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Short communication

Knowledge and self-efficacy among healthcare providers towards novel tobacco products in Japan

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ABSTRACT

Several new tobacco products, including e-cigarettes and heated tobacco products (HTPs), have become highly prevalent in Japan. As safety data continues to evolve, healthcare providers are considered important sources for product use, yet little is known about provider knowledge or self-efficacy to counsel patient about novel tobacco product use. This cross-sectional study used data from a Japanese Association of Smoking Control Science (JASCS) online survey of physicians, pharmacists, nurses, and public health practitioners (N = 277) to assess provider knowledge of novel tobacco products and self-efficacy to counsel patients about product use. Correlates of knowledge and self-efficacy were also assessed. More than half the sample had received previous training in treating tobacco use, but 62% of respondents had no knowledge of HTPs; 80% of respondents indicated that they occasionally or always provide smoking cessation support. Overall knowledge of HTPs was low (41.4% correct) with higher knowledge for HTPs containing nicotine (89% correct) vs. HTPs emitting no carbon monoxide (25%). Self-efficacy to counsel patients about novel tobacco products was low on a scale ranging from 10 to 70 (Mean = 31.2; Standard Deviation = 16.7). Greater knowledge of HTPs was associated with male gender, higher rates of training at JASCS and previous learning about HTPs at JASCS. (p < 0.05). The results suggested that healthcare providers' knowledge and self-efficacy regarding novel tobacco products remains low in Japan, but additional training may improve it.

1. Introduction

The deaths caused by tobacco have spread like an epidemic and are among the world's most significant public health threats. More than 8 million people in the world die annually because of tobacco use ([World Health Organization](https://www.who.int)). Direct tobacco use related deaths are more than 7 million, while around 1.2 million are related to second-hand smoking ([World Health Organization](https://www.who.int)). Cigarette smoking is the leading cause of premature, preventable deaths in Japan, claiming about 157,800 deaths each year ([The Tobacco Atlas](https://www.who.int)). Due to increasing awareness of the harmful effects of smoking, its prevalence is gradually decreasing in Japan, from ~ 35% in 1997 ([Honjo and Kawachi, 2000](https://www.who.int)) to about 18% in 2018 ([Japan Tobacco Inc., 2018](https://www.who.int)). This reduction has translated into a significant decline in global combustible tobacco sales and introduction of novel tobacco products such as e-cigarettes and the new heated tobacco products (HTPs).

As with e-cigarettes, whose use globally has increased from about 7 million in 2011 to 41 million in 2018 ([World Health Organization](https://www.who.int)), HTPs were designed to reduce smoking by replacing conventional cigarettes. HTPs heat the tobacco leaf until approximately 260° C using battery power to produce an inhalable tobacco aerosol, while conventional cigarettes heat tobacco up to 600 °C ([Tabuchi et al., 2016](https://www.who.int)). HTPs usage has been exponential since the launch of IQOS (*I quit ordinary smoking*) in 2014 by Phillips Morris Japan, followed by other products like glo and Ploom Tech.

An exposure to HTPs can also be potentially harmful, similar to e-cigarettes and conventional cigarettes. Evidence regarding second-hand emissions suggests that HTPs exposes users and bystanders to substantially lower but measurable particulate matter levels and harmful and potentially harmful compounds ([Simonavicius et al., 2019](https://www.who.int)). IQOS exposure, in particular, leads to altered mitochondrial function and lung cancer through active epithelial-mesenchymal transition, as seen in

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smokers (Sohal et al., 2019). As these products are new, their long-term effects on human health are unknown, which poses a challenge to healthcare providers who are often asked about novel tobacco product safety. Indeed, several studies report that healthcare providers are unsure about how to advise patients about the use of these novel tobacco products (El Hajj et al., 2012)(Yaldrum et al., 2017).

Healthcare providers are in an ideal position to address tobacco product use on a broad population level (El Hajj et al., 2012). Many studies show that people consider medical personnel to be the most reliable source of knowledge, leading to more adherence to tobacco product advice (Schnoll and Engstrom, 2004; Pipe et al., 2009). General physicians, dentists, pharmacists, and nurses can play an essential role in supporting tobacco product cessation (El Hajj et al., 2012; Thananithisak et al., 2008; Kanchustambham et al., 2017). However, many reports indicated that these healthcare providers lack knowledge, confidence, and training to address tobacco use (Thananithisak et al., 2008; Kanchustambham et al., 2017; Saito et al., 2010), particularly new tobacco products like IQOS. There have been some studies on non-conventional tobacco products from different countries, but there is little information on knowledge and self-efficacy concerning HTPs use among healthcare providers. Knowledge and self-efficacy to address tobacco use are important predictors of addressing patient tobacco use and engaging in treatment (Zgliczyński et al., 2019; Shama et al., 2009). Thus, considering the recent exponential growth in the use of these modern tobacco products, (World Health Organization.) and that many smokers seek advice from healthcare professionals about these novel tobacco products, this study aimed to evaluate the current level of knowledge and self-efficacy for smoking cessation support among healthcare providers, focusing specifically on novel tobacco products like HTPs.

2. Methods

2.1. Study design

This is a cross-sectional study utilizing data provided by the Japanese Association of Smoking Control Science (JASCS) (<https://www.jascs.jp/>). JASCS conducted an online survey before a smoking cessation workshop in July 2020 to assess knowledge and self-efficacy among

healthcare providers regarding novel tobacco products, including HTPs and e-cigarettes. The recruitment was done on the web and was for all those involved in smoking cessation support and smoking prevention education and was not limited to JASCS members only. JASCS is an academic organization that has been focused on smoking cessation education and treatment since 2006. The ethical committees of JASCS and Kyoto University approved the study, and participants provided informed consent.

2.2. Study population

Participants were healthcare providers, including physicians from different specialties, pharmacists, nurses, public health nurses, and other healthcare providers (OHCP) like health insurance officers, occupational therapists, and dental hygienists, who participated in the online survey. Survey was conducted online because of COVID-19. Participants were members and non-members of JASCS and the participation was on a voluntary basis. Table 1 describes the demographics and professional characteristics of the participants.

2.3. Questionnaire

Data were collected through self-reported web-questionnaires which were developed based on surveys used in past studies (Nickels et al., 2017; Yaldrum et al., 2017) and in consultation with a panel comprised of experts at JASCS and survey specialists at the Kyoto University School of Public Health. The questionnaire included 41 questions, which were divided into three sections. The first section consisted of eight questions addressing socio-demographic and professional characteristics (e.g., type of healthcare provider). The second section consisted of 26 knowledge items (Supplementary Table 1). They were related to contents, harmful effects, manufacturers, and rules outside and within Japan concerning e-cigarettes and HTPs. A score of one was given for a correct response and zero was given for an incorrect response, for a total knowledge score was calculated from 0 to 26, determined by the number of correct answers. The third section had seven self-efficacy items, and the participants' responses were measured on a ten-point Likert scale from 1 to 10, with a maximum self-efficacy score of 70 (Supplementary

Table 1
Descriptive characteristics of participants [n (%)] or [mean (SD)].

	Variables	All Participants	Physicians	Nurses	PHN	Pharmacist	OHCP
1	Total Participants	n = 277	38 (14)	81 (29)	61 (22)	52 (19)	45 (16)
	Males [n (%)]	52 (19)	20 (39)	0	0	19 (36)	13 (25)
	Females [n (%)]	225 (81)	18 (8)	81 (36)	61 (27)	33 (15)	25 (14)
2	Age in years [mean (SD)]	46.8 (10.8)	53.1 (9.9)	45.4 (8.7)	41.8 (10.6)	50.0 (11.0)	47.3 (11.8)
3	Anti-Smoking Support Training						
	None [n (%)]	109 (39)	14 (37)	25 (31)	31 (51)	14 (27)	25 (56)
	Primary [n (%)]	96 (35)	11 (29)	34 (42)	16 (26)	21 (40)	14 (31)
	Intermediate [n (%)]	54 (19)	8 (21)	18 (22)	12 (20)	12 (23)	4 (9)
Advanced [n (%)]	18 (7)	5 (13)	4 (5)	2 (3)	5 (10)	2 (4)	
4	No of attending training sessions at JASCS after Jan 2019						
	0 times [n (%)]	118 (43)	13 (11)	29 (25)	31 (26)	22 (19)	23 (19)
	1 time [n (%)]	81 (29)	15 (19)	23 (29)	18 (23)	11 (14)	12 (15)
	2/more (max 10) times [n (%)]	78 (28)	10 (13)	29 (37)	12 (15)	19 (24)	8 (11)
5	Learned HTPs via web or elsewhere after Jan 2019						
	0 times [n (%)]	171 (62)	22 (13)	49 (29)	41 (24)	31 (18)	28 (16)
	1 time [n (%)]	67 (24)	8 (12)	22 (33)	15 (22)	12 (18)	10 (15)
	2/more (max 16) times [n (%)]	39 (14)	8 (20)	10 (26)	5 (13)	9 (23)	7 (18)
6	Learned HTPs in JASCS after Jan 2019						
	0 times [n (%)]	145 (52)	16 (11)	41 (28)	35 (24)	24 (17)	29 (20)
	1 time [n (%)]	77 (28)	13 (18)	25 (32)	11 (14)	18 (23)	10 (13)
	2/more (max 16) times [n (%)]	55 (20)	9 (15)	15 (28)	15 (28)	10 (17)	6 (12)
7	Involved in Smoking cessation support						
	Not engaged [n (%)]	56 (20)	6 (16)	16 (20)	9 (15)	5 (10)	19 (42)
	Occasionally engaged [n (%)]	144 (52)	10 (26)	41 (51)	36 (59)	40 (77)	18 (40)
	Always engaged [n (%)]	77 (28)	22 (58)	24 (30)	16 (26)	7 (13)	8 (18)

JASCS: Japanese Association of Smoking Control Science, PHN: Public health Nurse, OHCP: Other healthcare providers, HTPs: heated tobacco products, SD: Standard deviation.

Table 2). The Cronbach alpha for this scale was 0.95. Higher scores on these measures indicated greater knowledge or self-efficacy, respectively.

2.4. Statistical methods

The survey data were analyzed using SPSS Version 23. Basic descriptive statistics (mean, standard deviation, frequencies) assessed sample socio-demographic and professional characteristics (e.g., gender, anti-smoking support) and knowledge and self-efficacy. One-way ANOVA was used to evaluate the means across types of healthcare providers. Descriptive statistics were used to characterize the level of knowledge and self-efficacy across the sample and ANOVA was used to assess correlates of knowledge and self-efficacy. Spearman correlation assessed the association between knowledge and self-efficacy.

3. Results

3.1. Description and differences across healthcare groups

A total of 278 participants completed the questionnaire; 1 participant refused to give the informed consent (Supplementary Fig. 1). The sample consisted of 38 physicians, 81 nurses, 61 public health nurses, 52 pharmacists, and 45 OHCP. The mean age of the participants was 46.8 (SD = 10.8) years and 225 (81%) were females. Regarding anti-smoking support training assessed by JASCS, 109 (39%) had no training, 96 (35%) had primary training, 54 (19%) had intermediate training, and 18 (7%) had advanced training. No association was seen among different professional groups on knowledge ($p = 0.56$) and self-efficacy ($p = 0.28$). Additional sample characteristics across different professional roles are shown in Table 1.

3.2. Level of knowledge and Self-efficacy

Supplementary Table 1 shows 26 knowledge items with the participants' percentages who gave the correct answers. The range of percentage correct for the items was 13% (for price of HTPs) to 92% (for

passive smoking from HTPs). Summing across the items, the mean for correct responses was 10.8 (5.9), indicating low levels of knowledge regarding HTPs and e-cigarettes across the sample. Supplemental Table 2 shows the results of self-efficacy items. The range of means for the items was 3.5 (2.4)-5.7 (3.0) and the mean total score was (31.2, SD = 16.7), indicating low levels of perceived self-efficacy to address novel tobacco products. The Spearman correlation between knowledge and self-efficacy was 0.55 ($p < 0.001$), indicating that self-efficacy increases with increased knowledge.

3.3. Knowledge and Self-efficacy by participant Characteristics.

Table 2 shows the mean knowledge and self-efficacy values by participant characteristics. Male gender, anti-smoking support training, the number of previous training sessions attended at JASCS, the degree to which participants reported learning about HTPs at training sessions attended at JASCS, was associated with greater knowledge and higher self-efficacy levels. ($p < 0.05$).

4. Discussion

This study examined level and correlates of healthcare provider knowledge and self-efficacy in Japan regarding novel tobacco products. The study revealed that Japanese healthcare providers lack sufficient knowledge about novel tobacco products and lack perceived self-efficacy for smoking cessation support. Since healthcare providers are often consulted by their patients about tobacco product use, these data indicate the need to provide supplemental training to these professionals so that they are prepared to address the changing landscape of tobacco products.

As this is the first study to address knowledge about HTPs among healthcare providers, there is no direct comparison with our study and so we compare our results to previous studies of e-cigarettes that used similar items. A few past studies have examined healthcare provider knowledge of e-cigarettes. Zgliczyński et al. (2019) with 412 physicians reported that 80.5% agreed that exhaled e-cigarette aerosol is harmful, 86.1% agreed that e-cigarettes are carcinogenic, and 85.3% agreed that

Table 2
Baseline Knowledge and Self-efficacy by Participant Characteristics.

	Variables	n	Knowledge		Self-Efficacy		
			Mean (SD)	p-value	Mean (SD)	p-value	
1	Total score	All participants	277	10.8 (5.9)		31.2 (16.7)	
	Gender	Male	52	12.7 (5.9)	<0.001 ^a	36.3 (16.1)	<0.001 ^a
		Female	225	10.3 (5.8)		30.0 (16.6)	
2	Profession	Physicians	38	11.9 (7.0)	0.56 ^b	35.8 (17.5)	0.28 ^b
		Nurses	81	10.3 (5.5)		29.7 (17.5)	
		PHN	61	11.1 (5.7)		31.9 (16.6)	
		Pharmacists	52	10.1 (5.3)		31.9 (14.4)	
		OHCP	45	10.9 (6.3)		28.3 (16.9)	
3	Anti-Smoking Support Training	None	109	10.1 (5.1)	0.22 ^b	32.1 (16.2)	0.25 ^b
		Primary	96	11.3 (6.5)		29.8 (17.4)	
		Intermediate	54	10.4 (5.8)		29.7 (16.9)	
		Advanced	18	12.7 (6.0)		37.7 (14.7)	
4	No of attending training sessions at JASCS after Jan 2019	0 times	118	8.9 (4.1)	<0.001 ^b	24.4 (14.3)	<0.001 ^b
		1 time	81	12.0 (5.9)		33.7 (16.7)	
		2/more times	78	12.3 (6.2)		38.8 (16.3)	
5	Learned HTPs via web or else after Jan 2019	0 times	171	10.4 (5.7)	0.09 ^b	28.5 (16.2)	<0.001 ^b
		1 time	67	10.5 (5.9)		31.9 (16.5)	
		2/more times	39	12.7 (6.2)		41.7 (15.2)	
6	Learned HTPs at JASCS after Jan 2019	0 times	145	9.4 (5.4)	<0.001 ^b	26.6 (16.0)	<0.001 ^b
		1 time	77	11.4 (5.8)		32.3 (16.2)	
		2/more times	55	13.6 (6.1)		41.7 (14.3)	
7	Involved in smoking cessation support	Not engaged	56	11.3 (5.8)	0.12 ^b	32.9 (15.9)	0.67 ^b
		Occasionally engaged	144	10.0 (5.0)		30.5 (18.7)	
		Always engaged	77	11.7 (5.6)		34.3 (17.9)	

JASCS: Japanese Association of Smoking Control Science, PHN: Public health Nurse, OHCP: Other healthcare providers, HTPs: heated tobacco products, SD: Standard deviation.

a: t-test b: one-way ANOVA.

e-cigarettes increase the risk of chronic lung diseases. In contrast, in the present study, 29% of participants knew about deaths in the United States from lung injury associated with e-cigarettes and only 41% indicated that HTPs has more carcinogens than combustible tobacco. Although the sample characteristics were different across studies, some knowledge items were commonly used in both studies. Further, although the products sold in Japan and the US are different, knowledge regarding these novel tobacco products appears to be substantially lower in Japan, suggesting the need for augmented training. A study by Sheffer et al. (2009) may serve as a useful model for training healthcare providers in the area of novel tobacco product use. Given that knowledge levels varied across issues related to novel tobacco products, a program for Japanese healthcare providers should be designed to provide targeted information.

To the best of our knowledge, this is the first study to assess healthcare provider self-efficacy to address novel tobacco products. The results here suggest that self-efficacy to address novel tobacco products is lower for healthcare providers in Japan than when considering combustible tobacco or may be lower since the present sample included a broad range of providers. For example, a national survey by Nickels et al. (2017) among 561 USA physicians found that more than 80% of pulmonologists and primary care providers were confident in their ability to help patients quit combustible tobacco use and more than 60% of pulmonologists were confident in their ability to answer questions about e-cigarettes. In the present study, self-efficacy was low even for encouraging patients to quit HTPs, indicating the need for interventions to support healthcare providers in Japan to address this growing concern. A recent study in Vietnam indicated that training providers in treating tobacco use could improve self-efficacy and implementation of tobacco use treatment (VanDevanter et al., 2020).

Lastly, our analyses of correlates of knowledge and self-efficacy provides further support for the potential effectiveness of tobacco control training programs to increase these key factors associated with the provision of tobacco use treatment. In particular, past training – and amount of training – provided by JASCS was associated with increased knowledge and self-efficacy. The results also suggest that female healthcare providers may need to be targeted for training. While it remains unclear why there is a gender gap in knowledge, the results concerning self-efficacy are consistent with a past study that reported that female physicians have overall less clinical confidence than men (Nomura et al., 2010). Efforts may be needed to boost female clinician self-efficacy overall to ensure their ability to address HTPs.

These results should be considered in the context of study limitations. First, data were self-reported and collected online, which may lead to response or selection bias. Second, since the study sample was small, the generalizability of the results may be limited. So, we warrant more such studies on the larger healthcare provider sample. Third, since HTPs are relatively new, we relied on scales created specifically for this study, which have unknown psychometric properties. However, we did base the scales on previous measures of similar products and had adequate internal consistency for the self-efficacy scale. Lastly, while the gender distribution in our study sample resembles a greater number of female JASCS members and a higher number of public health nurses and registered nurses in Japan, future studies should strive for more equitable gender balance in their samples.

Nevertheless, this study indicates that, at least in Japan, healthcare provider knowledge of, and self-efficacy to address, novel tobacco products like HTPs is not ideal, indicating that an important constituency in the battle to address tobacco-related morbidity and mortality need additional support. The present results support the need for training healthcare providers to address these novel tobacco products, thereby preparing them to understand the harmful effects of HTPs better. Also, the healthcare providers need to recognize that HTPs cannot be advised as a smoking cessation tool as these products contain tobacco and still have yet to be determined to be a safe alternative to conventional tobacco smoking. Given that healthcare providers are often relied

upon for medical advice and that training can increase the provision of tobacco use treatment, future efforts to prepare healthcare providers to address novel tobacco products may contribute significantly to reducing the negative health impact of novel tobacco products, including training programs offered by JASCS that include information in HTPs.

CRediT authorship contribution statement

Swati Mittal: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Tomoe Uchida:** Data curation. **Yoshitaka Nishikawa:** Writing – review & editing, Visualization. **Hiroshi Okada:** Writing – review & editing. **Robert A. Schnoll:** Writing – review & editing. **Yoshimitsu Takahashi:** Data curation. **Takeo Nakayama:** Conceptualization, Methodology, Funding acquisition, Writing – review & editing, Supervision. **Yuko Takahashi:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Declaration of interests

Dr. Schnoll has received varenicline and placebo free from Pfizer and has provided consultation to Pfizer. Dr. Schnoll has provided consultation to GlaxoSmithKline and Palliatech. Dr. Nakayama served as a Vice President and Dr. Takahashi as the President of The Japanese Association of Smoking Control Science. Other authors declare no potential conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2021.101649>.

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