RESEARCH COMMUNICATION

Case-Control Study of Occupational Categories and Breast Cancer Risk in Thailand

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Abstract

Breast cancer is common malignancy in Thai female. Although there are well established risk factors, many environmental agents with an impact are still unknown especially with reference to occupation. The objective of this study was to investigate the risk of female breast cancer among different occupational categories in Thailand. A frequency-matched case-control study was conducted among Thai women aged 17-79 . A total of 516 pairs of cases and controls were recruited at the Thai National Cancer Institute, Khon Kaen University Hospital and Khon Kaen Provincial Hospital during 2002-2004. Cases were newly diagnosed with histological confirmed breast cancers while controls were selected from healthy women matched by age (±5 years) and geographical area. After informed consent was signed, information was obtained on occupation and other risk factors from each subject using an interviewer-administered and structured questionnaire. The International Standard Classification of Occupations version 1968 (ISCO-68) was used to code for occupational categories. The relation between occupational categories and breast cancer risk was evaluated by unconditional logistic regression analysis. The mean age of cases and controls were 46.9±10.6 and 47.8±9.9 years, respectively. Fifty-five percent of cases were pre-menopausal women. After adjusting for confounding factors by multiple logistic regression analysis, the results showed that occupational category as production and related workers, transport equipment operators and labourers was associated with an increased risk of breast cancer (OR=1.41 95% CI=1.01-1.97) and this finding was also supported by a statistically significant positive trend for duration of employment (p=0.01). A significantly decreased breast cancer risk was observed in clerks (OR=0.59, 95% CI=0.37-0.96). In conclusion, this study revealed that women who have lifetime occupation in an industrial setting may have higher risk to develop breast cancer. Further studies are needed to assess occupational exposure in specific occupations.

Keywords: Occupation - breast cancer - risk factor

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Introduction

Breast cancer is one of the second most common malignancy among Thai female. According to the current data, the incidence of breast cancer in each year was approximately 20-25 per 100,000 women, varying from region to region (Chaiweerawattana, 2008), and the incidence rate is continuously increasing over the past decade. Although there are well established risk factors such as reproductive factor, family history of breast cancer etc. (Key et al., 2001), many environmental risk factors for breast cancer are still unknown especially in relation to occupation. Bernardino Ramazzini, the father of occupational medicine, observed that some workers had more breast cancer when comparing to general population (Franco, 1999). Subsequently, epidemiological studies demonstrated that the majority of cancer was attributable to environmental factors (Sasco, 2001; Brody and Rudel, 2003). The reports by Lichtenstein et al stated that 67% of breast cancer are attributable to non shared environmental factors, while genetic contributed 27% and shared environmental factor 6% (Lichtenstein et al., 2000). However, the role of specific occupation on the risk of breast cancer in occupational and environmental health is controversy.

In Thailand, working population is three-fourths of the whole population. More than 15 million were female workers (National Statistical Office, 2004). A variety of occupations worldwide, including industrial, agricultural and service sectors, has been identified as having some evidence of higher breast cancer risk (Peptonska and Szeszenia, 2001). During working lifestyle, they may be exposed to several health hazards in working environment including occupational carcinogen. Some of these are

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potential to cancer risk such as non ionizing radiation (Caplan et al., 2000), multiple chemicals i.e. organic solvent (Labrèche and Goldberg, 1997), polycyclic aromatic hydrocarbon (PAHs) (Petralia et al., 1999), pesticide (Buranatrevedh, 2001; Jaga and Dharmani, 2005), shift work (Megdal, 2005), etc. The rising of breast cancer in Thailand may be related to past exposure of carcinogens in the workplace (Snedeker, 2006). Although some chemical exposures are suspected to affect breast cancer risk, the association between occupation and breast cancer in unclear. In most cases, the estimates of or actual exposures to these chemicals in the workplace have not often been determined.

In this study, a case-control study on breast cancer among Thai women was conducted. The aim of the study was to investigate the risk of female breast cancer among different occupational categories in Thailand. Identification of these factors may enhance the ability to prevent the disease by permitting better-focused occupational health and other preventive strategies.

Materials and Methods

Cases were all new incident breast cancer patients histologically diagnosed in the National Cancer Institute, Khon Kaen University hospital and Khon Kaen hospital during 2002-2004. Controls were randomly selected from healthy women who visited inpatients to the same hospitals for diseases other than breast or ovarian cancer. Cases comprising women with the age range from 17 to

Table 1. Distribution of Socio-Demographic, Lifestyle and Reproductive Factors Related to Breast Cancer Risk

Factor	Case (n = 516)		Control (n = 516)		Crude OR	95%CI
	n	%	n	%		
Age group						
≤40 years	119	23.06	157	30.43	1.00	-
41-55 years	293	56.78	251	48.64	1.54	(1.15-2.06)
> 55 years	104	20.16	108	20.93	1.27	(0.89-1.82)
Status						
Single	89	17.25	99	19.19	1.00	-
Married	362	70.16	360	69.77	1.12	(0.81-1.54)
Widowed, separate	65	12.59	57	11.04	1.27	(0.80-2.00)
Body mass index; BMI						
Normal (18.50-24.99kg/m^2)	289	56.01	338	65.50	1.00	-
Underweight (<18.50kg/m^2)	27	5.23	37	7.17	0.85	(0.51-1.44)
Overweight (≥ 25.00kg/m^2)	200	38.76	141	27.33	1.66	(1.27-2.17)
Regular exercise						
Never	392	75.97	335	64.92	1.00	-
Ever	124	24.03	181	35.08	0.59	(0.45-0.77)
Smoking history						
Non-smoker	443	85.85	478	92.64	1.00	-
Passive smoker	58	11.24	30	5.81	2.09	(1.32-3.30)
Smoker	15	2.91	8	1.55	2.02	(0.85-4.82)
Regular drinking alcohol						
Never	479	92.83	489	94.77	1.00	-
Ever	37	7.17	27	5.23	1.40	(0.84-2.33)
Family history of breast cancer						
No	19	3.68	5	0.97	1.00	-
Yes	497	96.32	511	99.03	3.91	(1.82-8.13)
Age at 1st menstruation						
≤ 11 years	12	2.32	12	2.32	1.00	-
12-16 years	402	77.91	417	80.81	0.96	(0.43-2.17)
> 16 years	102	19.77	87	16.87	1.17	(0.50-2.74)
Pattern of menstruation						
Regular	426	82.56	434	84.11	1.00	-
Irregular	90	17.44	82	15.89	1.23	(0.87-1.73)
Menstruation status						
Premenopause	277	53.68	290	56.20	1.00	-
Menopause < 55 year	227	43.99	219	42.44	1.06	(0.83-1.36)
Menopause ≥ 55 year	12	2.33	7	1.36	1.90	(0.69-5.20)
Age at 1st child						
No children	126	24.42	137	26.55	1.00	-
≤ 30 years	354	68.60	351	68.02	1.10	(0.83-1.46)
> 30 years	36	6.98	28	5.43	1.40	(0.81-2.42)
Previous lactation						
Never	172	33.33	158	30.62	1.00	-
Ever	344	66.67	358	69.38	0.88	(0.68-1.15)
Previous use of pill						
Never	299	57.95	336	65.12	1.00	-
Ever	217	42.05	180	34.88	1.36	(1.05-1.74)

79 years were frequency matched to control with age ±5 years. 516 pairs of cases and controls were recruited in the study. After inform consent, exposure status, regarding the potential risk factors, is ascertained through face-to face interviewed by trained field nurses. The standardized questionnaires were carried out to collect information on occupation, demographic, life style and reproductive history. The study was approved by the ethical review committee for research in human subjects, Ministry of Public Health, Thailand.

The International Standard Classification of Occupations (ISCO-version 68) was used to classify occupations into categories by the first digit job title codes (International Labour Office, 1969). These occupational categories were conducted to identify the association of breast cancer in the major work group. All occupation in working life were collected. Subjects who never worked in those occupational categories were included in the reference category. Risk by duration of work was calculated from the number of years from age start to work and to end of work in those occupations. The duration of work was divided into two categories, namely 1-10 years and more than 10 years. Latency of work was calculated from the range of years from age start to work and to the age of diagnosis in cases or to the age of interview in control. To avoid the influence from short term employment, only occupations which lasted more than 1 year were regarded in the study.

Statistical analysis

All the data entry and analyses were conducted by using SPSS for windows (version 11.5, SPSS Incorporated). The categorical data were described by frequency and percentage. The relation between occupational category and breast cancer by multivariate analysis was investigated. Unconditional logistic regression was used to estimate adjusted odds ratios (OR) and 95% confidence intervals (CI). In the statistical modeling, occupational category was fixed in the model and adjusted for other factors with p-value <0.2 by stepwise regression procedure. Appropriateness of the final model was checked by Hosmer-Lemeshow goodness-of-fit tests (Chan, 2004). The study also stratified analysis by duration and latency. Chi-square test for trend were utilized in duration of work for dose response relationship.

Results

The age of subjects ranged from 17 to 79 years. Mean and standard deviation of ages in cases and controls were 46.9±10.6 and 47.8±10.0 years, respectively. Table 1 show demographic, lifestyle and reproductive factors. Several factors were found to associate with breast cancer in univariate analyses such as age group, body mass index, ever use of pill, smoking history, exercise, family history of breast cancer. So, some selected risk factors were utilized to adjusted confounder in analyses with occupation factor. In Table 2, most of occupations in all study population were agricultural, animal husbandry and forestry worker, fisherman and hunters (33.8%). The highest proportion of occupation in cases was production and related workers, transport equipment operators and labourers (58.19%). There are 196 persons who worked only in one or more than one occupation, but the results show no association between breast cancer risk and number of occupations in work life (OR=0.84, 95% CI=0.56-1.25 and 1.32, 95% CI=0.83-2.11, respectively).

After adjusting for other breast cancer risk factors by multivariate analysis, occupational categories which remained significantly increased risk of female breast cancer were observed for production and related workers, transport equipment operators and labourers (OR=1.41, 95% CI=1.01-1.97) (in Table 2). On the other hand, a significantly decreased breast cancer risk was observed in clerks (OR=0.59, 95% CI=0.37-0.96). The odds ratio of breast cancer risk in these occupational categories were significantly associated gradients with duration of work in an incremental manner with the p for trend=0.01 and latency less than 10 years as shown in Table 3.

Discussion

In Thailand, occupational cancer is not top of priority of research in occupational health field. (Siriruttanapruk, 2004)The epidemiological data are also limited, although occupation is one source of carcinogen exposure.

Table 2. The Distribution of Study Population and Cases in Each Occupational Category

Major group of occupation[a]	Total[b] (person)	Percent	Number of cases (person)	Proportion of case	Crude odds ratio		Adjusted odds ratio[c]	
					OR	95%CI	OR	95%CI
00	112	10.85	58	51.79	1.08	(0.73-1.60)	0.99	(0.66-1.49)
0/1	161	15.60	69	42.85	0.71	(0.51-1.00)	0.87	(0.61-1.24)
2	17	1.65	6	35.29	0.54	(0.20-1.47)	0.54	(0.19-1.51)
3	85	8.24	30	35.29	0.52	(0.33-0.82)	0.59	(0.37-0.96)
4	168	16.28	95	56.55	1.37	(0.98-1.91)	1.42	(1.00-2.00)
5	144	13.95	82	56.94	1.38	(0.97-1.97)	1.37	(0.95-1.97)
6	349	33.82	178	51.00	1.06	(0.82-1.38)	0.93	(0.71-1.23)
7/8/9	177	17.15	103	58.19	1.49	(1.07-2.07)	1.41	(1.02-1.97)

[a] Group 00 Student, housewife. Group 0/1 Professional, technical, Group 2 Administrative and managerial workers, Group 3 Clerks, Group 4 Sale workers, Group 5 Service workers, Group 6 Agricultural, animal husbandry and Forestry worker, fisherman and hunters, Group 7/8/9 Production and related workers, transport equipment operators and labourers; [b] the total not equal to sum of cases and controls, because 196 subjects have more than one occupation; [C] adjusted for age group, BMI, regular exercise, smoking history, family history of breast cancer and previous use of pill.

Table 3. Adjusted Odds Ratio between Occupational Category and Breast Cancer Risk Stratified by Duration and Latency of Work

Major group of occupation	Duration of work		Latency of work	
	Adjusted OR 1-5 year	Adjusted OR > 5 year	Adjusted OR 1-10 year	Adjusted OR > 10 year
0/1	0.57 (0.21-1.62)	0.91 (0.63-1.32)	0.89 (0.35-2.27)	0.87 (0.60-1.26)
2	1.01(0.06-16.68)	0.49 (0.16-1.50)	No subjects in this category	0.74 (0.24-2.22)
3	0.41 (0.13-1.36)	0.63 (0.38-1.07)	0.26 (0.08-0.81)	0.74 (0.43-1.26)
4	1.21 (0.61-2.38)	1.48 (1.00-2.18)	1.55 (0.80-3.00)	1.38 (0.93-2.03)
5	1.14 (0.51-2.55)	1.42 (0.96-2.12)	0.87 (0.38-1.99)	1.50 (1.00-2.24)
6	0.58 (0.18-1.84)	0.96 (0.73-1.27)	0.27 (0.06-1.32)	0.97 (0.73-1.28)
7/8/9	1.26 (0.63-2.56)	1.44 (1.01-2.09)	3.40 (1.22-9.47)	1.26 (0.89-1.80)

It is difficult to investigate the association between occupational exposure and cancer risk since the study looks backward and examines the past exposure. Occupational exposure in working environment could be assessed by different methods (Teschke, 2002). The present study starts with a simplified method by occupational category which included all occupations held through lifetime and adjusted for other potential risk factors of breast cancer. When lifetime occupational history was considered, an increased risk of breast cancer was found among women who worked in production, transport equipment operators or labourers compared with women who never work in those occupations. The national cancer statistic also showed the high incidence of breast cancer in industrial province (Chaiweerawattana, 2008). In addition, a dose-response pattern for duration of employment was also supported this finding by a statistically significant positive trend for duration of work (p for trend=0.01). For Latency period, it was stronger risk for workers who were employed for less than 10 years after first exposure. Thus, it seems that long latency may not be the important factor that associated with an increased risk of breast cancer. However, misclassification cannot be exclude.

Work in production, transport equipment operators or labourers may have been more likely to have jobs involving exposure to multiple carcinogens (Snedeker, 2006). Current review by Brody and Rudel suggests exposure to organic solvents, metals, acid mists, sterilizing agents (ethylene oxide), some pesticides and light at night (shift work) mostly found in industrial workplace increases breast cancer risk among women in occupational settings (Brody and Rudel, 2003). The hypothesis has been put forward that exposure to these hazards act as endocrine-disrupting compounds could be mimic the actions of estrogens, affected endocrine function as a consequence, could promoted growth of breast cancer cell. The report by the National Toxicology Program indicated more than 40 chemicals can induce mammary tumors conducted by animal cancer bioassays, and most of these are still in production industries (Dunnick, 1995). Some hazards such as ionizing radiation were genotoxic to affected mammary gland development and responsiveness to increase the breast cancer (Peplonska, 2007). The increase risk of breast cancer may be direct cause to breast cancer form direct exposure to carcinogen. The indirect effect should not be excluded. Some female industrial workers may have changing reproductive pattern such as few children, non breast feeding. On the other hand, clerks had decrease risk compared with women who never work in those occupations. This may be explained by indirect effect such as lifestyle, reproductive factors (Pollán and Gustavsson, 1999). This occupation may have more lifetime leisure-time and occupational physical activity, which could be substantially modified the underlying degree of adiposity that were protective against breast cancer (Kramer and Wells, 1996; Moradi et al, 2000). In this study found that agriculture and service sectors, the major occupations in Thailand were not significantly associated with breast cancer. Our result was contrasted to the report of previous studies (García, 2003; Mills and Yang, 2005).

The case-control design of this study had some limitations. Possible explanations for this overall negative study might be biases. Recall bias was unavoidable in case-control study. Thus, the result of this study should be interpreted with caution (Morgenstern and Thomas, 1993). This study had information on only the occupation plus the duration of employment and latency period that may cause misclassification. In-depth assessment of occupational histories by other method can reduce the exposure misclassification (Teschke et al, 2002). Also, selection bias of control may occur in this study. To exclude potentially "non-causal" occupational exposures from analysis, in an additional duration of work and latency analysis, only exposures up to 1 year of these occupations also cause selection bias as well. Replication of these findings with other occupational exposure assessment methods such as job exposure matrix will be needed to confirm the findings (Nieuwenhuijsen, 2003).

Due to the increasing proportion of the female workforce in Thailand. Result from moving of occupation in Thai female from household to other occupation. Further studies should be performed especially in high risk occupation. This study suggests that Thai female workers who work in industrial sector may contribute to the etiology of breast cancer. However, further studies are warranted to confirm the specific exposure. Occupational health provider should be aware of the current science on breast cancer risks in the workplace. Avoidable of carcinogen exposure and surveillance of high risk women should be performed. Education campaigns, particularly those concerning breast self-examination and breast cancer screening, should be used to raise awareness.

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