RESEARCH PAPER

Workplace smoking related absenteeism and productivity costs in Taiwan

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Objective: To estimate productivity losses and financial costs to employers caused by cigarette smoking in the Taiwan workplace.
Methods: The human capital approach was used to calculate lost productivity. Assuming the value of lost productivity was equal to the wage/salary rate and basing the calculations on smoking rate in the workforce, average days of absenteeism, average wage/salary rate, and increased risk and absenteeism among smokers obtained from earlier research, costs due to smoker absenteeism were estimated. Financial losses caused by passive smoking, smoking breaks, and occupational injuries were calculated.
Results: Using a conservative estimate of excess absenteeism from work, male smokers took off an average of 4.36 sick days and male non-smokers took off an average of 3.30 sick days. Female smokers took off an average of 4.96 sick days and non-smoking females took off an average of 3.75 sick days. Excess absenteeism caused by employee smoking was estimated to cost US$178 million per annum for males and US$6 million for females at a total cost of US$184 million per annum. The time men and women spent taking smoking breaks amounted to nine days per year and six days per year, respectively, resulting in reduced output productivity losses of US$733 million. Increased sick leave costs due to passive smoking were approximately US$81 million. Potential costs incurred from occupational injuries among smoking employees were estimated to be US$34 million.
Conclusions: Financial costs caused by increased absenteeism and reduced productivity from employees who smoke are significant in Taiwan. Based on conservative estimates, total costs attributed to smoking in the workforce were approximately US$1032 million.

The adverse health effects of cigarette smoking have been studied extensively since the publication of the US Surgeon General's first report on smoking and health in 1964.[1] Cigarette smoking is now recognised as the most preventable cause of premature death and disability in Taiwan.[2–4] Life expectancy would increase by four years in Taiwan if no one smoked.[5] Although emphasis has been placed on premature death and disability caused by smoking in the general population, the financial burden caused by smoking in the workplace has received limited attention despite the fact that more than half of the four million smokers in Taiwan are in the workforce.

Employers suffer tangible and intangible financial losses because of worker smoking. Employee smoking imposes considerable costs on employers due to increased medical care and productivity losses. In response, some employers in Taiwan have introduced smoking policies.[6] However, few are likely to have fully considered the costs they bear due to employee smoking.

Our purpose is to estimate costs of employee smoking with respect to absenteeism and productivity losses.

WORKPLACE SMOKING PREVALENCE

Cigarette smoking is highly prevalent in Taiwan's adult male population and has changed little in the last 20 years.[2] Overall, the prevalence of smoking in Taiwan is approximately 55–60% for men and 3–4% for women. Peak smoking rates among men occur between the ages of 26 and 40 years and the peak rates among women occur around the age of 40.

Few surveys have been conducted on smoking prevalence in working populations. Based on data collected by the Taiwan Provincial Tobacco and Liquor Monopoly Bureau in 1996, smoking prevalence was 55.1% in men and 3.3% in women.[7] Smoking rates were particularly high in men aged 26–40 with rates ranging between 63–67%. Among men, occupations with the highest smoking rates were non-skilled labourers (70%), machine operators (68%), agricultural workers (67%), service and sales persons (65%), and skilled technicians (63%). Professional men had the lowest prevalence of smoking (37%). For women, the three occupational groups with the highest smoking rates were service and sales persons (5%), non-skilled labourers (5%), and representatives from all levels of government (5%). Based on data collected from 1884 randomly sampled workers by the Labor Insurance Bureau in 1997, the Institute of Occupational Safety and Health in Taiwan reported a smoking prevalence of 48% for male workers and 6% for female workers.[8] Average duration of smoking for men was 15.9 years and for women was 9.3 years, with an average of 14 and 9 cigarettes smoked daily, respectively.

WORKPLACE SMOKING CONTROL POLICIES

Tobacco control by the Taiwan government has been largely limited to smoking bans in public places, such as hospitals, theatres, bus and railroad stations, and other sites of mass transportation. The extent of smoking policies in Taiwanese workplaces has been described in a recent report sponsored by the National Science Council.[9] The report identified factors that affect formulation of workplace smoking policies and evaluated the impact of prohibitive, restrictive, and non-restrictive smoking policies on employees' smoking behaviours.

To examine smoking policies, Hu *et al* conducted a survey to assess workplace smoking policies in Taiwan and their association with employees' smoking behaviour.[6] A questionnaire was mailed to the presidents of the 800 largest companies in Taiwan (including 500 manufacturing industries, 250 service companies, and 50 banking institutions,

most of which had more than 250 employees) and asked them to forward the questionnaire to the responsible manager. After two follow ups, 264 companies, including 149 manufacturing industries, 88 service companies, and 27 banks, returned their questionnaires. The response rate was 62% after excluding blank returns due to incorrect addresses, incorrect contact persons, or the company being closed. Based on these completed questionnaires, approximately half of the manufacturing industries (49.7%) and service companies (51.1%) have implemented prohibitive smoking policies. Less than 30% of the banking institutions had implemented such policies, while 48% of all banks had no restrictive smoking policy whatsoever. Companies with more than 750 employees were most likely to have implemented a total smoking ban (57%). Reasons for banning smoking varied with respect to business type. For example, workplace safety was the major reason in 58% of manufacturing industries, compared to 33% of service companies and 19% of banks. Maintenance of air quality in the work environment was the most frequently cited reason for restricting smoking in 72% of service companies, 66% of manufacturing industries, and 41% of banking institutions. Less than half of employers cited concerns for smokers' health (47%) or for protecting non-smokers' health (45%).

Different policies had different effects on smoking behaviour. Companies that had implemented a total smoking ban had a smoking rate of 30%, which was significantly lower than the 43% and 45% rates in companies with restrictive or non-restrictive policies, respectively. Significant differences in cigarette consumption were also noted. Fifty three per cent of smokers in workplaces with prohibitive policies smoked fewer than 10 cigarettes per day, whereas 54% in restrictive and 64% in non-restrictive workplaces smoked 10–29 cigarettes each day.

During work hours, 69% of smokers in workplaces with prohibitive policies used designated smoking rooms; 52% did so in non-prohibitive environments. It is not surprising that the potential for environmental tobacco smoke (ETS) exposure was highest in workplaces without smoking policies (56%), followed by those with restrictive policies (51%) and smoke-free policies (29%).

COSTS OF EMPLOYEE SMOKING

The financial impact attributable to smoking is important to industry. Several studies have reported that smoking employees have substantially greater absenteeism, injuries, and accidents than do non-smoking employees.[10–15] Smokers may be less productive because of time lost on smoking breaks. Insurance premiums may be higher because of fire damage claims. Tobacco smoke may damage facilities and equipment.

Table 1 Estimated days of absence for smokers and non-smokers

	Males	Females
Average days of absence per year†	3.9	3.8
Estimated % excess absence (smokers)§	32.2%	32.2%
Total employment	5610000	3679000
Smoking prevalence	55.1%	3.3%
Estimated number of smokers	3091110	121407
Estimated number of non-smokers	2518890	3557593
Estimated days of absence: smokers	4.36‡	4.96
Estimated days of absence: non-smokers	3.30*	3.75
Excess days of absence: smokers	1.06	1.21

*5610000×3.9 days/(3091110×1.322+2518890) = 3.30 days.
†Source: Institute of Occupational Safety and Health.[8]
‡3.30 days×1.322 = 4.36 days
§Source: Bertera.[12]

The following estimates use the human capital approach to calculate lost productivity by assuming that value of lost productivity is equal to the wage/salary rate. Estimated costs in Taiwan caused by absenteeism were based on: (1) prevalence of smoking among the working population; (2) average days of absence among workers; (3) average wage/salary rate; and (4) excess risk and days of absence among smokers reported in other studies. Similar analyses were conducted by Parrott and colleagues in estimating the cost of employee smoking in the workplace in Scotland.[16] Smoking prevalence in the Taiwan workforce averages 55% for males and 3% for females.[7] These prevalence rates were applied to corresponding employed populations to provide estimated numbers of male and female workers who smoke. Based on a 1999 survey of 1700 workers (853 males and 856 females), the Institute of Occupational Safety and Health determined the annual average days of illness absence were 3.9 for men and 3.8 for women.[8] Average hourly wage/salary rates (converted to US dollars, US$1 = 33.5 Taiwan dollars) of US$6.73 for men and US$4.98 for women were used to approximate labour productivity.[17] A number of studies in the literature have reported estimates of increased absenteeism in different working populations.[10–15 18] Based on a survey of cigarette smoking and sick leave at a large petrochemical complex in Shanghai, China, Wang and Dobson reported that smoking was positively associated with sick leave, with relative risks ranging from 1.32 to 1.56.[10] The mean duration of sick leave for this study was 3 days per year. Van Tuinen and Land examined employees of Missouri Health Department (97 smokers and 309 non-smokers) and found that smokers took an average of 8 days of sick leave per year compared to 6.5 days for non-smokers, an excess absence of 1.5 days per year, or 23% more sick days for smokers than for non-smokers.[11] Based on a large diversified workforce (n = 45976) of a chemical company (DuPont), Bertera reported that smokers had a 0.9 day per year excess absence from work, which was 32.2% higher than the number of absence days per year for non-smokers.[12]

Tsai and colleagues examined employees at several Shell Oil Company facilities and estimated an excess sick leave of approximately 3 days among smokers.[13–15] In a study based on employees' absence data from 1990 to 1999, average days of absence were 6.4 days a year for smokers, 4.8 days for ex-smokers, and 3.5 days for non-smokers.[15] Smokers were thus absent 2.9 and 1.6 more days than non-smokers and ex-smokers, which can be translated to 83% and 33% higher rates of absenteeism, respectively. The Whitehall study of UK civil servants estimated a 46% higher short absence rate and an 81% higher long absence rate for male smokers, and higher short and long absence rates of 9% and 37%, respectively, for female smokers.[18]

We used the DuPont study's[12] conservative estimate of excess sick leave among smokers. Using the average 3.9 sick days a year for male employees in Taiwan, average sick leave can be estimated to be 4.36 days for smokers and 3.30 days for non-smokers (table 1). Corresponding sick leave for female employees was 4.96 days for smokers and 3.75 days for non-smokers. Costs of employee smoking in terms of excess absenteeism were estimated to be US$178 million per year for males and US$6 million for females: a total of US$184 million per year (table 2).

ETS in the workplace is a potential financial burden on employers. Studies have reported that employees exposed to ETS at work have higher nicotine metabolite levels in their blood than those who are not exposed.[19] Passive smoking may be biologically equivalent to a small amount of active smoking, and there is increasing evidence that links it to lung cancer,[20] ischaemic heart disease,[21 22] and late onset of asthma.[23] Absenteeism and increased use of medical services

Table 2 Estimated cost of absenteeism caused by smoking in Taiwan

	Males	Females	Total
Total employment*	5610000	3679000	9289000
Smoking prevalence	55.1%	3.3%	–
Estimated number of smokers	3091110	121407	3212517
Excess hours of absence per smoker	8.48	9.68	–
Wage per hour†	US$6.73	US$4.98	–
Cost of absence	US$177503877	US$5856148	US$183360025

*Source: Taiwan Provincial Tobacco and Liquor Monopoly Bureau.[7]
†Source: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China.[17]

have been reported as consequences of ETS exposure. A recent study of Hong Kong police officers found a 27% increase in sick days during a six month period for male officers and a 42% increase for female officers due to ETS exposure.[24] Since only 48% of major employers in Taiwan have smoking policies that restrict smoking to smoking rooms, the impact of ETS is likely to be high. Assuming half of non-smokers in Taiwan are exposed to ETS in the workplace and applying that figure to males, we estimate that the cost of excess sick days from ETS for male workers is approximately US$53.6 million. Assuming 20% of non-smoking females had routine ETS exposure, we estimate the cost of excess sick days from ETS for female workers to be $27.2 million (table 3). The workplace injury frequency rate has been reported to be significantly higher among smokers than non-smokers, with a relative risk of 2.456 (95% confidence interval (CI) 2.448 to 2.464).[25] Based on the increased relative risk of occupational injuries among smokers (compared to non-smokers), the potential cost incurred from occupational injuries among smokers was estimated to be US$34 million (table 4).

We also evaluated indirect costs from productivity losses due to smoking. Male adults in Taiwan smoke on average 14 cigarettes per day.[8] Assuming 20% of these, or 3 cigarettes, are smoked at work and assuming an average of 6 minutes per cigarette, we calculated a time loss per smoker of 18 minutes per day, or 9 days per year. Similar calculations were performed for females, who smoke 9 cigarettes per day on average,[8] yielding a time loss of 6 days per year per female employee due to smoking breaks. We applied these productivity loss estimates to the 48% of major employers that provided smoking rooms before implementation of the Tobacco Hazards Control Act (1997). This is a more conservative approach for estimating losses for companies with restrictive or non-restrictive smoking policies. Applying the average annual wage/salary, we estimated reduced productivity costs from smoking breaks to be US$733 million (table 5). Premature deaths of smokers and non-smokers exposed to ETS as well as smoker related fire damage constitute additional sources of financial burden on employers. Available data are not sufficient to assess fully their financial impact in Taiwan.

Table 3 Estimated cost of absenteeism of non-smokers caused by environmental tobacco smoke (ETS)

	Male	Female
Estimated days of absence: non-smokers	3.30	3.75
Estimated % excess absence (ETS)	27%	27%†
Estimated number of non-smokers	1259445	711519
Estimated days of absence: ETS	3.71*	4.52
Estimated days of absence: no ETS	2.92§	3.56
Excess days of absence: ETS	0.79	0.96
Cost of ETS	US$ 53568754	US$27213042

*2.92 days×1.27 = 3.71 days.
†Per cent excess for males was used.
§2518890×3.3 days/(1259445×1.27+1259445) = 2.92 days.

Table 4 Estimated cost of occupationally related absence caused by smoking (males only)

Factor	Value
Relative risk of occupational injuries†	2.456
Total employment	5610000
Estimated number of smokers	3091110
Estimated number of non-smokers	2518890
Occupational injuries absence per year: smokers	0.341 days* (2.72 hours)
Occupational injuries absence per year: non-smokers	0.139 days§ (1.11 hours)
Excess absence hours per year due to smoking	1.61 hours
Wage per hour	US$6.73
Cost of occupational injuries	US$33602712

*0.139 days×2.456 = 0.341 days.
†Source: Tsai *et al*.[25]
§1402080 days/(3091110×2.456+2518890) = 0.139 days.
1402080 = Total absence days due to occupational injuries among male workers in 1999.[26]

Assuming that gross domestic product (GDP) represents labour of the entire working population, we estimated that smoking related productivity losses (US$1032 million) accounted for 0.36% of total GDP in 2000.[17]

DISCUSSION

Financial costs of excess absenteeism, reduced productivity, and occupational injury from employees who smoke are significant in Taiwan. Based on conservative estimates, total costs of smoking among working adults in Taiwan were approximately US$1032 million: US$184 million from increased sick leave, US$81 million from ETS, US$34 million from occupational injuries, and US$733 from lost productivity. Estimated costs from absenteeism were based on several factors as mentioned earlier (sick days among smokers, sick days among non-smokers due to ETS exposure, occupational related sick days, and loss of productivity due to smoking breaks). Applying available probable ranges for these parameters, table 6 shows that the financial costs due to smoking in Taiwan range from US$740 million to US$1476 million.

These estimates of smoking related costs in the workplace are highly dependent on assumptions. For example, there are a number of methods to assess the cost of lost productivity due to illness absence. This study uses the human capital method which can overestimate the actual loss.[27] For some absences (for example, short term absence), productivity may drop only slightly if staff (mainly office workers) can be replaced by others or made up by the sick person on his/her return to work. But for skilled hourly workers, the loss can be more than the actual hourly wages for such workers. New data and alternative assessment methods would modify cost figures presented in this paper.

Table 5 Productivity loss caused by smoking breaks

	Males	Females	Total
Smoking allowed in smoking rooms	48%	48%	48%
Average hours lost per smoker/year	72	48	–
Estimated number smokers in facilities	1483733*	58275	1542008
Hourly rate	US$6.73	US$4.98	–
Estimated cost per year	US$718957662	US$13930056	US$732887718

*1483733 = 3091110×0.48.

Table 6 Range of financial costs due to smoking

	Lower estimate	Costs (US$)	Upper estimate	Costs (US$)
% Excess absence (smokers)	23%*	$136688311	83%†	$384510305
% Excess absence (ETS)	27%‡	$80781796	27%‡	$80781796
Workplace injuries (RR)	2.448	$33500018	2.464	$33704907
Estimated smoking breaks (min/cig)	4	$488591812	8	$977183624
Total		$739561937		$1476180632

*Source: Van Tuinen and Land.[11]
†Source: Tsai *et al*.[25]
‡Alternative data are not available.
ETS, environmental tobacco smoke; RR, relative risk.

What this paper adds

Smoking workers lost productivity through excessive sick leave, on-the-job injuries, and frequent smoking breaks. Non-smoking workers also lose productivity through exposure to second hand smoke. Together these effects incur the equivalent of US$1 billion loss in productivity, accounting for 0.36% of total gross domestic product in Taiwan. Employers can reduce these substantial losses through establishing and implementing smoke-free workplace policy.

The current study is limited in its ability to assess potential confounders. Illness absence in working populations is a complex phenomenon including many factors. A potential confounding variable in this study is the possible effect of alcohol and drug abuse on the observed increase in absence among smokers. Further, the potential exists for educational level, socioeconomic status, and other factors (for example, diet, occupational factors) to confound the relation between smoking and morbidity, particularly that caused by injury where confounding involving low occupational status smokers being likely to perform more dangerous jobs is a consideration. However, these factors cannot be properly assessed in the present study.

Medical evidence of the hazards of smoking has been widely reported since the 1960s but only limited studies have been conducted, particularly among Asian populations, on the loss of productivity due to smoking. The policy goal for the workplace should be to require entirely smoking free environments for the protection of non-smoking workers. The Labor Safety and Health Law in Taiwan requires employers to provide a clean air and carcinogen-free workplace. Associated implications to policy issues have been addressed elsewhere.[28]

The loss of productivity and costs associated with worker replacement due to smoking related premature mortality were not included in this paper. While reducing smoking will clearly lead to a reduction in premature mortality and increased productivity, these will not happen immediately. However, the sooner workplace smoking ban policies are introduced, the earlier employees and employers will reap their effects. Businesses in Taiwan today, in an effort to remain competitive, seek ways to contain costs and increase productivity. Establishing smoke-free workplaces is one important way of achieving this. We believe reducing smoking among working populations would be a cost effective way to increase national productivity.

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