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Occupational difference in use of heated tobacco products: a cross-sectional analysis of retail workers in Japan

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ABSTRACT

Objective Although heated tobacco products (HTPs) have become popular worldwide, research on occupational differences in smoking HTPs remains scarce. We aimed to examine the prevalence of smoking HTPs among a working population in Japan.

Setting, design and participants In 2018, we conducted a cross-sectional study comprised of 7714 retail business workers in the service industry in Japan.

Primary and secondary outcome measures For the definition of smoking HTPs, we identified current HTP smokers who only smoked HTPs, using five mutual categories of current smoking status (never, former, HTPs only, combustible cigarettes only and dual smokers who smoked both combustible cigarettes and HTPs). Occupational classes were classified into office workers (eg, upper non-manual workers) and other workers. ORs and 95% CIs of office workers were estimated for HTP usage, adjusted for age, sex, employment type and cigarette smoking-related health knowledge.

Results The overall prevalence of smoking HTPs was 3.0% (male 5.0%, female 2.2%). The prevalence of HTP smokers differed across occupational classes (5.6% in office workers vs 2.5% in others; p<0.05). Compared with other workers, the adjusted odds of office workers for smoking HTPs remained elevated (OR: 1.97, 95% CI: 1.40 to 2.77). Sensitivity analyses with workers of all smoking status showed the same pattern. When stratified by sex, the occupational difference only remained significant in male workers.

Conclusions We found a positive occupational difference in smoking HTPs, particularly among male workers in the retail sector in Japan. National tobacco control should explicitly address this occupational gap and further encourage individuals to quit smoking.

Strengths and limitations of this study

- ► This is the first study to examine occupational differences in the prevalence of smoking heated tobacco products (HTPs) among a sizeable working population in Japan.
- ► This study analysed a sample of over 7700 retail business workers reporting their HTP usage and occupational class in 2018.
- ► This study adjusted for variables that might affect occupational differences in smoking HTPs.
- ► Limitations include a cross-sectional design, which does not allow firm conclusions regarding causal mechanisms.

INTRODUCTION

Heated tobacco products (HTPs) are smoking devices that heat tobacco sticks to produce aerosols containing nicotine and other chemicals for inhalation.[1 2] The widespread use of HTPs represents an emerging public health concern. After the initial marketing of IQOS (a brand of HTPs) in Japan and Italy in 2014, HTP usage rapidly spread to more than 30 countries.[2] In Japan, HTP brands IQOS and Ploom Tech (launched in March 2016) and Glo (launched in December 2016) are currently available,[2] and the market share was accounted for 21% in total tobacco sales in 2018.[3] The prevalence of HTP usage was found to have reached approximately 8% in men and 2% in women in 2018.[4] Although limited studies on HTPs usage are available, the prevalence has begun to increase worldwide (approximately 1.4% in Italy in 2017 and 2.9% in Guatemala adolescents in 2020).[5 6] In some Asian countries, the market for HTPs remains relatively small, and HTPs are not officially retailed in China and Hong Kong.[7] Although the impression of HTPs as a healthy alternative is promoted by direct-to-consumer and indirect-to-consumer advertising of HTPs compared with conventional combustible cigarettes (eg, reduced harmfulness and a smoke-free image),[8] there is accumulating evidence for HTP-related adverse effects on health, including acute respiratory diseases and cardiovascular events.[9 10] In addition, the long-term safety of HTPs has not been proven.

In Japan, the use of HTPs may be related to social patterning. For instance, the distribution of HTP usage has been found to differ

across sex and age: men and younger people in their 20s and 30s were found to be more likely to smoke HTPs compared with their female and older counterparts,[11–13] which has been proposed to be partly attributable to a popular television programme.[2] Furthermore, several studies have suggested that a socioeconomic difference for the use of HTPs should be investigated.[4 11 13 14] A recent online cross-sectional survey suggested a potential 'positive' socioeconomic difference in HTP usage.[11] In that study, individuals with higher socioeconomic status (SES), in terms of educational attainment and household income, were more likely to smoke HTPs compared with their lower SES counterparts. However, the occupational difference, one of three fundamental SES indicators (education, income, and occupation), remains unclear in relation to the use of HTPs.

The present study aimed to examine the overall and sex-specific prevalence of smoking HTPs among a sizeable working population in the retail sector, a common service industry sector in Japan. We sought to examine whether higher occupational class is associated with higher prevalence of smoking HTPs.

METHODS

Data setting

Among a working population of the Department Store Health Insurance Association in the retail sector, we conducted a cross-sectional survey about smoking and related health knowledge in August 2018. As a baseline survey, this study was intended to capture a broad overview of occupational factors associated with smoking HTPs. The survey instrument was a self-report questionnaire about smoking behaviours (smoking status and duration of smoking) and HTPs. The survey also asked respondents about their knowledge of smoking-related adverse effects such as cancer and cardiovascular risks. We distributed 8638 questionnaires to all workers in the working population of department stores; 7837 self-reported questionnaires were collected (response rate, 90.7%). For each participant, the Department Store Health Insurance Association mutually linked collected data to individual basic demographics (age and sex) and current job information, including occupational class (eg, managerial and clerical workers) and employment type (full-time or part-time workers). We obtained a deidentified data set from the Department Store Health Insurance Association. Written informed consent was obtained and participants received a prepaid card with a value of 300 Japanese yen (approximately US $3) after the survey for their cooperation.

From 7837 study participants, we excluded data from participants with missing information (n=123, 1.6%), which gave a total of 7714 study participants (2215 men and 5499 women; mean age, 46.6 (SD: 12.8) years) for analysis.

Main outcome of HTP usage

The primary outcome was to assess the prevalence of smoking HTPs currently in the retail sector in Japan.

In the questionnaire, HTPs were described as 'tobacco', in accord with the Tobacco Business Act in Japan. We cited the IQOS, Glo and Ploom Tech as HTPs with pictures because these products were commercially available in Japan in 2018. The study participants chose one status for smoking (never, former, sometimes or every day) from the question, 'Do you currently smoke?' If they answered 'sometimes' or 'every day,' we defined them as current smokers. For current smokers, we distinguished between smoking combustible cigarettes, HTPs or both, using the following question: 'Which type(s) of tobacco do you smoke? Please choose all options that apply from the following: combustible cigarettes, IQOS, Glo, or Ploom Tech'. Based on this protocol, we classified participants into three current smoking status categories (never, former and current). We also divided current smokers using HTPs, ultimately identifying five mutually exclusive groups, as follows.

1. Never smokers
2. Former smokers
3. HTP smokers, who currently smoke HTPs only
4. Combustible cigarette smokers, who currently smoke combustible cigarettes only
5. Dual smokers, who currently smoke both combustible cigarettes and HTPs

To clarify and simplify the context of using HTPs, we defined smoking HTPs by identifying HTPs smokers only (but excluding dual smokers). Following the rapid rise in prevalence of HTPs after 2016 in Japan,[2] most HTP smokers were found to have switched from combustible cigarettes, after a long history of smoking (≥15 years of smoking history, 140 of 229 participants, 61.1%).

Occupational information, smoking-related health knowledge, and other variables

According to the Erikson–Goldthorpe–Portocarero scheme, an internationally valid occupational class measurement for SES[15] and previous studies that adapted the Erikson–Goldthorpe–Portocarero scheme for Japanese occupational classes,[11 16 17] we defined two groups of occupational classes: office workers (managerial and professional workers, 5.2% (n=399) and clerical workers, 9.4% (n=723)) and other workers (service workers, 78.4% (n=6047) and manual workers, 7.1% (n=545)). In the Erikson–Goldthorpe–Portocarero scheme, clerical workers (classified as lower non-manual workers) are considered as a lower job class group compared with managerial and professional workers (classified as upper non-manual workers). However, because clerical workers have been reported to have more favourable health outcomes in terms of mortality and cancer survival compared with managerial and professional workers in Japan,[16 18] we classified clerical workers into the office worker group.

For a broad indicator of health knowledge that might affect risky behaviour of smoking HTPs (because the long-term safety of HTPs has not been proven), study participants were asked whether they knew about the

link between cigarette smoking and each of five common diseases: asthma (yes/no), lung cancer (yes/no), stroke (yes/no), angina/myocardial infarction (yes/no) and periodontal disease (yes/no). By calculating how many links they knew about, we obtained a total sum score of smoking-related health knowledge, a continuous variable ranging from 0 (did not know about any links to diseases) to 5 (knew about all links to diseases). Because the study participants may have learnt about all of the links to diseases through public education provided by the government,[19] we handled all diseases equally without using different weights.

In our analytical model for explaining the association between occupational class and smoking HTPs, potential confounding variables included basic demographics (age and sex) and employment type (full-time or part-time workers).[11] As a potential mediating variable that could explain the association (but not be a confounding factor), we included the total sum score of smoking-related health knowledge as an explanatory variable in our regression model. Although HTP-related risks for common chronic diseases have not been established and health-related knowledge regarding cigarette smoking might not provide a complete substitute for the potential motivations for smoking HTPs, we empirically employed this indicator as a potential behavioural mediator.

Statistical analysis

Descriptive analyses were used to report the background characteristics of the study participants and the prevalence of HTP usage.

Next, compared with the other workers, we estimated ORs and 95% CIs of office workers for HTP usage using logistic regression. In multivariable regression analyses, we adjusted for age, sex and employment type (full-time/part-time) (model 1). In model 2, we additionally adjusted for smoking-related health knowledge as a continuous variable. Analyses were also stratified by sex.

Furthermore, we used all 7714 study participants, which also included former smokers, combustible cigarette smokers and dual smokers. To examine the association for each smoking status against occupational classes, we estimated multinomial ORs using multinomial logistic regression.[11] Again, we adjusted for age, sex and employment type in model 1 and additionally adjusted for smoking-related health knowledge in model 2. Analyses were also stratified by sex. For a supplementary analysis within HTP smokers, we explored potential reasons for smoking HTPs and health attitudes regarding HTPs.

In addition, to further elucidate occupational differences in use of HTPs, we performed sensitivity analyses using two different occupational categories: (a) upper non-manual workers (ie, managerial and professional workers) versus service and manual workers and (b) upper non-manual workers versus clerical, service and manual workers combined.

All p-values were both sided and the alpha level was set at 0.05. Data were analysed using SPSS V.26.0 (SPSS, Chicago, USA).

Patient and Public Involvement

No patients or the public involved.

RESULTS

Of the total 7714 study participants, the prevalence of HTPs was 3.0% (male 5.0%, female 2.2%; table 1). The prevalence of HTPs smokers was greater in a younger population aged in their 30s and 40s than an older population aged in their 60s and above. The prevalence of HTPs smokers differed across occupational classes and employment types, respectively (all p<0.05, figure 1).

Table 1 Background characteristics of a large working cohort of department stores in Japan

	N (%) or mean (SD)*		
Characteristics	**Total (n=7714)**	**Male (n=2215)**	**Female (n=5499)**
Age, mean (SD)	46.6 (12.8)	40.2 (13.7)	49.2 (11.4)
Office workers	1122 (14.5)	797 (36.0)	325 (5.9)
Full-time employment	1800 (23.3)	1349 (60.9)	451 (8.2)
Current smoking status			
Never smokers	4580 (59.4)	1011 (45.6)	3569 (64.9)
Former smokers	1428 (18.5)	466 (21.0)	962 (17.5)
Current smoker	1706 (22.1)	738 (33.3)	968 (17.6)
Combustible cigarette smokers	1217 (15.8)	505 (22.8)	712 (12.9)
HTPs smokers	229 (3.0)	110 (5.0)	119 (2.2)
Dual smokers†	260 (3.4)	123 (5.6)	137 (2.5)

*Percentage may not total 100 due to rounding.
†Dual smokers are those who currently smoke both combustible cigarettes and HTPs.
HTPs, heated tobacco products.;

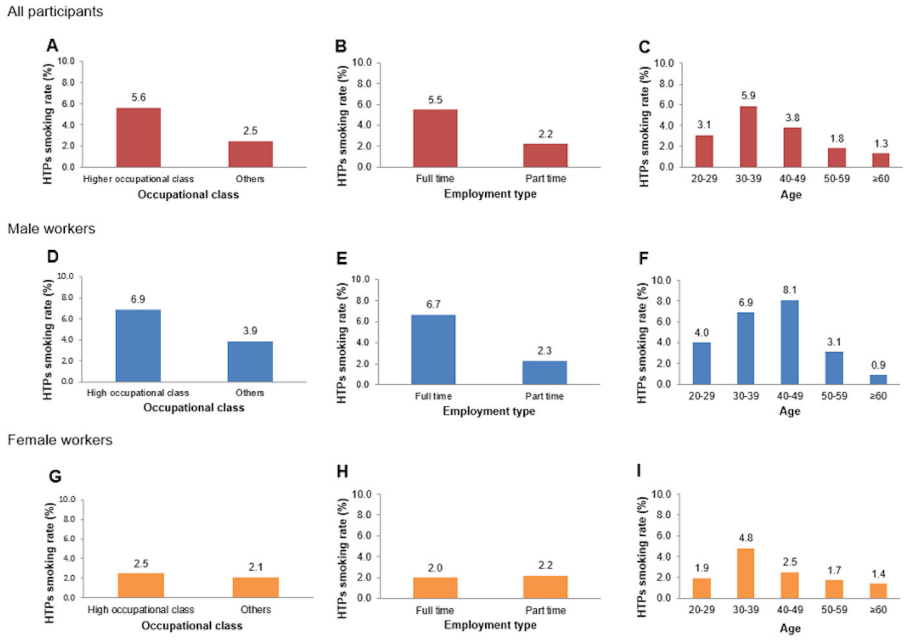

Figure 1 Prevalence of heated tobacco smokers across various background characteristics in the cohort. Each bar shows the prevalence of heated tobacco smokers within specific background characteristics. HTP, heated tobacco products.

Occupational differences only remained significant in male workers when stratified by sex (figure 1).

The percentage of current smokers among office workers was higher than that among other workers (p<0.001) (table 2). Among male office workers, the prevalence of individuals who had ever smoked or were HTP smokers was again greater, and the prevalence of current smokers tended to be greater (table 2). Meanwhile, none of the smoking status groups differed across occupational classes among female workers.

Overall, most of the specific disease knowledge was insufficient, except for lung cancer, and most of the study participants did not know about the link between smoking and cardiovascular diseases (table 2).

In regression analyses, although the background characteristics differed across occupation and smoking status (table 2 and online supplemental table S1), a positive occupational difference for HTP usage was observed in multivariable logistic regression (model 1, table 3). Even after controlling for smoking-related health knowledge (model 2), the elevated odds remained significant (OR: 1.97, 95% CI: 1.40 to 2.77, table 3). In addition, the odds of full-time employment and smoking-related health knowledge were significantly elevated (model 2, table 3). However, for the sex-specific association, the occupational difference only remained significant in male workers (table 3).

In addition, in a sensitivity analysis including all types of smokers, office workers were more likely to smoke HTPs (table 4), and the observed patterns were almost identical. In sensitivity analyses using different occupational categories, the observed patterns were almost identical: (a) compared with service and manual workers, the OR of upper non-manual workers for smoking HTPs was 3.54 (95% CI: 2.16 to 5.80, model 2) and (b) compared with clerical, service and manual workers combined, the OR of upper non-manual workers for smoking HTPs was 3.04 (95% CI: 1.88 to 4.89, model 2). Among HTP smokers, the dominant reason for smoking HTPs was reduced odour and smoke, rather than taking care of others (ie, not to bother others) or considering health-related aspects (online supplemental table S2).

DISCUSSION

Using a large working population in the retail sector in Japan, we first found that the prevalence of HTP usage was at least 5% in male workers and 2% in female workers, with a positive occupational difference for smoking HTPs. Male workers in the higher occupational class in this population were more likely to be ever smokers, with a higher prevalence of smoking HTPs. In addition, no significant occupational difference was observed in current smoking status among female workers. Public awareness was generally insufficient regarding tobacco-induced health disadvantages, despite contemporary public education.

Cigarette smokers, particularly those in high occupational classes, should fundamentally be encouraged to quit smoking, and not to use HTPs.[20] The majority of HTP smokers in the current study (>60%) were former combustible cigarette smokers, and office workers were more likely to have ever been smokers than their occupational counterparts, consistent with a well-known contemporary pattern in Japan.[21 22] Additionally, among HTP smokers, the dominant reason for smoking HTPs was reduced odour or reduced smoke.

Behavioural and environmental aspects associated with the workplace in Japan may also play a role in the pattern

Table 2 Occupational differences in smoking status and cigarette smoking-related heath knowledge stratified by sex

Characteristics	N (%) or mean (SD) Office workers	Others	P value*
Total	n=1122	n=6592	
Age, mean (SD)	45.5 (11.8)	46.8 (12.9)	0.001
Female	325 (29.0)	5174 (78.5)	<0.001
Full-time employment	466 (41.5)	1334 (20.2)	<0.001
Current smoking status			
Never smokers	518 (46.2)	4062 (61.6)	<0.001
Former smokers	273 (24.3)	1155 (17.5)	<0.001
Current smoker	331 (29.5)	1375 (20.9)	<0.001
Combustible cigarette smokers	222 (19.8)	995 (15.1)	<0.001
Dual smokers	46 (4.1)	214 (3.2)	0.143
HTPs smokers	63 (5.6)	166 (2.5)	<0.001
Total score, mean (SD)†	2.9 (1.4)	2.7 (1.3)	<0.001
Asthma	794 (70.8)	4581 (69.5)	0.391
Lung cancer	1042 (92.9)	6150 (93.3)	0.600
Stroke	509 (45.4)	2671 (40.5)	0.002
Angina/myocardial infarction	540 (48.1)	2707 (41.1)	<0.001
Periodontal disease	342 (30.5)	1789 (27.1)	0.021
Male	n=*797*	n=1418	
Age, mean (SD)	45.4 (11.8)	37.4 (13.9)	<0.001
Full-time employment	426 (53.5)	923 (65.1)	<0.001
Current smoking status			
Never smokers	304 (38.1)	707 (49.9)	<0.001
Former smokers	219 (27.5)	247 (17.4)	<0.001
Current smoker	274 (34.4)	464 (32.7)	0.427
Combustible cigarette smokers	178 (22.3)	327 (23.1)	0.696
Dual smokers	41 (5.1)	82 (5.8)	0.529
HTPs smokers	55 (6.9)	55 (3.9)	0.002
Total score, mean (SD)	3.0 (1.4)	2.6 (1.4)	<0.001
Asthma	574 (72.0)	908 (64.0)	<0.001
Lung cancer	752 (94.4)	1286 (90.7)	0.002
Stroke	385 (48.3)	589 (41.5)	0.002
Angina/myocardial infarction	411 (51.6)	507 (35.8)	<0.001
Periodontal disease	261 (32.7)	453 (31.9)	0.699
Female	n=*325*	n=5174	
Age, mean (SD)	45.7 (11.8)	49.4 (11.4)	<0.001
Full-time employment	40 (12.3)	411 (7.9)	0.005
Current smoking status			
Never smokers	214 (65.8)	3355 (64.8)	0.713
Former smokers	54 (16.6)	908 (17.5)	0.667
Current smoker	57 (17.5)	911 (17.6)	0.975
Combustible cigarette smokers	44 (13.5)	668 (12.9)	0.744
Dual smokers	5 (1.5)	132 (2.6)	0.256
HTPs smokers	8 (2.5)	111 (2.1)	0.704
Total score, mean (SD)	2.6 (1.4)	2.7 (1.3)	0.069

Continued

Table 2 Continued

Characteristics	N (%) or mean (SD) Office workers	Others	P value*
Asthma	220 (67.7)	3673 (71.0)	0.205
Lung cancer	290 (89.2)	4864 (94.0)	0.001
Stroke	124 (38.2)	2082 (40.2)	0.457
Angina/myocardial infarction	129 (39.7)	2200 (42.5)	0.317
Periodontal disease	81 (24.9)	1336 (25.8)	0.719

*P values for t-test or χ^2 test.
†Total scores were created by summing up each link known.
HTPs, heated tobacco products.

of results we observed. In contrast to the contemporary pattern seen in Western countries, higher occupational class workers are likely to experience greater job stress, potentially stemming from overtime work, hierarchical corporate culture in Japanese companies and a strongly emphasised concept of hospitality to meet customers' expectations.[23] Previous studies suggest that male full-time workers experience higher levels of job stress,[24] and occupational stress has long been assumed to lead to the development of stress coping responses, such as smoking.[25] In the current study, it might be expected that male workers in higher occupational positions, particularly those in the service sector,[23 26 27] are more likely to smoke, irrespective of tobacco products.

In addition to HTP product advertisements promoting a clean image of reduced harmfulness,[8] other behavioural drives for HTPs smoking may exist in Japan. For instance, an increase of tobacco ads has been observed in Japan[28] and tobacco industry widely promotes HTPs (eg, online stores and convenience stores).[29] Economic dimensions of HTPs may also support the positive occupational difference we observed. For instance, the price of an HTP device was reported to be 6–18 times more expensive than a pack of cigarettes in 2018,[30] and the prevalence of HTP smokers was higher among full-time workers (ie, affluent workers) in the present study. In addition, the higher price might be related to subjective impressions

Table 3 ORs for heated tobacco smokers against occupational class and other factors

Characteristics	N (%) or mean (SD) Never	HTPs	OR (95% CI) Crude	Model 1*	Model 2†
Total	n=4580	n=229			
Office workers	518 (11.3%)	63 (27.5%)	2.98 (2.20 to 4.03)	1.99 (1.42 to 2.78)	1.97 (1.40 to 2.77)
Full-time employment	988 (21.6%)	99 (43.2%)	2.77 (2.11 to 3.63)	1.75 (1.21 to 2.53)	1.73 (1.20 to 2.50)
Age	45.8 (13.5)	42.4 (11.1)	0.98 (0.97 to 0.99)	1.00 (0.99 to 1.02)	1.00 (0.99 to 1.01)
Female	3569 (77.9%)	119 (52.0%)	0.31 (0.23 to 0.40)	0.50 (0.34 to 0.72)	0.50 (0.35 to 0.73)
Total knowledge	2.5 (1.3)	3.0 (1.4)	1.33 (1.20 to 1.47)		1.34 (1.21 to 1.48)
Male	n=1011	n=110			
Office workers	304 (30.1%)	55 (50.0%)	2.33 (1.56 to 3.46)	2.15 (1.37 to 3.36)	2.09 (1.33 to 3.28)
Full-time employment	658 (65.1%)	90 (81.8%)	2.41 (1.46 to 3.99)	3.52 (2.05 to 6.04)	3.48 (2.02 to 5.99)
Age	34.9 (11.9)	38.3 (9.9)	1.02 (1.01 to 1.04)	1.03 (1.01 to 1.05)	1.03 (1.004 to 1.05)
Total knowledge	2.4 (1.4)	3.0 (1.4)	1.35 (1.17 to 1.55)		1.31 (1.13 to 1.53)
Female	n=3569	n=119			
Office workers	214 (6.0%)	8 (6.7%)	1.13 (0.54 to 2.35)	1.04 (0.50 to 2.17)	1.11 (0.53 to 2.32)
Full-time employment	330 (9.2%)	9 (7.6%)	0.80 (0.40 to 1.60)	0.51 (0.24 to 1.08)	0.51 (0.24 to 1.09)
Age	48.9 (12.2)	46.1 (10.7)	0.98 (0.97 to 0.997)	0.98 (0.96 to 0.99)	0.98 (0.96 to 0.99)
Total knowledge	2.6 (1.3)	3.1 (1.4)	1.34 (1.17 to 1.54)		1.35 (1.18 to 1.55)

*ORs for heated tobacco smokers against occupational class were estimated with unconditional logistic regression, adjusted for age, sex and employment type.
†Additional adjustment for smoking-related health knowledge.
HTPs, heated tobacco products.

Table 4 Multinomial ORs for each smoking status in high occupational class workers

Characteristics	Multinominal OR (95% CI)	
	Model 1*	Model 2†
HTPs smokers		
Office workers	1.99 (1.42 to 2.79)	1.94 (1.38 to 2.72)
Full-time employment	1.62 (1.12 to 2.33)	1.58 (1.09 to 2.29)
Age, continuous	0.997 (0.99 to 1.01)	0.99 (0.98 to 1.01)
Female	0.51 (0.36 to 0.73)	0.51 (0.35 to 0.73)
Total knowledge		1.34 (1.22 to 1.48)
Combustible cigarette smokers		
Office workers	1.02 (0.84 to 1.23)	0.99 (0.81 to 1.20)
Full-time employment	0.89 (0.73 to 1.09)	0.88 (0.72 to 1.07)
Age, continuous	1.03 (1.02 to 1.03)	1.03 (1.02 to 1.03)
Female	0.29 (0.24 to 0.35)	0.29 (0.24 to 0.34)
Total knowledge		1.31 (1.24 to 1.37)
Dual smokers		
Office workers	1.01 (0.71 to 1.45)	0.97 (0.67 to 1.40)
Full-time employment	1.83 (1.27 to 2.62)	1.79 (1.24 to 2.57)
Age, continuous	1.01 (0.99 to 1.02)	1.00 (0.99 to 1.01)
Female	0.43 (0.31 to 0.60)	0.42 (0.30 to 0.60)
Total knowledge		1.44 (1.31 to 1.59)
Former smokers		
Office workers	1.38 (1.15 to 1.65)	1.34 (1.12 to 1.61)
Full-time employment	0.82 (0.67 to 1.00)	0.81 (0.66 to 0.99)
Age, continuous	1.03 (1.03 to 1.04)	1.03 (1.02 to 1.03)
Female	0.44 (0.37 to 0.53)	0.44 (0.37 to 0.53)
Total knowledge		1.30 (1.24 to 1.36)

*Adjusted for age, sex and employment type.
†Additional adjustment for smoking-related health knowledge.
HTP, heated tobacco product.

of high-quality products, which could act as another potential driver for using HTPs.

Several limitations of the current study should be noted. First, our cross-sectional design does not allow firm conclusions regarding the causal mechanisms underlying the relationship between occupation and HTP usage. Additionally, we were not able to assess other relevant SES indicators (ie, educational attainment and income) in this working population. However, reverse causality appears to be unlikely because occupational classes are a fundamental SES indicator, and studies suggest a potential SES gap in smoking HTPs.[11] Second, although our data were extracted from a sizeable working population in the retail sector, the numbers of male and female workers were not balanced. In addition, the study participants only included workers in department stores, thereby limiting the generalisability of our findings. Despite these limitations, the current study is one of the most extensive investigations of the use of HTPs in Japan. Third, our self-reported questionnaires may have been subject to under-reporting of HTP usage. Smoking duration, amount (number of heat sticks/cartridge per day) and intensity were not separately available for combustible cigarettes and HTPs. Thus, these limitations might have introduced potential misclassifications in smoking categories. However, previous studies have supported the validity of self-reported smoking status and tobacco use.[31] Fourth, we intended to capture a broad overview of the relationship between occupation and HTPs. Thus, data for potential acute and chronic clinical outcomes were not available. In addition, due to the limitations of our data set, we were unable to completely assess how health knowledge related to HTPs is associated with smoking HTPs. Additionally, it remains unclear whether the observed positive occupational difference for HTP usage is associated with overall mortality and cardiovascular risk, combined with inflammatory and oxidative stress (eg, C-reactive protein and urinary 8-hydroxydeoxyguanosine).[32 33] Despite these limitations, the strengths of the current study included a large sample size for overall and female participants,

providing the first report of an occupational difference in smoking HTPs with a robust occupational indicator.[11 16 17]

Finally, our results suggest that HTP smoking is getting prevalent, particularly among higher-SES males in Japan. Previous studies reported a potential occupational difference in smoking HTPs among men but not among women,[4 11] which are in line with our result. Higher occupational workers are reported to have higher overall mortality and cardiovascular risk.[16 23] In addition, the long-term safety of HTPs has not been proven, and there is accumulating evidence for HTP-related adverse effects on health.[9 10] Therefore, further public education on tobacco control, including population approaches and high-risk approaches, should remain a high priority for combustible cigarette and HTPs smoking.

In conclusion, the current findings indicated that higher occupational class is associated with a higher prevalence of smoking HTPs, particularly among male retail workers in the service industry in Japan. Public awareness of tobacco-related health impacts is currently insufficient. Hence, national tobacco control should explicitly address this occupational gap and further encourage individuals to quit smoking.

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