 to 2008, the pneumoconiosis patients were 16,929, 17,224, 17,366, 17,566, 17,542, and 17,546, respectively. The number of pneumoconiosis patients will have increased by 1,014 from 2008 to 18,560 in 2013 after applying the average change rates taken from 2003 to 2007. It takes 15-20 yr to develop coal workers' pneumoconiosis (the main cause in Korea) and patients will continue to be diagnosed with pneumoconiosis for some years to come since it has only been 20 yr since the decline of the coal mining industry in Korea. In addition, pneumoconiosis patients are increasing in industries in which the risk of pneumoconiosis was relatively low shows the necessity to improve dust-exposed workplace environments.

**Key Words:** Pneumoconiosis; Korea; Estimates of Pneumoconiosis

## INTRODUCTION

Pneumoconiosis was first reported in Korea as an occupational disease in 1954 and accounted for 72.7% of occupational diseases detected among active workers in 1987 by the Special Health Examination. Since then, the number of active workers with coal workers' pneumoconiosis (CWP) has fallen since the coal mining industry's decline in the late 1980s.

However, we still need to take an interest in pneumoconiosis developing in manufacturing industries, such as foundry, shipbuilding, and welding, since the number of workers in non-mining industries has been increasing (1). Pneumoconiosis can be diagnosed among workers who have worked in poor workplace environments two to three decades ago even though their work environments have improved. Pneumoconiosis can develop more than ten years after dust exposure and can progress without further exposure (2-5).

There was no exact epidemiological data for pneumoconiosis until 1998, when the study conducted by the Ministry of Employment and Labor first revealed that there were about 13,000 pneumoconiosis patients during 1992-1996 (6). Through the follow-up studies (7, 8) conducted by the Occupational Safety and Health Research Institute (OSHRI), the number of diagnosed pneumoconiosis patients rose steadily until 2002, starting with 12,942 patients in 1993. The number of at-risk patients (pneumoconiosis patients with a radiological profusion of 0/1) also increased, starting with 1,956 patients in 1993. Pneumoconiosis is incurable and it will remain as a major work-related disease for many years.

This study identifies the number of pneumoconiosis patients

as of January 1st each year between 2003 and 2008 and estimates cases over the next several years.

## MATERIALS AND METHODS

We collected all of the electronic data for special pneumoconiosis examinations provided by the Ministry of Employment and Labor and the Korea Workers' Compensation and Welfare Service (COMWEL) as of December 31st, 2007, and we also collected the data for the Special Examinations for Pneumoconiosis from the documents for compensation benefits obtained from the previous study (6). We then eliminated any redundant cases, and compared the electronic data with the original documents to correct for coding errors. Deceased patients and their dates of death were found by checking names and social security numbers with data from the National Statistics Office and the Ministry of Public Administration and Security.

We first eliminated patients who had died before January 1st, 2003. Then, we also eliminated the Special Examinations for Pneumoconiosis data after January 1st, 2003 for those who were alive as of that date. We defined those who had been diagnosed with pneumoconiosis with a radiological category higher than 0 (0/1) lastly before January 1st, 2003 as "Pneumoconiosis patients in 2003." The number of pneumoconiosis patients as of January 1st for each year from 2003 to 2008 was identified and analyzed by occupation, sex, age, and radiological category of each patient.

Occupational histories were divided based on the eligibility for the Act on the Prevention of Pneumoconiosis and Protection, Etc., of Pneumoconiosis Workers (APPPW) applied to

the mining of coal, metal ores (iron, tungsten, gold, silver, lead, and zinc), non-metal (graphite or talc), and quarrying (stone, sand, and gravel). Because more than 90% of pneumoconiosis patients were eligible for the APPPPW, about 200 pneumoconiosis patients each year whose occupational histories could not be found (accounting for about 1% of pneumoconiosis patients) were placed in the group that was eligible for the APPPPW.

Patients' ages were divided into five groups: under the age of 50, 50-59, 60-69, 70-79, and over the age of 80 (as of January 1st of each year). The radiological findings of pneumoconiosis were divided by the profusion of small opacity as Category 1 (1/0, 1/1, 1/2), Category 2 (2/1, 2/2, 2/3), and Category 3 (3/2, 3/3, 3/+), and in the presence of large opacity as Category 4 (4A, 4B, 4C). We then estimated the number of pneumoconiosis patients every year for the next five years (2009-2013) by applying the average change rates of pneumoconiosis cases between 2003 and 2007, which consisted of rates for the 16 groups composed of 2 groups of eligibility for the APPPPW, 2 gender, and 4 radiological category groups, consecutively to the number of corresponding groups of pneumoconiosis patients in the previous year. The estimation was done once more in the same manner by applying the average change rates of pneumoconiosis cases between 2006 and 2007.

## RESULTS

### The number of pneumoconiosis patients

The number of pneumoconiosis patients showed a continuous

increase until 2006 and a leveling off since then (Fig. 1). The number of at-risk patients also increased until 2006, and then decreased. The percentage of pneumoconiosis patients covered each year from 2003 to 2008 by the APPPPW were 94.2%, 94.1%, 93.9%, 93.7%, 93.6%, and 93.0%. The number of pneumoconiosis patients working in the other industries not covered by the APPPPW increased slightly during that time.

Most pneumoconiosis patients were male and the proportion of male pneumoconiosis patients was in the range of 97-98% annually. The age distribution of male pneumoconiosis patients in 2003 was 6.3% under the age of 50, 27.2% in their 50s, 50.8% in their 60s, 13.5% in their 70s, and 2.2% over the age of 80. In 2008, these numbers had shifted to 2.4% under 50, 18.3% in their 50s, 46.3% in their 60s, 28.0% in their 70s, and 5.0% over 80. Those

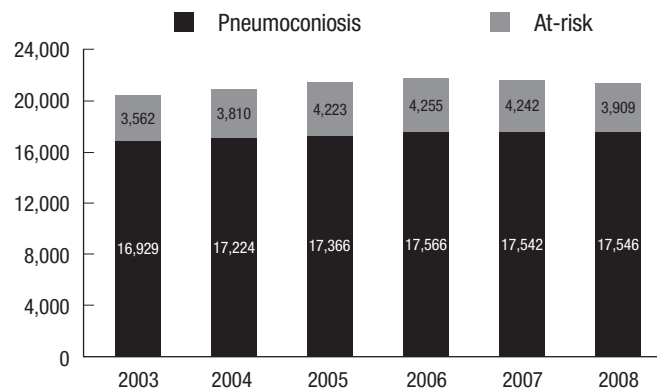


Fig. 1. The number of pneumoconiosis and at-risk patients between 2003 and 2008 as of January 1st.

Table 1. The distribution of pneumoconiosis patients who are eligible for APPPPW\* as of January 1st, 2008 categorized by gender, age, and radiological category (%)

Gender	Age (yr)	Radiological category					Total†
		At-risk (0/1)	1	2	3	4	
Male	-49	152	202 (68.7) (2.3)	72 (24.5) (1.8)	6 (2.0) (0.8)	14 (4.8) (0.6)	294 (100.0) (1.8)
	50-59	857	1,806 (64.7) (20.4)	637 (22.8) (16.0)	83 (3.0) (11.3)	264 (9.5) (11.1)	2,790 (100.0) (17.5)
	60-69	1,409	4,143 (55.8) (46.8)	1,886 (25.4) (47.4)	309 (4.2) (42.2)	1,080 (14.6) (45.2)	7,418 (100.0) (46.5)
	70-79	765	2,304 (49.9) (26.0)	1,181 (25.6) (29.7)	260 (5.6) (35.5)	874 (18.9) (36.6)	4,619 (100.0) (29.0)
	80-	137	402 (48.1) (4.5)	202 (24.2) (5.1)	75 (9.0) (10.2)	156 (18.7) (6.5)	835 (100.0) (5.2)
	Total	3,320	8,857 (55.5) (100.0)	3,978 (24.9) (100.0)	733 (4.6) (100.0)	2,388 (15.0) (100.0)	15,956 (100.0) (100.0)
Female	-49	0	1 (100.0) (0.3)	0 (0.0) (0.0)	0 (0.0) (0.0)	0 (0.0) (0.0)	1 (100.0) (0.3)
	50-59	21	15 (100.0) (5.2)	0 (0.0) (0.0)	0 (0.0) (0.0)	0 (0.0) (0.0)	15 (100.0) (4.2)
	60-69	117	125 (84.5) (43.0)	15 (10.1) (31.3)	1 (0.7) (25.0)	7 (4.7) (43.8)	148 (100.0) (41.2)
	70-79	72	123 (76.9) (42.2)	27 (16.9) (56.3)	2 (1.2) (50.0)	8 (5.0) (49.9)	160 (100.0) (44.6)
	80-	11	27 (77.1) (9.3)	6 (17.1) (12.4)	1 (2.9) (25.0)	1 (2.9) (6.3)	35 (100.0) (9.7)
	Total	221	291 (81.1) (100.0)	48 (13.4) (100.0)	4 (1.1) (100.0)	16 (4.4) (100.0)	359 (100.0) (100.0)

\*Act on the Prevention of Pneumoconiosis and Protection, etc., of Pneumoconiosis Workers; †Sum of categories 1, 2, 3, and 4.

over the age of 60 accounted for 79.3% of the patients in 2008.

The distribution of male pneumoconiosis patients in 2003 in the four radiological categories was 56% in Category 1, 26.6% in Category 2, 5.9% in Category 3, and 11.5% in Category 4 (large opacity). In 2008, the distribution in the four categories was 56.5%, 24.4%, 4.4%, and 14.7%, respectively. The proportion of patients in Category 2 and Category 3 decreased, but the proportion of patients in Category 4 increased. The distribution of pneumoconiosis patients in 2008 categorized by eligibility for the APPPPW, gender, age, and radiological category is shown in Tables 1, 2.

### The change rate for pneumoconiosis patients

The change rate of male pneumoconiosis patients who worked in the industries eligible for the APPPPW, accounting for 90.9% of pneumoconiosis patients in 2008, was 1.5% in 2003, 0.6% in 2004, and 0.9% in 2005. This upward trend then reversed, with a decrease of 0.3% in 2006 and 0.7% in 2007. From 2003 to 2007, the rate of change in the number of pneumoconiosis Category 1 patients showed no consistent upward or downward trend. However, the change rates in Category 2 and Category 3 showed a downward trend; in addition, the rate of change in the number of Category 4 (large opacity) patients was upward.

The change rate of female pneumoconiosis patients who worked in the industries covered by the APPPPW accounting for 2.1% of pneumoconiosis cases in 2008, was 7.7% in 2003, 1.5% in 2004 and 2005, 1.7% in 2006, and 2.3% in 2007. The rate of change in the number of Category 1 patients and Category 2

patients increased continuously, but the rate of change for Category 3 patients showed a steep decline. The rate of change in the number of Category 4 patients was inconsistent.

The change rate of male pneumoconiosis patients who worked in the industries not covered by the APPPPW, accounting for 6.7% of pneumoconiosis cases in 2008, was 2.9% in 2003, 3.5% in 2004, 5.2% in 2005, 0.9% in 2006, and 9.2% in 2007. The rate of change in the number of pneumoconiosis patients in Category 1 and Category 2 showed a general increase. The rate of change in the number of Category 3 patients was on the decline until it increased sharply in 2007. The rate of change in the number of Category 4 patients showed a continuous increase.

The change rate of female pneumoconiosis patients who worked in the industries not covered by the APPPPW, accounting for 0.3% of pneumoconiosis cases in 2008, was 5.3% in 2003, 10.0% in 2004, 9.1% in 2005, 8.3% in 2006, and 7.7% in 2007. The rate of change in the number of pneumoconiosis Category 1, Category 2, and Category 4 showed a continuous increase. The rate of Category 3 patients did not change.

Between 2003 and 2007, the average annual rate of change of pneumoconiosis patients covered by the APPPPW was 0.4% in males and 2.9% in females (Fig. 2A), and the rate of change of patients not covered by the APPPPW was 4.4% in males and 8.1% in females (Fig. 2B). However, considering that the number of male pneumoconiosis patients covered by the APPPPW accounted for more than 90% of pneumoconiosis patients and decreased in 2007 and 2008, the average annual rate of change in the number of pneumoconiosis patients covered by the AP-

**Table 2.** The distribution of pneumoconiosis patients who are not eligible for APPPPW\* as of January 1st, 2008 categorized by gender, age, and radiological category (%)

Gender	Age (yr)	Radiological category					Total <sup>†</sup>
		At-risk (0/1)	1	2	3	4	
Male	-49	25	75 (60.5) (9.3)	15 (12.1) (7.2)	4 (3.2) (18.2)	30 (24.2) (22.4)	124 (100.0) (10.6)
	50-59	125	246 (70.9) (30.3)	58 (16.7) (27.9)	6 (1.7) (27.3)	37 (10.7) (27.6)	347 (100.0) (29.5)
	60-69	156	366 (72.5) (45.1)	92 (18.2) (44.2)	7 (1.4) (31.8)	40 (7.9) (29.8)	505 (100.0) (43.0)
	70-79	43	119 (64.3) (14.7)	38 (20.6) (18.3)	5 (2.7) (22.7)	23 (12.4) (17.2)	185 (100.0) (15.7)
	80-	2	5 (35.7) (0.6)	5 (35.7) (2.4)	0 (0.0) (0.0)	4 (28.6) (3.0)	14 (100.0) (1.2)
	Total	351	811 (69.0) (100.0)	208 (17.7) (100.0)	22 (1.9) (100.0)	134 (11.4) (100.0)	1,175 (100.0) (100.0)
Female	-49	1	0 (0.0) (0.0)	0 (0.0) (0.0)	0 (0.0) (0.0)	1 (100.0) (14.3)	1 (100.0) (1.8)
	50-59	5	13 (92.9) (32.5)	0 (0.0) (0.0)	0 (0.0) (0.0)	1 (7.1) (14.3)	14 (100.0) (25.0)
	60-69	8	17 (65.4) (42.5)	5 (19.2) (71.4)	0 (0.0) (0.0)	4 (15.4) (57.1)	26 (100.0) (46.4)
	70-79	3	10 (66.7) (25.0)	2 (13.3) (28.6)	2 (13.3) (100.0)	1 (6.7) (14.3)	15 (100.0) (26.8)
	80-	0	0 (-) (0.0)	0 (-) (0.0)	0 (-) (0.0)	0 (-) (0.0)	0 (-) (0.0)
	Total	17	40 (71.4) (100.0)	7 (12.5) (100.0)	2 (3.6) (100.0)	7 (12.5) (100.0)	56 (100.0) (100.0)

\*Act on the Prevention of Pneumoconiosis and Protection, etc., of Pneumoconiosis Workers; <sup>†</sup>Sum of categories 1, 2, 3, and 4.

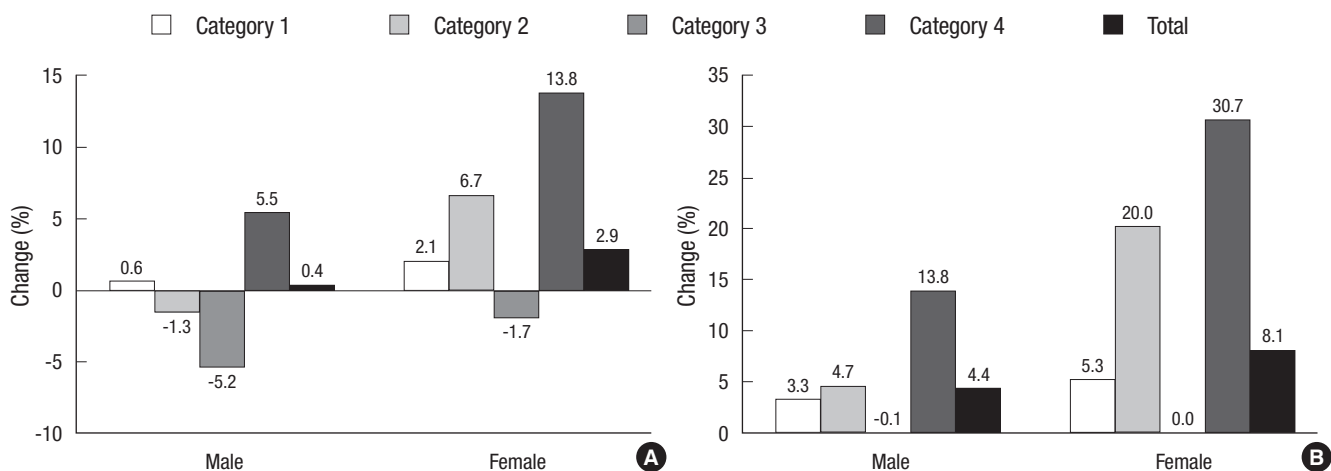


Fig. 2. The average annual rate of change of pneumoconiosis patients between 2003 and 2007 (A) APPPPW\* applied, (B) APPPPW\* not applied. \*Act on the Prevention of Pneumoconiosis and Protection, etc., of Pneumoconiosis Workers.

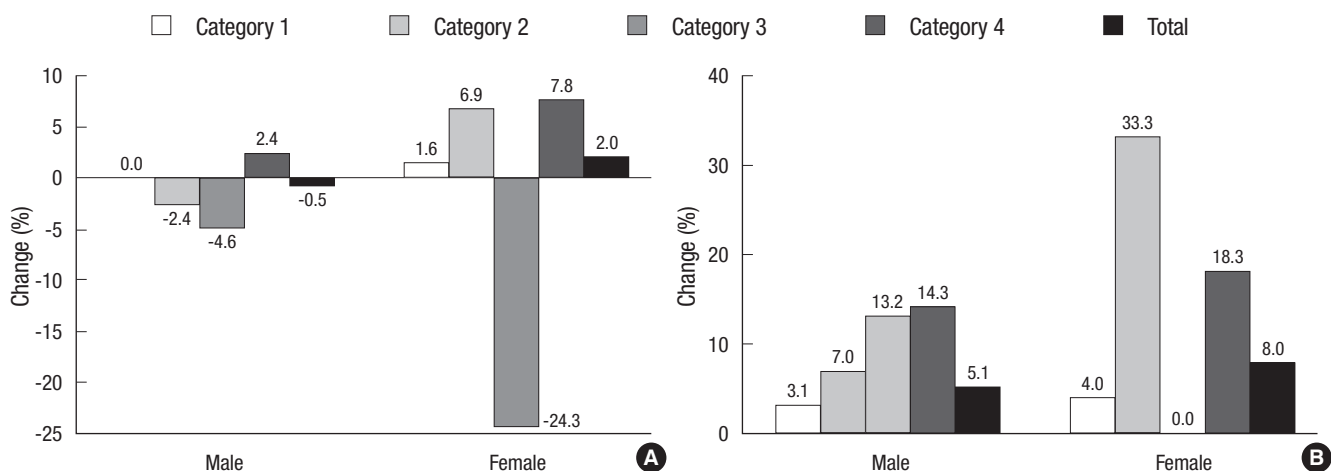


Fig. 3. The average annual rate of change of pneumoconiosis patients during 2006 and 2007 (A) APPPPW\* applied, (B) APPPPW\* not applied. \*Act on the Prevention of Pneumoconiosis and Protection, etc., of Pneumoconiosis Workers.

PPPW during 2006 and 2007 was -0.5% in males and 2.0% in females (Fig. 3A). The change in the rate of pneumoconiosis patients not covered by the APPPPW was 5.1% in males and 8.0% in females (Fig. 3B).

**Pneumoconiosis patients estimates**

The number of male and female pneumoconiosis patients covered by the APPPPW in 2013 (after applying the average change rates taken from 2003 to 2007) will have increased by 587 from 15,956 in 2008 and increased by 65 from 359 in 2008, respectively (Table 3). Accordingly, from 2009 to 2013, the number of pneumoconiosis patients covered by the APPPPW will be 16,423, 16,542, 16,672, 16,814, and 16,967, respectively.

The number of male and female pneumoconiosis patients not covered by the APPPPW in 2013 will have increased by 320 from 1,175 in 2008 and increased by 42 from 56 in 2008, respectively. Accordingly, from 2009 to 2013, the number of pneumoconiosis patients not covered by the APPPPW will be 1,292, 1,358,

1,429, 1,507, and 1,593, respectively.

The number of male and female pneumoconiosis patients covered by the APPPPW in 2013, (after applying the average change rates taken from 2006 and 2007) will have decreased by 285 from 15,956 in 2008 and increased by 47 from 359 in 2008 (Table 4). Accordingly, from 2009 to 2013, pneumoconiosis patients covered by the APPPPW will number 16,256, 16,203, 16,156, 16,114, and 16,077, respectively.

The number of male and female pneumoconiosis patients not covered by the APPPPW in 2013 will have increased by 366 from 1,175 in 2008 and increased by 40 from 56 in 2008, respectively. Accordingly, from 2009 to 2013, the number of pneumoconiosis patients not covered by the APPPPW will be 1,298, 1,371, 1,452, 1,541, and 1,637, respectively.

**DISCUSSION**

The Ministry of Employment and Labor has electronic data for

**Table 3.** The estimates of pneumoconiosis patients from 2009 to 2013 applying an annual average change rate taken from 2003 to 2007

Gender	APPPPW*	Radiological category	2009	2010	2011	2012	2013
Male	Applied	1	8,910	8,963	9,016	9,070	9,124
		2	3,927	3,877	3,828	3,780	3,731
		3	695	658	624	591	560
		4	2,520	2,660	2,808	2,963	3,128
		Total <sup>†</sup>	16,052	16,159	16,276	16,404	16,543
	Not applied	1	838	866	895	925	955
		2	218	228	239	250	262
		3	22	22	22	22	22
		4	152	173	197	225	256
		Total <sup>†</sup>	1,230	1,290	1,353	1,421	1,495
Female	Applied	1	297	304	310	317	324
		2	51	55	58	62	66
		3	4	4	4	4	4
		4	18	21	24	27	31
		Total <sup>†</sup>	371	383	396	410	424
	Not applied	1	42	44	47	49	52
		2	8	10	12	15	17
		3	2	2	2	2	2
		4	9	12	16	20	27
		Total <sup>†</sup>	62	68	76	86	98

\*Act on the Prevention of Pneumoconiosis and Protection, etc., of Pneumoconiosis Workers; <sup>†</sup>Total may not be the sum of categories 1, 2, 3, and 4 due to rounding.

**Table 4.** The estimates of pneumoconiosis patients from 2009 to 2013 applying an annual average change rate taken from 2006 to 2007

Gender	APPPPW*	Radiological category	2009	2010	2011	2012	2013
Male	Applied	1	8,861	8,865	8,869	8,873	8,877
		2	3,884	3,792	3,703	3,615	3,530
		3	699	667	636	606	578
		4	2,445	2,503	2,562	2,623	2,686
		Total <sup>†</sup>	15,889	15,827	15,770	15,718	15,671
	Not applied	1	836	863	890	918	946
		2	223	238	255	273	292
		3	25	28	32	36	41
		4	153	175	200	229	262
		Total <sup>†</sup>	1,237	1,304	1,377	1,456	1,541
Female	Applied	1	296	300	305	310	315
		2	51	55	59	63	67
		3	3	2	2	1	1
		4	17	19	20	22	23
		Total <sup>†</sup>	367	376	386	396	406
	Not applied	1	42	43	45	47	49
		2	9	12	17	22	29
		3	2	2	2	2	2
		4	8	10	12	14	16
		Total <sup>†</sup>	61	67	75	85	96

\*Act on the Prevention of Pneumoconiosis and Protection, etc., of Pneumoconiosis Workers; <sup>†</sup>Total may not be the sum of categories 1, 2, 3, and 4 due to rounding.

all Special Examinations for Pneumoconiosis after the APPPPW went into effect, but the workers who had left work before its enactment should have had the Special Examinations for Pneumoconiosis covered by the Industrial Accident Compensation Insurance (IACI) Act. Only workers who were determined eligible for disability benefits by the IACI Act examinations were qualified to have the health examinations offered to retired workers eligible for the APPPPW. Because the eligible disability grade of 13 (pneumoconiosis with Category 1 but no impairment of cardiopulmonary function) was not made until July 1st, 2003, some diagnosed pneumoconiosis patients with Category 1 could be missing from the Ministry of Employment and Labor's electron-

ic data, depending on the time of the diagnosis.

COMWEL has electronic data for Special Examinations for Pneumoconiosis. Data for the Special Examinations for Pneumoconiosis was recorded as of April 1st, 1995, when tasks related to the IACI Act were transferred from the Ministry of Employment and Labor to COMWEL. Data for the Special Examinations for Pneumoconiosis conducted prior to April 1st, 1995 were not recorded. As a result, it is not possible to identify patients who were diagnosed with pneumoconiosis prior to April 1st, 1995 with the electronic data from COMWEL. This is especially true of the data for retirees who had worked in the mining industries that were eligible for the APPPPW before the APPPPW was made,



had been diagnosed with pneumoconiosis Category 1 without impairment of cardiopulmonary function prior to April 1st, 1995, and had not received the Special Examination for Pneumoconiosis after April 1st, 1995. Data for these patients could be missing from the electronic data for both the Ministry of Employment and Labor and COMWEL. To identify these cases, it was necessary to check the documents of compensation benefits.

Unlike previous studies (6-9), this is the first study to find that the number of pneumoconiosis patients has recently stopped increasing and reached a stable level. The number of pneumoconiosis patients in this study was based on the number of existing pneumoconiosis patients with the number of deceased patients being eliminated and the number of newly diagnosed patients being added. So, the number of deceased pneumoconiosis patients (629 in 2003, 659 in 2004, 687 in 2005, 713 in 2006, and 692 in 2007) and the increase in the number of pneumoconiosis patients (295 in 2004, 142 in 2005, 200 in 2006, -24 in 2007, and 4 in 2008) were combined, respectively. The combined total was the number of newly diagnosed pneumoconiosis patients each year: 924 in 2003, 801 in 2004, 887 in 2005, 689 in 2006, and 696 in 2007. Based on these estimates, about 700 patients were still developing pneumoconiosis each year even though the number of newly diagnosed pneumoconiosis patients was in general decline.

It takes an average of 14 yr for coal mining workers to develop at-risk pneumoconiosis (10), and 4.6 yr to advance from at-risk to Category 1, 6.3 yr to advance from Category 1 to Category 2, 5.7 yr to advance from Category 2 to Category 3, and 6.3 yr to advance from Category 3 to Category 4 (large opacity) (11). It takes an average of 22.9 yr for at-risk pneumoconiosis patients to advance to pneumoconiosis Category 4. Because it has only been 20 yr since the coal mining industry's decline, patients will continue to be diagnosed with pneumoconiosis for some years. We can further expect continued diagnoses based on our awareness of the 3,900 at-risk pneumoconiosis patients in 2008, despite the rate of change in the number of at-risk patients that has recently stagnated.

The average change rates of pneumoconiosis in the industries not covered by the APPPPW (in which there was a lower risk of developing pneumoconiosis) were higher compared to the average change rates in the industries covered by the APPPPW. This represented 0.4% in males and 2.9% in females in the industries covered by the APPPPW versus 4.4% in males and 8.1% in females in the industries not covered by the APPPPW.

Pneumoconiosis patients were increasing in industries such as non-metal mining, manufacturing, and services, in which the risk of pneumoconiosis was relatively low. It means that new patients have been diagnosed recently who could not have had early detection examinations for pneumoconiosis in the past, even though pneumoconiosis could develop from their work related conditions. An easier diagnosis of pneumoconiosis is a

positive development; however, it also means that further efforts are needed to prevent pneumoconiosis in those industries.

Unlike the change rate of pneumoconiosis patients covered by the APPPPW, the change rate of pneumoconiosis patients not covered by the APPPPW for 2006 and 2007, was 5.1% in males and 8.0% in females. This is nearly identical to the increase rate taken from 2003 to 2007. The goal of reducing the number of pneumoconiosis cases remains unrealized, although there have been many efforts to prevent occupational diseases since the Occupational Safety and Health Act was passed in the early 1980s and the subsequent improvement of dust-exposed workplace environments.

As in previous studies (6-9), the proportion of older (over 60) pneumoconiosis patients was found to have increased sharply. In 2008, the proportion of male pneumoconiosis patients over the age of 60 had more than doubled to 79.3% from the 1997 proportion of 38.5% (9). In females, it rose from 54.8% to 92.5% during the same time. As pneumoconiosis patients age, various chronic diseases that increase in prevalence with aging (hypertension, diabetes mellitus, degenerative arthritis, and many kinds of malignant tumors) can develop. The presence of these other chronic diseases in many of the older pneumoconiosis patients makes it difficult to determine if the cause of death is work-related. It also indicates that the number of deceased pneumoconiosis patients will increase quickly after a certain point in time.

This study reveals the seriousness of pneumoconiosis. The proportion of radiological pneumoconiosis in Category 2 and Category 3 in male patients decreased from 30.5% and 7.8% in 1997 to 24.4% and 4.4% in 2008, respectively (9); however, the proportion of large opacity increased from 10.1% to 14.7% in 2008. A similar trend was also found in female pneumoconiosis patients. The proportion of Category 2 and Category 3 in female patients decreased from 15.6% and 4.0% to 13.3% and 1.4%, respectively; however, the proportion of large opacity increased from 1.0% to 5.5%. This supports the idea that pneumoconiosis is known to progress without further dust exposure (2-5).

According to the data as of December 31st, 2007 from COMWEL, there are 3,734 pneumoconiosis patients (21.3% of pneumoconiosis patients) receiving medical care benefits. A total of 71.0% have been receiving benefits for more than 3 yr (55.0% for more than 5 yr and 23.3% for more than 10 yr). Because patients receiving medical care benefits do not have the Special Examinations for Pneumoconiosis, there is a possibility that their radiological categories of pneumoconiosis have advanced further than those at the time of diagnosis. This would mean that, for radiological categories, the number of patients with advanced pneumoconiosis would be greater than the estimates from this study.

In male pneumoconiosis patients, the proportion of Category 1 (unlike Category 2 and Category 3) has increased from 51.6%

to 56.5% and in females, it has continued to remain at a high level (79.4%-79.8%). Considering that the proportion of patients in Category 2 and Category 3 has decreased, the number of pneumoconiosis patients newly diagnosed with Category 1 and patients who have progressed from at-risk pneumoconiosis to Category 1 is higher than the number of pneumoconiosis patients who have progressed from Category 1 to Category 2 and Category 3. Because the number of newly diagnosed patients with Category 1 is increasing, pneumoconiosis patients will not decline for a considerable period considering that there were still 3,900 at-risk patients in 2008, although there is a downward trend in the number of at-risk pneumoconiosis patients.

In 2013, the number of pneumoconiosis patients (after applying the average change rates taken from 2003 to 2007) will have increased by 1,014 to 18,560 from 2008. The number of pneumoconiosis patients, even after applying the stagnant average change rates taken from 2006 and 2007, will have increased by 168 to 17,714. Pneumoconiosis will remain a major occupational disease for a considerable period of time, even though it is generally considered a disappearing disease.

More than 20 yr have passed since the decline of the coal mining in Korea. Only seven coalmines (in which most pneumoconiosis cases were developed) that employ 5,700 workers remain and the number of those at risk for pneumoconiosis will decrease. Most pneumoconiosis patients are retired workers. The number of deceased patients will increase as pneumoconiosis patients continue to age and their diseases worsen. The downward trend in male patients covered by the APPPPW as of 2006 will continue, but it will take a long time for this trend to be linked to the decrease in the number of overall pneumoconiosis patients. The number of pneumoconiosis patients will remain at a similar level for a considerable period and it is necessary to remain attentive to the compensation needs for pneumoconiosis patients as well as the quality control of their medical care.

The number of pneumoconiosis patients in this study was smaller than the number in a previous study (9). The difference resulted from the corrections made for coding errors by comparing the electronic data since 2004 with the original documents from the Ministry of Employment and Labor and COMWEL. This difference also resulted from the elimination of deceased patients based on data from the National Statistics Office as well as the electronic data recorded by the Ministry of Public Administration and Security. Through this information, we were able to find information on patients who had died prior to 1991. Moreover, pneumoconiosis patients who were thought to be

alive (and were included in patient numbers) in the previous study (because of the late notification of death) may have died by the time this study was conducted. Therefore, the number of pneumoconiosis patients for the most recent 2-3 yr might be larger than the real number of patients; however, this study is the most accurate to date.

In conclusion, patients will continue to be diagnosed with pneumoconiosis for some years to come because it is known to take 15-20 yr for coal workers' pneumoconiosis to develop (the main pneumoconiosis in Korea) and that it has only been 20 yr since the decline of the coal mining industry. In addition, pneumoconiosis patients have increased in industries in which the risk of pneumoconiosis was previously relatively low and it has now become imperative to improve all dust-exposed workplace environments.

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