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Field Study

Health Disparities among Occupations in Taiwan: A Population Study

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Abstract: Health Disparities among Occupations in Taiwan: A Population Study: Fu-Li CHEN, *et al*. Department of Public Health, Fu-Jen Catholic University, Taiwan—Objectives: The first large-scale population survey was conducted in Taiwan to examine if and to what extent health disparities of four major chronic physical conditions exist among occupations. **Methods:** Face-to-face interviews about two risk behaviors (i.e., cigarette and alcohol use) and four major chronic physical conditions (i.e., cardiovascular disease, diabetes, liver disease and asthma) were conducted with 13,741 workers from nine major categories of occupations. **Results:** Health disparities among occupations were found based on a series of hierarchical logistic regression analyses after controlling for age, sex and two risk behaviors. In general, prevalence rates of cardiovascular disease among elementary occupations and skilled agricultural and fishery workers were approximately two to four times higher than those among other occupations. The above two occupations and plant and machine operators also had higher prevalence rates in diabetes and liver disease. **Conclusions:** The results concerning health disparities among occupations provide policymakers and researchers with invaluable benchmarks of chronic physical conditions among occupations. The findings also suggest the importance of investigating causal relationship between these diseases and exposures at work, identifying and reducing unique risk factors and hazard exposures experienced by workers and conducting targeted surveillance and health promotion programs for at-risk occupations.
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Significant health disparities among occupations have been reported in various studies around the world[1–3]. For instance, based on the results of a general population study in Norway, Trond documented that legislators, officials and managers reported better physical and mental health compared with drivers and agricultural and fishery workers[3]. Similarly, Gueorguieva found professional workers reported better health than workers in service, farming, fishery and mechanical industries[2]. Holmes also found marked differences among occupations in the mortality rates resulting from different diseases. For example, plant and machine operators and assemblers suffered more from coronary heart/ischemic heart disease, other circulatory and respiratory diseases, and endocrine, nutritional and metabolic diseases compared with other occupations[1].

Similar to the studies reported above, there have been some sporadic reports in Taiwan about health disparities among occupations. In general, these studies have focused on specific occupations (e.g., waiters/waitresses, flight attendants or carpenters[4–7]) or a specific illness or disease (e.g., depression, burnout, malignant mesothelioma) and were conducted on a small scale. For instance, Liu found unemployed workers exhibited more depression symptoms than either white or blue collar workers[7]. In addition, Li, Chi, Chang and Wu revealed higher metabolic syndrome incidence occurred among male salespersons or clerks and female farmers/operators[8]. Although these studies provided valuable information to understand the health status of some occupations, a broader and more comprehensive picture about the status of health disparities among occupations is still not available in Taiwan.

To address this need, a population-based survey was conducted to assess four major chronic physical conditions: cardiovascular disease (CVD), liver disease, diabetes and asthma. The choice of these four health concerns was based on the following ratio-

nales. First, CVD and liver disease are two of the top five causes of death among workers (the other three are cancer, accidents and stroke). Second, diabetes is the fifth highest cause of death among male workers and the sixth highest cause of death among female workers[9]. Finally, asthma is the most common occupational lung disease[10–12], and it has been estimated that 2.94% of adults suffer from asthma in southern Taiwan[13]. However, there is no empirical data based on a large population survey that would enable investigation of the prevalence of these chronic physical conditions among occupations in Taiwan. In sum, the present study would provide initial evidence about the status of health disparities concerning four major health concerns, which tend to be associated with occupations. The findings, in turn, could be utilized to develop strategic planning and research agendas to identify, reduce and control causes of these health disparities.

Methods

Respondents and procedures

The present study was performed using a secondary dataset containing variables from a population survey, which was sponsored by the Bureau of Health Promotion, Department of Health, Taiwan. The survey was conducted by face-to-face interviews between participants and trained health center nurses. Participants were randomly selected based on a multiple-stage clustering sampling approach. In the first step, 2 to 12 townships were randomly selected from each of the 23 counties in Taiwan. Within the selected townships, 12 to 123 neighborhoods were randomly selected. Within each neighborhood, which consisted of 10 to 200 households, four households were randomly selected. This resulted in 32,660 individuals aged 15 yr old or above being invited to participate in the study. Among them, 26,755 adults (81.92%) agreed to take part in the interview. In the present study, we selected the 13,741 participants who were currently employed, with an average response rate of 93.3% across the occupations. Response biases would likely be minimal based on the random selection procedure and the high response rate.

Participants' jobs were classified into one of the nine main occupations based on the modified ISCO-88[14]: professionals (e.g., engineers, medical doctors, or lawyers); senior officials and managers (e.g., government administrators or company directors); clerks (e.g., computing machine operators or market surveyors); salespersons, demonstrators, and models (e.g., technical salesmen or insurance and business service salesmen); craft and related workers (e.g., miners or painters); plant and machine operators and assemblers (e.g., cabinet makers, or machine tool operators); personal and protective services workers (e.g., cooks, or nursemaids); elementary occupations (e.g., unskilled construction workers or unskilled factory workers); and skilled agricultural and fishery workers (e.g., farmers, forestry workers, or fishermen).

Measures

Respondents' occupations, age (18–29, 30–39, 40–49, and 50–64), sex (male and female) and health risk behaviors (cigarette and alcohol use) were recorded in the interview. Workers above 65 yr of age were excluded in the present study for two practical reasons. First, in Taiwan, these workers are required to retire by law with the exception of self-employed workers. Second, workers above 65 yr old tend to suffer from more chronic diseases and illnesses than other workers due to the aging process. The inclusion of these workers would likely muddy the findings about health disparities among occupations. During the interview, respondents were asked if they had any of the following chronic physical conditions diagnosed by physicians: diabetes, CVD, liver disease or asthma. In addition, they were asked if they smoke or consume alcohol at least once per month.

Data analysis

Prevalence rates for risk behaviors and chronic physical conditions were calculated based on a different weight for each participant. These weights were derived based on the distributions of sex, age and the 23 counties and were provided in the dataset.

To assess if health disparities exist, we compared differences in the four chronic physical conditions among occupations by entering age, sex, risk behaviors (cigarette and alcohol use) first, followed by occupations in the second step in a series of hierarchical logistic regressions.

Ethical considerations

This study was reviewed and approved by the Bureau of Health Promotion, Department of Health, Taiwan. The purpose and voluntary nature of this study was explained by the interviewer. All respondents were assured the anonymity and confidentiality of their responses.

Results

The results section consists of three parts. First, descriptive statistics of sex, age, occupations and risk behaviors among respondents are described. Second, prevalence rates of chronic physical conditions and risk behaviors among occupations are reported. Finally, health disparities among occupations are examined by controlling for potential confounding variables including age, sex and risk behaviors.

As shown in Table 1, males (55.5%) and those aged between 30 and 39 (30.1%) made up the majority in the current sample. Most respondents' occupations fell into the category of clerks (22.5%) and senior officials and managers (22.0%). With regard to risk behaviors, 33.6% of them smoke cigarettes, and 26.3% of them consume alcohol.

Table 1. Distribution of sex, age, occupations, and risk behaviors among respondents

Characteristics	n (%)
Sex	
Male	7,835 (55.5)
Female	5,906 (44.5)
Age	
18–29	3,582 (27.5)
30–39	4,063 (30.1)
40–49	3,737 (27.3)
50–64	2,359 (15.0)
Occupations	
Professionals	1,427 (10.8)
Senior officials and managers	3,003 (22.0)
Clerks	2,769 (22.5)
Salespersons, demonstrators, and models	838 (6.0)
Craft and related workers	1,741 (12.7)
Plant and machine operators and assemblers	1,356 (9.9)
Personal and protective services workers	1,160 (8.4)
Elementary occupations	497 (3.3)
Skilled agricultural and fishery workers	950 (4.6)
Cigarette use	
Yes	4,791 (33.6)
No	8,949 (66.4)
Alcohol use	
Yes	3,892 (26.3)
No	9,826 (73.7)

numbers range from 13,718–13,741.

Notable disparities in chronic physical conditions among occupations are shown in Table 2. The prevalence rates of CVD among elementary occupations and skilled agricultural and fishery workers were approximately two to four times higher than those among other occupations. In addition, elementary occupations had a higher prevalence rate of asthma than the other occupations. Both of the above two occupations and plant and machine operators also had higher prevalence rates of diabetes and liver disease.

Prevalence rates of cigarette and alcohol use across occupations are also reported in Table 2. Overall, all but three occupations showed a high prevalence of cigarette smokers. It is particularly alarming that approximately 50% of craft workers and skilled agricultural and fishery workers smoke. In addition, craft workers, elementary occupations and skilled agricultural and fishery workers frequently engage in both risk behaviors, in contrast to other occupations. Finally, it is surprising to find that senior officials and managers consume alcohol more often than other occupations, except for craft workers.

To examine the disparity in the four chronic physical conditions among occupations, a series of hierarchical logistic regression analyses were conducted by controlling for age, sex and risk behaviors. In the first step, age (age 18–29 as the reference group), sex (male as the reference group) and risk behaviors (nonsmokers and nondrinkers as the reference groups) were regressed on each chronic physical condition. In the second step, eight occupation dummy variables (professionals as the reference group) were entered into each equation. The results of the final models are reported in Table 3. As expected, older workers reported more chronic physical problems such as CVD, diabetes and liver disease than younger workers. It is particularly noticeable for older workers

Table 2. Prevalence rates (%) of risk behaviors and chronic physical conditions among occupations

	Risk behaviors		Chronic physical conditions			
Occupations	Cigarette use	Alcohol use	CVD	Diabetes	Liver disease	Asthma
Professionals	16.5	15.3	2.5	1.0	7.6	1.3
Senior officials and managers	37.6	34.6	3.5	3.7	8.4	1.3
Clerks	21.0	15.8	2.2	1.3	5.6	0.8
Salespersons, demonstrators, and models	26.7	20.3	1.7	3.3	6.3	0.7
Craft and related workers	54.5	42.0	2.3	2.3	8.2	1.8
Plant and machine operators and assemblers	38.8	24.0	3.5	3.5	8.5	1.7
Personal and protective services workers	36.8	24.3	3.1	1.7	5.5	2.2
Elementary occupations	37.5	32.4	6.9	3.6	10.1	4.3
Skilled agricultural and fishery workers	46.5	33.6	5.7	3.9	9.2	1.5
Average %	33.6	26.3	3.0	2.5	7.4	1.4

numbers range from 13,710–13,739. CVD: Cardiovascular disease.

Table 3. Associations of chronic physical conditions and occupations while controlling age, sex, and risk behaviors

	CVD		Diabetes		Asthma		Liver disease	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age								
30–39 (vs. 18–29)	1.68**	1.16–2.45	2.18*	1.18–3.88	0.47***	0.30–0.71	1.09	0.92–1.31
40–49 (vs. 18–29)	3.22***	2.26–4.58	6.95***	4.02–11.80	0.99	0.69–1.43	1.30**	1.09–1.56
50–64 (vs. 18–29)	8.34***	5.86–11.88	24.32***	14.33–41.49	1.18	0.78–1.78	1.26*	1.02–1.56
Female sex (vs. male)	1.43**	1.12–1.83	0.58***	0.43–0.77	0.84	0.6–1.19	0.49***	0.42–0.58
Cigarette use (vs. non users)	1.18	0.92–1.52	1.51**	1.17–1.94	1.15	0.82–1.61	0.92	0.74–1.91
Alcohol use (vs. non users)	1.12	0.88–1.42	0.68**	0.53–0.88	0.87	0.62–1.22	1.05	0.90–1.21
Occupation (vs. Professionals)								
Senior officials and managers	0.90	0.62–1.33	1.79*	1.05–3.06	0.96	0.39–1.46	0.91	0.72–1.15
Clerks	0.89	0.59–1.32	1.48	0.83–2.65	0.63	0.35–1.13	0.78*	0.62–1.00
Salespersons, models and demonstrators	0.52*	0.28–0.95	2.72**	1.45–5.11	0.53	0.22–1.30	0.90	0.64–1.26
Craft and related workers	0.86	0.55–1.36	1.70	0.94–3.07	1.26	0.71–2.23	0.84	0.65–1.09
Plant and machine operators and assemblers	1.09	0.71–1.68	2.47**	1.38–4.39	1.24	0.68–2.26	1.07	0.82–1.40
Personal and protective services workers	1.04	0.66–1.65	1.38	0.71–2.69	1.64	0.91–2.93	0.72*	0.53–0.98
Elementary occupations	1.61	0.99–2.63	1.80	0.89–3.63	3.16***	1.67–5.99	1.30	0.91–1.87
Skilled agricultural and fishery workers	1.04	0.65–1.67	1.14	0.60–2.17	0.90	0.41–2.00	0.99	0.71–1.38

numbers range from 13,710–13,739. Reference group for occupation is professionals; age is 18–29 yr old; sex is male, and cigarette use and alcohol use is non-smoker and non alcohol user. *p<0.05, **p<0.01, ***p<0.001. CVD: Cardiovascular disease; OR: Odds Ratio; CI: Confidence interval.

(50–64 yr old) who had a high likelihood of suffering from CVD (odds ratio, 8.34) and diabetes (odds ratio, 24.32) compared with younger workers (18–29 yr old). In contrast to male workers, female workers reported more CVD but less diabetes and liver disease. However, the differences in chronic physical conditions between male and female workers are not as pronounced as those between older and younger workers (Results can be obtained from the first author).

To test if chronic physical conditions differ among occupations after controlling for age, sex, and risk behavior, χ^2-tests for differences between the full model and a nested model across the four chronic conditions were examined. Significant χ^2 statistics were found for CVD (χ^2 (8)=16.18, p<0.05), diabetes (χ^2 (8)=22.37, p<0.05), Asthma (χ^2 (8)=35.39, p<0.05) and liver disease (χ^2 (8)=17.39, p<0.05) respectively, which suggests that chronic physical conditions differ among occupations after controlling for age, sex and risk behaviors. Senior officials and managers, salespersons and plant operators reported more diabetes when compared with professionals. In addition, elementary workers reported more asthma than professionals. Overall, professionals reported liver disease more than clerks and personal/protective services workers and more CVD than salespersons.

Discussion

The current study is the first population survey conducted in Taiwan to examine health disparities of four major chronic diseases among occupations. In general, blue-collar workers or unskilled workers tend to have a higher prevalence of diabetes, CVD and liver disease when compared with other occupations. These findings are similar to those found in the Netherlands[15]. However, these findings should be interpreted with caution due to the limitations of self-report accuracy regarding chronic illness diagnosed by physicians, as well as incomplete information about the algorithm used to derive individual weights while estimating prevalence rates. The former limitation may be improved in future research by providing evidence of physician diagnosis. Furthermore, broad occupational classifications utilized in the present study can be improved by utilizing specific job titles and characteristics. This information would likely assist researchers in exploring what specific job characteristics may be associated with health disparities.

Our findings that risk behaviors were engaged in

more often by blue-collar workers and male workers are similar to those reported previously[16, 17]. The most alarming observation is that the current results show a higher smoking rate on average (33.6%) compared with that among adults (27.0%) reported by the Bureau of Health Promotion, Taiwan[18]. It has been shown that smoking and alcohol consumption are associated with increased risk of liver disease, especially when both risk behaviors are engaged in[19]. This finding suggests the need to develop efficacious and effective workplace programs to address smoking and drinking problems, particularly targeting blue-collar workers and senior officers and managers.

The results concerning health disparities among occupations also pointed toward a future research agenda to investigate how these chronic diseases develop and to identify and reduce unique risk factors and hazard exposures of different occupations. The literature concerning occupational health disparities and occupational health psychology seem to suggest that mental (e.g., burnout) or physical health disparities (e.g., CVD or asthma) may be attributed to working conditions and job characteristics such as ergonomic risk factors[20]; exposures to vinyl chloride, silica, carbon fuel, wood dust, asbestos, mineral oils; or external ionizing radiation at work[21–23]; amount of control or discretion at work[24–30]; and skills and abilities required to perform tasks (e.g., regulating one's emotions and ways of expressing them to meet requirements at work[31]. Other contributing factors also include shift work and eating habits[32], management and organizational structure[33], safety and health climate[34], nature of jobs that create conflict between work and family[35], access to and utilization of quality health care[36] and organizational regulations or policies (e.g., sick leave policies or return to work policies).

In addition, it has been argued that the relationship between health disparity and occupation is likely indirectly affected by factors such as income, socioeconomic status, health, insurance and occupational status[2]. Furthermore, it has been suggested that the associations between health disparity and occupations could be moderated by risk behaviors such as cigarette use[37, 38] or alcohol consumption[39, 40]. However, we did not find a moderating effect in our study.

Finally, in addition to investigating pathways of occupational hazard exposure or risk factors and chronic health concerns, future research needs to conduct targeted surveillance for specific occupations and develop occupationally-specific health promotion programs. It is also recommended to consider linking the surveillance data consisting of detailed job titles with several well-established databases that describe the nature of jobs. For instance, Occupational Information Network (O*NET), a well-established job analysis database, contains six major domains pertaining to job positions and occupations: worker characteristics (e.g., ability, work styles, or occupational values and interests), worker requirements (e.g., basic skills and knowledge), occupational requirements (e.g., work context and generalized work activities), experience requirements (e.g., license, amount of training needed), occupation-specific requirements (e.g., tasks, duties) and occupational characteristics (e.g., labor market). By linking both databases, researchers would be able to explore to what extent different aspects of the above six domains may be associated with chronic physical conditions. These findings would likely shed light on what specific aspects of jobs may be responsible for health disparities.

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