

High Mortality And Relevant Factors Among Migant Workers

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ABSTRACT

We investigated morbidity and mortality among migrant workers, and clarified the relevant factort of death.

Questionnaires on occupational pattern were sent to all male inhabitants aged 30 or over in an area that supplies many migrant workes. Respondents were followed up for more than 10 years. Among those who died, the cause and dates of death were confirmed by death certificates.

41 % of respondents had worked as migrant workers. 69 % of these had worked on the job with exposure to dust such as tunnel construction. Silicosis was found in 85 % of them. Most of the patients retired and returned to their home towns without having been given any diagnosis and medical care at their places of employment.

The standardized mortality ratio for migrant workers exposed to dust, calculated using all the Japanese male population as the referent population, was significantly higher than that for non-migrant workers not exposed to dust. The duration of migrant work exposed to dust, smoking habits and some respiratory symptoms were independently predictive of mortality.

INTRODUCTION

Protection and therapies againt pneumoconiosis are provided in Japan under the Pneumoconniosis Law of 1960 that followed the Special Act for Protection of Workers from Silicosis and Other Pneumoconiosis enacted in 1955. Legislative measures against Pneumoconiosis were the earliest to be introduced and are considered to be the most advanced for the various occupa-

tional diseases in Japan. However, the Labor Ministry statistics showed an increase in new cases awarded compensation for total disability due to pneumoconiosis in 1970 particularly among workers engaged in tunnel construction (Fig. 1). In addition, an increase in the numbers pneumoconiosis patients was reported in the late 1970's in regions all over Japan that supplied a large numcer of migrant workers (Fig. 2).

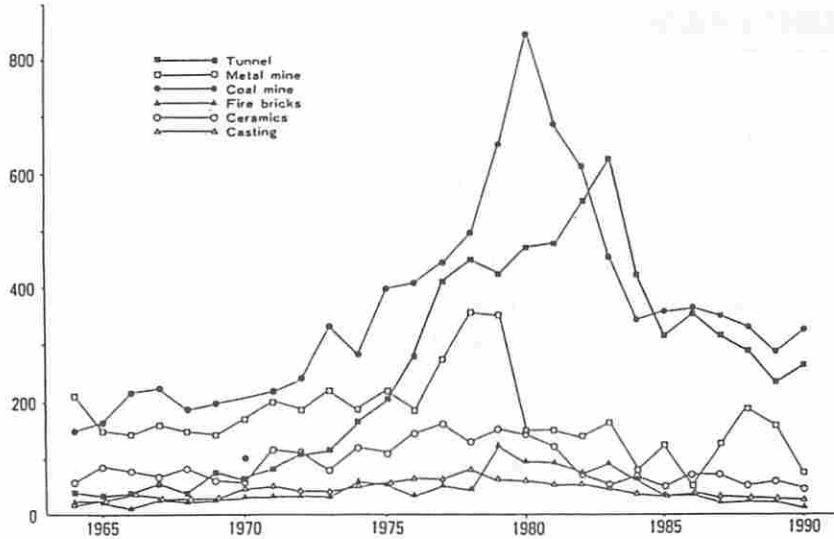


Figure 1 The number of new cases awarded compensations for total disability due to pneumoconiosis. (General guidebook on industrial health, Minister for Labour)



Figure 2 The number of tunnel migrant workers awarded compensations for total disability due to pneumoconiosis classified by areas. (Yamazaki : Social Medicine, 1982)

Migrant work is defined in Japan to be employment for 1 month or more to less than a year away from the place of permanent residence followed by return to the place of residence. Such a practice is called "dekasegi". Migrant workers have often been victims of deterioration of health, work-related accidents, and occupational diseases as they have generally been forced to work for long hours under inferior working environments in addition to instability of position and poor health management under subcontract and sub-subcontract employment systems.¹⁾

Eastern Toyama Prefecture, which is under the jurisdiction of Kurobe Health Center, is one of the areas with a high incidence of silicosis among migrant workers.^{2,3)} In this study, the statistical facts and the state of silicosis patients in this jurisdiction were surveyed, and factors in the high incidence and severity of their condition were examined.

Silicosis generally shows an unfavorable prognosis, and the symptoms are known to progress gradually even after cessation of exposure to dust.⁷⁾ This high prevalence of silicosis is considered to exert profound effects on health conditions, mortality rate, and causes of death in this area. Health management of migrant workers engaged in dust-exposure operations, therefore, must be regarded as an important problem of local health administration.

METHODS

Five areas under the jurisdiction of Kurobe Health Center, Toyama Prefecture (Fig. 3) were selected arbitrarily, and questionnaire surveys primarily concerning the

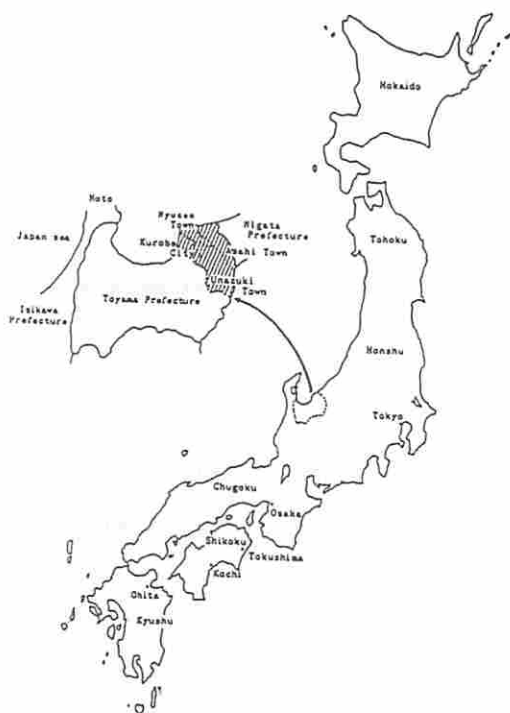


Figure 3 Study area and its location in Japan

occupational history were conducted in summer, 1977 and 1987 in all males in these areas aged 30 years or above. The questionnaires were distributed to each subject and filled in by the subject himself. Including those whose answers were initially incomplete and who have been incorporated in the survey later through follow-up works, a total of 2,260 individuals (87 % of the 2,604 to whom the questionnaires were sent) were available for the study. On the basis of the questionnaires, screening for pneumoconiosis was carried out for those who had engaged in migrant work in occupations involving dust exposure. The screening consisted of interview, somatometry, direct chest roentgenographic examination, lung function test. The radiograms were evaluated by 5 doctors including the author according to the classification of the Pneumoconiosis Law of Japan⁴⁾ which is based on ILO/UICC Classification, 1971. When opinion differed among the doctors, the diagnosis was made by the majority rule.

Analysis of follow-up data was carried out, in which survival, death, or moving of them from the area of the survey by the end of 1988 were examined. Causes of death were studied by death certification, and classified according to the 9th Revision of the Basic Classification of Causes of Death.

The mortality rate was calculated by the person-year method. Standardized mortality ratio (SMR) was computed using the entire Japanese population and death rate as a reference population and death rate. Two groups (non-migrant workers and migrant workers with exposure to

dust) were extracted from total subjects for comparison of mortality rate. Statistical significance was corrected for age and tested by the Mantel-Haenzel's X² method. The effect on mortality of variables were examined by use of Cox's Proportional Hazard Model.

After eliminating those who could not be followed up for reasons such as leaving the area at an unknown date, 2254 people (99.7% of those returning the questionnaire) were included in this study.

RESULTS

I. Results of questionnaires and screening for pneumoconiosis

Table 1 shows the results of the questionnaires about migrant work carried out in the summer of 1977 and 1978. Nine hundred and thirty-one individuals, or 41 % of the valid respondents, had experienced migrant work. Of these 931 subjects, 645 (29 % of valid respondents) had been exposed to dust in work. Tunnel construction was predominant among the works involving dust exposure, accounting for nearly 90 %, followed by mining of minerals other than coal and coal-mining.

Of the 645 subjects, 566 underwent screening for pneumoconiosis, the results of which are shown in Table 2. Signs of silicosis were observed in 477 subjects

Table 1 The number of migrant workers according to questionnaires

	Total	Age group (years)						Unknown
		30-39	40-49	50-59	60-69	70-79	80~	
No. of respondents	2260 (100)*	496 (100)	643 (100)	531 (100)	376 (100)	177 (100)	33 (100)	4
Migrant Workers	931 (41.2)	83 (16.7)	287 (44.6)	265 (49.9)	194 (51.6)	87 (49.2)	15 (45.5)	
Migrant Workers with exposure to dust	645 (28.5)	42 (8.5)	203 (31.6)	196 (36.9)	141 (37.5)	52 (29.4)	11 (33.3)	

* Figures in brackets are percentages

Table 2 Chest roentgenographic findings of silicosis in migrant workers with exposure to dust at the of their first examination in the course of this research

	Total	Age group (years)					
		30-39	40-49	50-59	60-69	70-79	80-
No. of subjects	566 (100)**	25 (100)	160 (100)	200 (100)	134 (100)	43 (100)	4 (100)
Silicosis patients	477 (84.3)	14 (56.0)	124 (77.5)	180 (90.0)	112 (83.6)	41 (95.3)	4 (100)
Classification of silicosis*							
Type 1	248	10	69	85	58	23	3
2	122	4	27	50	31	10	0
3	54	0	16	19	17	2	0
4	53	0	14	26	6	6	1

* Classification of silicosis according to the Pneumoconiosis Law of Japan

** Figures in brackets are percentages

Table 3 Total duration of migrant works with exposure to dust according to the roentgenographic category

	Total	Roentgenographic category of silicosis*				
		0	1	2	3	4
No. of Subjects	561**	89	245	120	54	53
Total duration (years)						
-9	208	62	108	24	6	9
10-19	136	18	68	26	16	8
20-29	129	5	40	44	18	22
30-39	64	3	22	19	8	12
40-	24	1	8	7	6	2
Mean duration (Mean±S. D.)	16.0±11.8	7.7±8.1	14.0±11.2	20.6±11.5	22.5±11.4	21.8±9.9

* Classified according to the Pneumoconiosis Law of Japan

** Durations of 5 migrant workers (type 1 : 3, type 2 : 2) are unknown

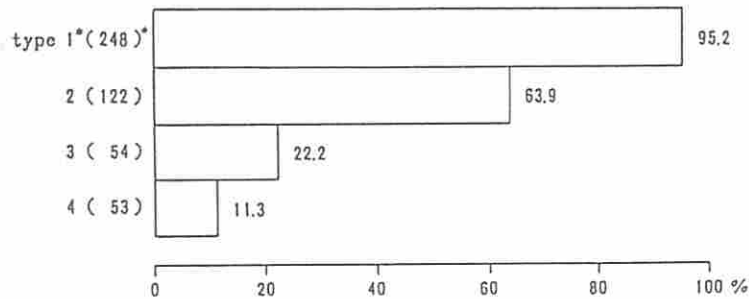


Figure 4 The rates of the silicosis patients who were first detected in the course of this research according to the roentgenographic category.

* Type 1, 2, 3, 4, : Roentgenographic categories of silicosis.

* Figures in brackets are numbers of subjects.

(84 % of those undergoing screening). According to the roentgenographic categories, 248 (52 %) belonged to type I, 122 (26 %) to type II, 54 (11 %) to type III, and 53 (11 %) to type IV pneumoconiosis.

Table 3 shows the relationship between the X-ray grading of the disease and the duration of dust exposure. Silicosis was noted in 94 %, 80 %, and 70 % of those exposed to dust for 20 years or more, 10-19 years, and less than 10 years, respectively, indicating a relationship between the increase in incidence and the duration of dust exposure.

By evaluating lung function test according to the Pneumoconiosis Law of Japan, 83 (15 %) of all migrant workers exposed to dust were considered to have marked impairment of pulmonary function. These consisted of 80 patients with established silicosis (20 %) and 3 showing no signs of the disease (3 %). According to roentgenographic categories, type I silicosis was observed in 33 patients (13 %), type II in 17 (14 %), type III in 10 (19 %), and type IV in 20 (38 %), with more patients in advanced roentgenographic categories showing more severely impaired pulmo-

nary functions.

Of the 477 patients with silicosis, 332 had not known that they had contracted the disease and were given the diagnosis for the first time by our examination (Fig 4). These patients naturally more often belonged to milder roentgenographic categories, accounting for 95 % of type I and 64 % of type II patients, but also for 22 % and 11 % of patients with more advanced type III and type IV lesions, respectively. Twenty to thirty percent of patients who were first diagnosed to have silicosis complained of cough, sputum, and Hugh Jones grade III or severer dyspnea, and 12 % were considered to have marked impairment of pulmonary function on the basis of the criteria of the Pneumoconiosis Law.

II. Mortality among migrant workers

Table 4 shows the number of examinees and the duration of their follow-up in each occupational history group. The study encompassed a total of 21963 person-years, and the mean duration of follow-up per examinee was 9.7 person years. During

the observation period, 356 subjects (15.8 % of all the subjects) died. The mortality per 1,000 person-years of population over 30 years was 25.2 in those with a history of dust exposure during migrant works, and 10.9 in those with no history of migrant work.

In the group without a history of migrant work, the SMR in overall deaths was significantly low (76). The group with a history of dust exposure during migrant work showed a significantly higher SMR in overall deaths (138); the values were increased for lung cancer (247) as well as accidents (271), but smaller for cerebrovascular diseases (75) and stomach cancer (84). In this group, the SMR for pneumoconiosis and pulmonary tuberculosis were markedly increased (2464, 5882, respectively). The mortality for overall death, pneumonia & bronchitis, pulmonary tuberculosis, pneumoconiosis and accidents among migrant workers with dust exposure were significantly higher than those among non-migrant workers (Table 5).

Table 6 provides results of multivar-

Table 4 Subjects investigated in follow-up study of migrant workers

	Total subjects	Non-migrant worker without a history of dust exposure	Migrant worker with a history of dust exposure	The others
No. of subjects	2254	1181	645	428
Total person-years of observations	21963	11791	5981	4191
Mean person-years of observations per person	9.7	10.0	9.3	9.8
No. of deaths during observations	356	128	151	77
Crude mortality rate per 1,000 person-years	16.21	10.86	25.24	18.37

Table 5 The number of deaths and standardized mortality ratios (SMR) from different causes in each occupational history group

	Non-migrant worker without a history of dust exposure			Migrant worker with a history of dust exposure		
	Actual No. of deaths	Expected No. of deaths [#]	SMR	Actual No. of deaths	Expected No. of deaths [#]	SMR
All causes	128	168.83	76 ^{-###}	151	109.74	138 ^{###} ***
Cerebro-vascular diseases	22	32.06	69	12	20.76	58
Ischemic heart diseases	13	12.09	108	6	8.02	75
Non-ischemic heart disease	18	19.37	93	17	12.34	138
Malignant neoplasms	47	47.74	98	39	32.43	120
Stomach	14	14.06	100	8	9.50	84
Trachea, Bronchus and Lung	10	8.84	113	15	6.08	247 ^{##} *
Pneumonia & bronchitis	3	10.78 ⁻	28 ^{-##}	7	6.85	102 *
Pulmonary tuberculosis	0	1.69	0	28	1.14	2464 ^{###} ***
Pneumoconiosis	0	0.51	0	20	0.34	5882 ^{###} ***
Accidents	3	6.16	49	10	3.68	271 ^{##} *
Suicides	4	4.75	84	2	2.58	77

SMR (Standardized mortality ratio) was calculated using the entire Japanese population as a reference population. * p<0.10, ** p<0.05, *** p<0.01, **** p<0.001 (Comparison with the group without a history of migrant work) * p<0.05, ** p<0.01, *** p<0.001 (Comparison with the entire Japanese population)

Table 6 Multivariate analysis of survival rates for the combined group of non-migrants workers and migrant workers with a history of dust exposure using Cox's Proportional Hazards Model

Variables	All cause				Lung cancer				Pneumonia & Bronchitis			
	r	SEE	t	P valuer	r	SEE	t	P valuer	r	SEE	t	P valuer
Age	0.099	0.006	17.4	p<0.001	0.072	0.020	3.63	P<0.001	0.123	0.033	3.76	P<0.001
cigarettes (Pack years)	0.065	0.058	1.11		0.642	0.244	2.64	P<0.01	-1.009	0.438	-2.31	P<0.05
Migrant work with dust exposure	0.483	0.130	3.72	P<0.001	0.908	0.442	2.05	P<0.05	1.383	0.746	1.85	P<0.10

Measurement dimensions of variables

Age Year (linear)
Cigarettes 0 = Pack years 0
1 = 1-39
2 = 40-79
3 = 80-

Pack years means the number of cigarette packs (1 pack = 20 cigarettes) × the number of smoking years

Migrant work 0 = no
with dust exposur 1 = yes

iate analyses of prognostic factors for the combined group of non-migrant workers and migrant workers with dust exposure. Age and Migrant work with dust exposure were important factors predicting mortality for overall death. Age, smoking and migrant work with dust exposure were increased risk factors dying from lung

caner.

The results of multivariate analyses of prognostic factors for the migrant workers exposed to dust are demonstrated in Table 7. In the mortality from overall death, the regression coefficients for age, cough and shortness of breath were significant. Those three variables were independently

Table 7 Multivariate analysis of survival rates for migrant workers with a history of dust exposure using Cox's Proportional Hazard Model

	All causes	Lung cancer	Pneumonia & Bronchitis	Plumunary tuberculosis	Pneumocociosis
Age	0.086 ***		0.158 **	0.051	
Cigarette's (Pack years)		0.896 *	-1.053 **		
Duration of migrant works with dust exposure		0.703 **			
Respiratory symptom					
Cough	0.435 *	1.814 **			1.390 *
Phlegms					
Shortness of breath	0.501 **	-1.052 #	1.978 #	1.655**	1.895 *
Wheezing		-1.229 **		0.989 *	

The table represents the regression coefficients for each variable.

#p<0.10, *P<0.05, **P<0.01, ***P<0.001

Measurement dimensions of variables

Age	Year (linear)		Respiratory symptoms	
Cigarettes	0 = Pack years	0	Cough	0 = no
	1 =	1-39		1 = yes
	2 =	40-79	Phlegms	0 = no
	3 =	80-		1 = yes
Duration of migrant work with dust exposure	0 = 1-9 years		shortness of breath	0 = no
	1 = 10-19		wheezing	1 = yes
	2 = 20-29			0 = no
	3 = 30-			1 = yes

predictive of mortality from overall death. Duration of migrant work with dust exposure, smoking and cough were at high risk of factors in death from lung cancer. Age, shortness of breath and wheezing were risk factors of predicting mortality for pulmonary tuberculosis. Cough and shortness of breath were high risk factors in death from pneumoconiosis.

DISCUSSION

The percentage of migrant workers in the total working population is considered to be higher in areas where the productivity of the primary industry is lower.¹⁾ In eastern Toyama, 61 % of migrant workers from this area had to engage in migrant work for pure subsistence, and only 19 % did so for more than subsistence. In addition to these inherent economic circumstances, several tunnels were constructed

in this region between 1920 and 1930 for the development of rivers for hydroelectric power sources. The Kurobe River flowing in the eastern part of Toyama Prefecture was developed for hydroelectric power development programs since 1920's because of its rich water supply and steepness of the river bed. These programs, which peaked with the completion of the Fourth Kurobe River Power Plant in 1962, yielded 4 dams and 14 power plants (a total output of 800,000 kw) by 1970. The above survey of migrant workers employed in occupations involving dust exposure showed that the number of migrant workers increased during the period of development of power sources and declined with its termination.

In many patients, silicosis was not noted during migrant work but was first detected more than 10 years after discontinuation of the employment, first because

most of them were seasonal workers not covered even by the minimum health management at the work place. The Pneumoconiosis Law of Japan requires health check-up at the beginning, during (periodic), and end of employment. However, of the migrant workers employed in occupations involving dust exposure,^{5,6)} in eastern Toyama, only 60 % had undergone health examinations at the work place; the percentages were lower in those in their 50's (25 %) and those over 60 (10 %). Migrant workers employed on a monthly basis not only could seldom take periodic health check-ups (once every 3 years for those constantly exposed to dust and once every year for pneumoconiosis patients) nor could they have the examination at dismissal, which was intended for those who worked for 1 year or more, but they were also often excluded from the examination list. Moreover, since these workers were employed at irregular times, not many of them received the check-up at the time of employment. In addition, even after they contracted silicosis, they were not regarded as employees in operations involving dust exposure during intervals or after discontinuation of migrant work and were not covered by the follow-up programs provided by the Pneumoconiosis Law. For these reasons, migrant workers with silicosis visited medical institutions only after considerable progression of their disease and were the first diagnosed. This situation lasted until 1972, when the Law of Labor Safety and Hygiene was enforced to provide free annual health check-up for those radiologically diagnosed after retirement to have type II or more advanced

pneumoconiosis. However, this health check-up requires the certificate of employment at the last work place, which is often difficult to obtain for many migrant workers employed as subcontractors and sub-subcontractors. Furthermore, those who discontinued migrant work before the enforcement of the Pneumoconiosis Law are not covered by this law and are left unattended. As shown in Table VI, 27 % of migrant workers in eastern Toyama had retired before 1960.

Secondly, insufficient education about pneumoconiosis at the work place is considered to be a factor in the poor management of workers with the disease.^{5,6)} According to our survey, 84 % of the patients were aware of the risk of pneumoconiosis associated with work involving dust exposure, but only 21 % received education at the work place about the possible hazard of dust exposure, and 49 % obtained the knowledge from friends or by observing colleagues developing silicosis. Six percent of the patients became aware of the danger of dust exposure for the first time after they began to be treated for silicosis. Dust masks were worn by only 51 % and worn consistently by one-third of them.

A study of morbidity or mortality with its impact on the local health status generally requires accurate recording of clinical courses from the onset of the disease to the complete recovery or death of patients during a long-term follow-up of the same group of subjects. For this reason, we conducted a follow-up study with a mean duration of 9.7 years in those who were previously examined in a questionnaire survey for all male residents over 30 years

of age of eastern Toyama Prefecture. The SMR of overall deaths for migrant workers exposed to dust was significantly high and also higher than that of non-migrant workers without dust exposure. High mortalities of lung cancer, pulmonary tuberculosis, pneumoconiosis and accidents among migrant workers with dust exposure. Important prognostic factors were dust history, smoking history and some respiratory symptoms. Dose-response relationships were recognized between dust history and mortality of lung cancer after adjustment for age and smoking.

A high mortality among workers engaging in dust-exposure occupations was demonstrated in follow-up studies in coal miners.⁸⁻¹⁰⁾ The mortality was particularly high among retired workers, pneumoconiotic patients exhibiting severe radiographic manifestations, those with subjective symptoms, smokers, and those with decreased pulmonary function.⁸⁻¹⁰⁾ Migrant workers have been observed often to suffer from deterioration of chronic diseases due to stressful working conditions and to develop such fatal conditions as apoplexy and heart failure. The results of follow-up of our subjects with an experience of migrant work were consistent with the above observations. In those engaged in dust-exposure occupations, however, work-related diseases such as pneumoconiosis and pulmonary tuberculosis appeared to be more responsible for the poor health status than the adverse conditions commonly affecting all migrant workers. There was no relationship between smoking and mortality, the mortality increased progressively as the duration of migrant works with

dust exposure increased in length and as the prevalence of respiratory symptoms increased.

Effect of dust exposure in migrant workers must be assessed by a long-term observation of their physical conditions besides the analysis of mortality. Progression of their disease was suggested to be more rapid in those engaged in tunnel construction.¹¹⁾ We also noted a rapid development of subjective complaints and a decrease in pulmonary function over a short period of time in migrant workers engaged in dust exposure operation.¹²⁾ Radical approaches are considered to be necessary for health management of migrant tunnel construction workers and silicosis patients, who are offered inadequate administrative health-related service and turn to medical aid only after considerable progression of the disease.

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