Cancer incidence and mortality among temporary maintenance workers in a refinery/ petrochemical complex in Korea

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Background: Petrochemical plant maintenance workers are exposed to various carcinogens such as benzene and metal fumes. In Korea, maintenance operations in petrochemical plants are typically performed by temporary employees hired as contract workers.

Objectives: The purpose of this retrospective study was to evaluate cancer risk in temporary maintenance workers in a refinery/petrochemical complex in Korea.

Methods: Subjects consisted of 14 698 male workers registered in a regional petrochemical plant maintenance workers union during 2002–2007. Cancer mortality and incidence were identified by linking with the nationwide death and cancer registries during 2002–2007 and 2002–2005, respectively. Standardized mortality ratios (SMRs) and standardized incidence ratios (SIRs) were calculated for each cancer.

Results: Increased SMR 3.61 (six cases, 95% CI: 1.32–7.87) and SIR 3.18 (five cases, 95% CI: 1.03–7.42) were observed in oral and pharyngeal cancers.

Conclusion: Our findings may suggest a potential association between oral and pharyngeal cancers and temporary maintenance jobs in the petrochemical industry. Future studies should include a longer follow-up period and a quantitative exposure assessment.

Keywords: Petrochemical, Maintenance, Cancer, Construction, Refinery, Pharynx, Oral, Leukemia

Introduction

Oil refinery and petrochemical plants require regular maintenance of equipment such as pipes, pumps, and reactors to ensure the continuous production of chemical products. However, during regular maintenance operations, exposure of petrochemical plant workers to carcinogenic compounds is a concern. For example, during the welding of pipelines carrying petroleum, workers may be exposed to chemicals, such as benzene and 1,3-butadiene, and metal fumes containing heavy metals, such as chromium and nickel, and/or asbestos.¹ In Korea, maintenance operations in petrochemical plants are typically performed by temporary employees hired as contract workers.

In a regional petrochemical plant maintenance workers union, several cases of leukemias among workers have been reported, raising public concern

on the health of maintenance workers in Korea. Previous epidemiological studies investigating the association between petrochemical plant maintenance employees and cancer risks have been inconclusive, except in the case of asbestos-related mesothelioma.^{2–15} Furthermore, prior studies have investigated maintenance employees of petrochemical plants engaged in more supervisory rather than in maintenance roles.

To address gaps in the literature about the health of temporary maintenance workers, we conducted a field study measuring benzene exposure level and evaluating cancer risks for this population. The benzene monitoring study was carried out to assess benzene exposure during turnaround maintenance operations, and the resultant air benzene levels are described in detail elsewhere.¹

This aim of this study was to retrospectively evaluate the cancer risks of temporary maintenance workers in a refinery/petrochemical complex. This is the first study to investigate the cancer risks of petrochemical plant maintenance workers who are primarily engaged in actual maintenance operations.

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Methods

Study population

Study subjects were male members of a maintenance workers union at a regional petrochemical plant located in a refinery/petrochemical complex on the southwestern seacoast of Korea. Although plants in the refinery/petrochemical complex were opened in the late 1960s, the union was not established until 2002. All temporary maintenance workers at the refinery/petrochemical complex were required to join the union.

The study population included 14 698 male workers aged 20–72 who registered with the union anytime between 1 May 2002 and 31 December 2007. Employees were hired on fixed-term contracts and engaged in petrochemical plant maintenance operations and in construction work. Maintenance worker tasks involved a range of jobs including: pipefitter, welder, mechanic, painter, insulator, rigger, electrician, structure fitter, and tank fitter. Privacy concerns prohibited us from obtaining information on specific task and occupational histories for employees. Information about relevant confounders, such as cigarette and alcohol use, and history were not available.

Data sources

Data on cancer mortality between 1 May 2002 and 31 December 2007 were obtained from the death registry of the Korea National Statistics Office (KNSO). The KNSO classification (Korea Classification of Diseases and Causes of Death, 4th edition) of cancer was based on the tenth revision of the International Classification of Disease (ICD-10).

Data on cancer incidence were obtained from the Korea National Central Cancer Registry (KNCCR) for the dates 1 May 2002 to 31 December 2005, the end date of the registry coverage. Korea National Central Cancer Registry was initiated as a hospital-based cancer registry in 1980, maintaining a nationwide cancer incidence registry starting in 1999. KNCCR has been estimated to have a >95% ascertainment of cancer incidence.¹⁶

Data analysis

Standardized mortality ratios (SMRs) and standardized incidence ratios (SIRs) were calculated by indirect standardization to the regional and the national cancer death and incidence rates. The entry point of the study was the date of registration with the workers union, and the exit date was the date of death or cancer diagnosis. In case of no death or no cancer, the exit date was 31 December 2007 for cancer mortality and 31 December 2005 for cancer incidence. The 6-year mortality observation period was divided into two calendar periods, 2002–2006 and 2007. The Korean national population in 2004 and 2007 was used as reference populations. Age groups were categorized by 5-year intervals between 20 and 80 years old. The expected number of deaths was calculated from age-specific mortality rates for the 5-year age groups and two calendar periods.

Cancer incidence was observed from 1 May 2002 to 31 December 2005, and the national cancer incidence rates of the 5-year age groups in 2003 were used as reference rates. The expected number of cancers was calculated from age-specific cancer incidence rates for the 5-year age groups. After indirect age and calendar time standardization, the sum of the observed number of deaths or cases was divided by the sum of the expected number of deaths or cases, which yielded SMRs and SIRs, respectively. Exact 95% Poisson confidence intervals (CIs) were computed using an SAS macro program.¹⁷

Results

The average age for maintenance workers at the time of union registration was 39 years, with the largest percentage of workers falling into the 40–49 age category (34%). The most frequent year of registration with the union was 2002 (33%) (Table 1).

The all cancers mortality of temporary maintenance workers was lower than cancer mortality in the general male population (SMR 0.79, 95% CI: 0.60–1.01) (Table 2). There was a statistically significant increase in mortality for oral and pharyngeal cancers

Table 1 Characteristics of study subjects

Variable		Number of workers	Percent (%)
Age of registration with the union	20–29	2883	19.61
	30–39	4301	29.26
	40–49	5017	34.13
	50–59	2133	14.51
	60–69	359	2.44
	70–79	5	0.03
Year of registration with the union	2002	4849	32.99
	2003	1504	10.23
	2004	2809	19.11
	2005	1481	10.08
	2006	1643	11.18
	2007	2412	16.41
Total		14698	100

among temporary maintenance workers compared to the general population (SMR 3.61, 95% CI: 1.32–7.87). Mortality for leukemia was increased compared to the general population, but was not statistically significant (SMR 1.46, 95% CI: 0.30–4.27).

The all cancers incidence of maintenance workers was similar to the general male population (SIR 1.02, 95% CI: 0.78–1.30). There was a statically significant increase in the incidence of oral and pharyngeal cancers in maintenance workers compared to the general population (SIR 3.18, 95% CI: 1.03–7.42). Incidence for leukemia was increased compared to the general population, but was not statistically significant (SIR 2.71, 95% CI: 0.56–7.91).

Discussion

Our analysis showed an increased mortality and incidence of oral and pharyngeal cancers in petrochemical plant maintenance workers. This is the first study to present this result with this understudied population.^{2–10}

Increased risk of oral and pharyngeal cancers has been reported for other occupational groups including: construction workers, machine workers, painters, plumbers, carpet installers, vehicle repair workers, textile workers, leather industry workers, pulp industry workers, wood workers, sugarcane farmers, and butchers.^{18–30} Among the aforementioned study populations, a relatively strong association has been found among oral and pharyngeal cancers and construction workers and machine operators.³¹ The job tasks of maintenance workers in petrochemical plants are similar to those of construction and machine operator workers. Exposure to solvents and/or metal fumes and dusts have been hypothesized

as the materials possibly related to the diagnosis of oral and pharyngeal cancers.^{19,32} Benzene and hexavalent chromium are two known carcinogens found in solvents or metal fumes/dusts. In our study, we were not able to examine the specific causes of cancer due to the unavailability of information occupational tasks. However, our findings may support a potential association between solvents or metal fume/dust exposure and oral and pharyngeal cancers.

The most important non-occupational causes of oral and pharyngeal cancers are cigarette smoking and alcohol consumption.³³ Similarly, no health behavior data was available in this study. However, according to hypothetical calculations by Axelson,³⁴ if the association between exposure and health outcome is strong enough to yield a SMR of >3, the confounding effect of smoking becomes insignificant. In our study, both SMR and SIR of oral and pharyngeal cancers exceeded 3, suggesting that the increased risk of oral and pharyngeal cancers may exist irrespective of confounding effects of smoking and drinking habits. In addition, increased risk of other smoking or alcohol-related cancer patterns, such as lung or liver cancers, was not observed in our results. However, because the numbers of mortality and incidence cases are too small (six mortality and five incidence cases) to infer a confident association, our findings should not be over-interpreted. Our research highlights the needs for a follow-up study with a larger sample size and the inclusion of possible confounders.

We also found an increased risk for nasopharyngeal cancer risk in our study. Nasopharyngeal cancer is typically an occupation-related cancer, thought to be

Table 2 Cancer incidence and mortality of male contract maintenance workers in a refinery/petrochemical complex

Cancer site	ICD-10	Mortality, 2002–2007 (PY=74 741)			Incidence, 2002–2005 (PY=26 537)		
		Obs	SMR	95% CI	Obs	SIR	95% CI
All cancers	C00–C97	63	0.79	0.60–1.01	62	1.02	0.78–1.30
Lip, oral cavity, and pharynx	C00–C14	6	3.61	1.32–7.87	5	3.18	1.03–7.42
Tongue	C01–C02	2	39.2	4.75–142	2	8.70	1.05–31.5
Nasopharynx	C11	3	5.88	1.21–17.2	3	8.33	1.72–24.5
Hypopharynx	C13	1	3.70	0.09–20.6	0	–	–
Esophagus	C15	1	0.51	0.01–2.85	0	–	–
Stomach	C16	11	0.83	0.41–1.48	15	0.99	0.56–1.64
Intestine, anus	C18–C21	2	0.33	0.04–1.20	7	0.91	0.37–1.88
Liver	C22	21	0.82	0.51–1.25	14	1.07	0.58–1.79
Pancreas	C25	2	0.57	0.07–2.07	2	1.41	0.17–5.09
Larynx	C32	0	–	–	1	1.25	0.03–6.94
Lung	C33–34	9	0.68	0.31–1.29	5	0.73	0.24–1.71
Skin	C43	1	5.05	0.13–28.2	0	–	–
Prostate	C61	1	2.51	0.06–14.0	1	1.20	0.03–6.71
Brain and spine	C70–C72	2	1.21	0.15–4.36	2	2.36	0.29–8.52
Blood	C82–C85,C90–C95	5	1.19	0.39–2.78	6	1.97	0.72–4.29
Non-Hodgkin's lymphoma	C82–C85	2	1.24	0.15–4.47	3	1.83	0.38–5.34
Leukemia	C91–C95	3	1.46	0.30–4.27	3	2.71	0.56–7.91

PY: person-years; ICD-10: International Classification of Diseases, tenth revision; Obs: observed number of cases; SMR: standardized mortality ratio; SIR: standardized incidence ratio.

related to formaldehyde exposure, a well-known carcinogen. Previous research has hypothesized that formaldehyde causes DNA damage that in turn results in cancer.³⁵ Epstein–Barr virus (EBV) infection and salted fish or food consumption are also risk factors of nasopharyngeal cancer.³⁶ For example, nasopharyngeal cancer in southern Chinese patients was found to be associated with the consumption of a salted fish containing nitrosamine, a known carcinogen. The refinery/petrochemical complex in this study is located near seacoasts and therefore maintenance workers may be more exposed to seafood than the general population. However, in a previous cohort study examining the cancer risks of petrochemical plant employees at the same refinery/petrochemical complex, no significantly increased risk for lip, oral cavity, and pharynx cancer risk was observed compared to the general population.⁴ This leads us to believe that there is the possibility of exposure to a carcinogen beyond salted fish. In particular, metal work, such as welding or working with cutting oil, has been reported to increase the risk of nasopharyngeal cancer.^{37–39} Future studies should investigate the potential association between nasopharyngeal cancer and metal work using quantitative exposure assessment.

We were not able to consider the latency period of cancer development (ranges from several years to decades) due to the lack data about occupational history.⁴⁰ According to a survey of union members, the proportions of workers working ≥ 1 year and ≥ 10 years were 85.1% and 50.2%, respectively.⁴¹ The inclusion of short term workers might have skewed our results toward non-significance. We were not able to control for previous exposures in our analyses, which is a limitation of our study. The all cancers mortality in temporary maintenance workers was lower than that in the general populations, which represents a healthy worker effect. The healthy worker effect might have contributed to moving the relative cancer risk toward the null.⁴²

Contrary to previous studies that have examined the risk of cancer among maintenance employees permanently hired by refineries or petrochemical companies, our study was the first to focus on the cancer risks of temporary maintenance workers.^{2–10} Maintenance workers are hired temporarily according to projects. This type of employment offered petrochemical companies considerable flexibility in meeting their workforce needs. However, it also weakened the company's responsibility for safety training and supervision.^{42–44} In refinery and petrochemical industries, contract workers typically perform the most hazardous jobs, while regular employees of petrochemical plants have little contact with chemicals. Most epidemiological studies have examined cancer risks of this official workforce and

occupational exposure limits are based on the findings of these epidemiological studies. This may result in standards that are not protective for temporary contract workers.⁴⁵ From a prevention perspective, our findings raise a question about health problems in maintenance workers exposed to solvents or metal fumes/dusts during maintenance operations that fall outside surveillance.

Our study showed a non-significant increased risk for leukemia. Previous studies evaluating cancer risk of maintenance employees showed inconsistent results with only one study reporting a statistically significant increased risk of leukemia (SMR 1.79, 95% CI: 1.11–2.73) and lymphohematopoietic cancers (SMR 1.60, 95% CI: 1.17–2.15).^{2–10} The inconsistency may be the result of small case numbers. A larger follow-up study should be carried out to further examine the excess risk of leukemia.

In summary, we examined the cancer risk of temporary maintenance workers in a refinery/petrochemical complex by linking the roster of the workers union with national death and cancer registries. In spite of the short follow-up period, the results show a potential association between oral and pharyngeal cancers and maintenance jobs in the petrochemical industry. These findings highlight the need for larger study follow-up studies that use quantitative exposure assessments to examine carcinogen-cancer associations.

Disclaimer statements

Contributors Dong-Hee Koh analyzed data and wrote manuscript. Eun-Kyo Chung, Jae-Kil Jang, Hyang-Woo Ryu, and Kye-Mook Yoo performed benzene exposure assessment. Hye-Eun Lee performed questionnaire survey. Eun-A Kim and Kyoo-Sang Kim designed study and reviewed the results.

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Conflicts of interest The authors declare no conflict of interest.

Ethics approval This study protocol was approved by the institutional review board of Occupational Safety and Health Research Institute.

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References

- Chung E, Shin J, Lee B, Kwon J, Lee N, Chung K, *et al.* Characteristics of occupational exposure to benzene during turnaround in the petrochemical industries. *Saf Health Work.* 2010;1:51–60.
- Huebner WW, Schnatter AR, Nicolich MJ, Jorgensen G. Mortality experience of a young petrochemical industry cohort: 1979–1992 follow-up study of US-based employees. *J Occup Environ Med.* 1997;39:970–82.
- Huebner WW, Chen VW, Friedlander BR, Wu XC, Jorgensen G, Bhojani FA, *et al.* Incidence of lymphohaematopoietic malignancies in a petrochemical industry cohort: 1983–94 follow up. *Occup Environ Med.* 2000;57:605–14.
- Koh DH, Kim TW, Yoon YH, Shin KS, Yoo SW. Lymphohematopoietic cancer mortality and morbidity of workers in a refinery/petrochemical complex in Korea. *Saf Health Work.* 2011;2:26–33.
- Raabe GK, Collingwood KW, Wong O. An updated mortality study of workers at a petroleum refinery in Beaumont, Texas. *Am J Ind Med.* 1998;33:61–81.
- Tsai SP, Waddell LC, Gilstrap E, Randsdell JD, Ross CE. Mortality among maintenance employees potentially exposed to asbestos in a refinery and petrochemical plant. *Am J Ind Med.* 1996;29:89–98.
- Divine BJ, Hartman CM, Wendt JK. Update of the Texaco mortality study 1947–93: part I. Analysis of overall patterns of mortality among refining, research, and petrochemical workers. *Occup Environ Med.* 1999;56:167–73.
- Wong O, Harris F, Rosamilia K, Raabe GK. An update mortality study of workers at a petroleum refinery in Beaumont, Texas, 1945 to 1996. *J Occup Environ Med.* 2001;43:384–401.
- Wong O, Harris F, Rosamilia K, Raabe GK. Updated mortality study of workers at a petroleum refinery in Torrance, California, 1959 to 1997. *J Occup Environ Med.* 2001;43:1089–102.
- Divine BJ, Hartman CM. Update of a study of crude oil production workers 1946–94. *Occup Environ Med.* 2000;57:411–7.
- Finkelstein MM. Asbestos-associated cancers in the Ontario refinery and petrochemical sector. *Am J Ind Med.* 1996;30:610–5.
- Finkelstein MM. Maintenance work and asbestos-related cancers in the refinery and petrochemical sector. *Am J Ind Med.* 1999;35:201–5.
- Gun R, Pratt NL, Roder DM, Ryan P. Asbestos-related cancers in refinery workers in the Australian petroleum industry. *Arch Environ Occup Health.* 2006;61:11–6.
- Sorahan T. Mortality of UK oil refinery and petroleum distribution workers, 1951–2003. *Occup Med.* 2007;57:177–85.
- Gennaro V, Finkelstein MM, Ceppi M, Fontana V, Montanaro F, Perrotta A, *et al.* Mesothelioma and lung tumors attributable to asbestos among petroleum workers. *Am J Ind Med.* 2000;37:275–82.
- KNCCR. Completeness survey of Pusan Cancer Registry. 5th Cancer Registry Symposium. Seoul, Korea: Korea Ministry of Health and Welfare; 2001.
- Daly L. Simple SAS macros for the calculation of exact binomial and Poisson confidence limits. *Comput Biol Med.* 1992;22:351–61.
- Richiardi L, Corbin M, Marron M, Ahrens W, Pohlabein H, Laggiou P, *et al.* Occupation and risk of upper aerodigestive tract cancer: the ARCAGE study. *Int J Cancer.* 2012;130:2397–406.
- Tarvainen L, Kyyronen P, Kauppinen T, Pukkala E. Cancer of the mouth and pharynx, occupation and exposure to chemical agents in Finland [in 1971–95]. *Int J Cancer.* 2008;123:653–9.
- Kato I, Tominaga S, IKari A. An epidemiological study on occupation and cancer risk. *Jpn J Clin Oncol.* 1990;20:121–7.
- Haguenoer JM, Cordier S, Morel C, Lefebvre JL, Hemon D. Occupational risk factors for upper respiratory tract and upper digestive tract cancers. *Brit J Ind Med.* 1990;47:380–3.
- Schildt E, Eriksson M, Hardell L, Magnuson A. Occupational exposures as risk factors for oral cancer evaluated in a Swedish case-control study. *Oncol Rep.* 1999;6:317–20.
- Tisch M, Enderle G, Zoller J, Maier H. Cancer of the oral cavity in machine workers. *Laryngorhinootologie.* 1996;75:759–63.
- Merletti F, Boffetta P, Ferro G, Pisani P, Terracini B. Occupation and cancer of the oral cavity or oropharynx in Turin, Italy. *Am J Ind Med.* 1991;17:248–54.
- Boffetta P, Gridley G, Gustavsson P, Brennan P, Blair A, Ekstrom AM, *et al.* Employment as butcher and cancer risk in a record-linkage study from Sweden. *Cancer Cause Control.* 2000;11:627–33.
- Huebner WW, Schoenberg JB, Kelsey JL, Wilcox HB, McLaughlin JK, Greenberg RS, *et al.* Oral and pharyngeal cancer and occupation: a case-control study. *Epidemiology.* 1992;3:300–9.
- Andreotti M, Rodrigues AN, Cardoso LM, Figueiredo RA, Eluf-Neto J, Wunsch-Filho V. Occupational status and cancer of the oral cavity and oropharynx. *Cad Saude Publica.* 2006;22:543–52.
- Moss E, Lee WR. Occurrence of oral and pharyngeal cancers in textile workers. *Br J Ind Med.* 1974;31:224–34.
- Decoufle P. Cancer risks of associated with employment in the leather and leather products industry. *Arch Environ Health.* 1979;34:33–7.
- Coble JB, Brown LMB, Hayes RB, Huang WY, Winn DM, Gridley G, *et al.* Sugarcane farming, occupational solvent exposures, and the risk of oral cancer in Puerto Rico. *J Occup Environ Med.* 2003;45:869–74.
- Riechelmann H. Occupational exposure and cancer of the oral cavity and pharynx. *Laryngorhinootologie.* 2002;81:573–9.
- Gustavsson P, Jakobsson R, Johansson H, Lewin F, Norell S. Occupational exposures and squamous cell carcinoma of the oral cavity, pharynx, larynx, and oesophagus: a case-control study in Sweden. *Occup Environ Med.* 1998;55:393–400.
- Mayne ST, Morse DE, Winn DM. Cancers of the oral cavity and pharynx. In: Shottenfeld D, Fraumeni J Jr, editors. *Cancer epidemiology and prevention*, 3rd edn. New York: Oxford University Press; 2006. p. 674–96.
- Axelsson O. Aspects on confounding in occupational health epidemiology. *Scand J Work Environ Health.* 1978;4:85–9.
- Thompson CM, Grafstrom RC. Commentary: mechanistic considerations for associations between formaldehyde exposure and nasopharyngeal carcinoma. *Environ Health.* 2009;8:53–8.
- Chang ET, Adami HO. The enigmatic epidemiology of nasopharyngeal carcinoma. *Cancer Epidemiol Biomarkers Prev.* 2006;15:1765–77.
- Hendersen BE, Louie E, SooHoo JJ, Buell P, Gardner MB. Risk factors associated with nasopharyngeal carcinoma. *N Eng J Med.* 1976;295:1101–6.
- Marsh GM, Youk AO, Buchanich JM, Erdal S, Esmen NA. Work in the metal industry and nasopharyngeal cancer mortality among formaldehyde-exposed workers. *Regul Toxicol Pharmacol.* 2007;48:308–19.
- Zhu K, Levine RS, Brann EA, Hall I, Caplan LS, Gnepp DR. Case-control study evaluating the homogeneity and heterogeneity of risk factors between sinonasal and nasopharyngeal cancers. *Int J Cancer.* 2002;99:119–23.
- Checkoway H, Pearce N, Kriebel D. *Research methods in occupational epidemiology*, 2nd edn. Oxford University Press, Oxford; 2004.
- Yoo S, Lee HE, Koh DH, Kim KS, Kim TW, Kim MG, *et al.* Relationship between musculoskeletal symptoms and non-fatal occupational injuries in construction workers in Korea. *Korean J Occup Environ Med.* 2011;23:9–17.
- Rebitzer JB. Job safety and contract workers in the petrochemical industry. *Ind Relat.* 1995;34:40–57.
- Baughner JE, Roberts JT. Perceptions and worry about hazards at work: unions, contract maintenance, and job control in the U.S. petrochemical industry. *Ind Relat.* 1999;38:522–41.
- Kochan TA, Smith M, Wells JC, Rebitzer JB. Human resource strategies and contingent workers: the case of safety and health in the petrochemical industry. *Hum Resour Manage.* 1994;33:55–77.
- Egilman D, Howe S. Against anti-health epidemiology: corporate obstruction of public health via manipulation of epidemiology. *Int J Occup Environ Health.* 2007;13(1):118–24.