Short communication

Prevalence and denial of current tobacco product use: Combustible and heated tobacco products, Japan, 2022

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**A B S T R A C T**

Monitoring tobacco use has become more complex with the proliferation of novel tobacco products, including heated tobacco products (HTPs). We assessed the latest prevalence and denial of tobacco product use in Japan, a major market for HTPs. 28,124 individuals aged 16–74 responded to a nationwide, internet-based, self-reported survey. Current (past-30-day) tobacco use was assessed for HTPs, cigarettes, non-cigarette combustible tobacco, and dual (combustible plus HTP) use. Denial of current tobacco use was determined when respondents reported past-30-day use of a specific tobacco product (“On how many days did you use [the respective products]?”) but denied having used any tobacco (“Do you currently use tobacco?”) in the past 30 days. Descriptive and multivariable analyses were weighted to account for the selectivity of the internet-based sample. In 2022, current tobacco use was 11.8 % (HTPs), 19.4 % (cigarettes), 3.6 % (non-cigarette combustible tobacco), and 6.8 % (dual use). Among past-30-day users of specific tobacco products (N = 6,343), 19.5 % denied current tobacco use including single-product users of HTPs (10.0 %), cigarettes (21.7 %), and non-cigarette combustible tobacco (53.3 %), and dual users (20.2 %). The likelihood of denying current tobacco use was lower among exclusive HTP users and dual users compared to exclusive cigarette smokers; the likelihood was higher among females, never/ non-current drinkers, less-frequent tobacco users, and those not reporting tobacco dependence. HTP use remained high in Japan. One-fifth of past-30-day tobacco users denied having used any tobacco products in the past 30 days. Increasing the sensitivity of questions to assess tobacco use can mitigate nondisclosure of tobacco use status.

1. Introduction

Japan has been a major market for heated tobacco products (HTPs). The prevalence of HTP use jumped from 0.2 % to 11.3 % between 2015 and 2019 (Hori et al., 2020) and has remained almost unchanged during 2019–2021, (Hori, 2022; Odani and Tabuchi, 2021) as the second most used tobacco product after cigarettes in Japan.

The proliferation of novel tobacco products such as HTPs has affected tobacco use behaviors and perceptions about the tobacco-attributable health risks, social acceptance of tobacco use, and whether people even consider themselves tobacco users if they use tobacco products. (Hair et al., 2018; Tabuchi, 2021; Lau et al., 2021) In surveys and clinical settings, tobacco use is often assessed by asking people whether they smoke or use any tobacco in general without specifying the type of tobacco or the timing of use (Ministry of Health, Labour and Welfare, 2022; Centers for Disease Control and Prevention, 2022; World Health Organization, 2022) (e.g. “Do you currently smoke/use tobacco?”). Such assessments may not capture tobacco users who simply do not consider themselves tobacco users, posing challenges for monitoring tobacco use (“M” in the World Health Organization’s MPOWER) (World Health, 2021) and offering tobacco users help to quit (“O” in MPOWER). (World Health, 2021).

The available studies on denial of tobacco use or being a tobacco user are limited. The majority of previous research has either included specific populations such as students and young adults in Western industrialized countries or focused only on combustible tobacco products such as cigarettes and cigars. (Tombor et al., 2015; Choi et al., 2010; Leas et al., 2015; Guillory et al., 2017; Agaku et al., 2018; Smith et al., 2019; Berg et al., 2009; Ridner et al., 2010) Given the increasing complexity of tobacco product profiles and usage, a better understanding of tobacco-related self-reporting patterns can help inform clinical and public health practice, particularly with regard to tobacco screening, counseling, surveillance, and education programs. The objectives of the present study were 1) to provide the latest prevalence of tobacco product

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use in Japan for HTPs, cigarettes, and other combustible tobacco products, and 2) to estimate the percentage of current users of specific tobacco products who deny current tobacco use.

2. **Methods**

2.1. **Data source**

The study was a cross-sectional analysis of the 2022 wave from the Japan Society and New Tobacco Internet Survey (JASTIS), a nationwide, internet-based, self-reported survey. Respondents were randomly drawn from more than two million panelists of a private vendor, Rakuten Insight Inc., by considering wide-ranging demographic and socioeconomic variables including education, housing, and marital status as defined by the Japan census (Tabuchi et al., 2019). For the present study, data were collected during February 1–28, 2022. We excluded individuals who provided unreasonable answers (N = 2,870) using a set of questions incorporated in the questionnaire (Tabuchi et al., 2019). For example, individuals who answered with the same number over an entire set of questions, those who checked all multiple-choice items of questions asking about illegal substance use (seven items) or presence of chronic conditions (15 items), or those who chose a wrong answer to the question “Choose the second item from the bottom” were excluded. Individuals aged 75 + years (N = 2,006) were also excluded to keep consistency with our previous report (Odani and Tabuchi, 2021), which resulted in 28,124 individuals to be included in the analysis. In-depth details of the sampling methods have been described elsewhere (Tabuchi et al., 2019). The study was reviewed and approved by the Research Ethics Committee of the Osaka International Cancer Institute (approval number 20094–2).

2.2. **Prevalence of current tobacco product use**

Current tobacco product use was assessed as past-30-day use of HTPs, cigarettes (manufactured and roll-your-own), non-cigarette combustible tobacco products (little cigars/pipes/water pipes), and dual use of combustible tobacco and HTPs. Respondents were asked product-specific questions (“During the past 30 days, on how many days did you use [the respective products]?”), and those who reported having used the product on ≥1 day in the past 30 days were classified as current users. (Hori et al., 2020; Odani and Tabuchi, 2021) A list of product names and separate answer spaces were provided for each tobacco product, as well as specific brand examples for HTPs (Ploom Tech/Ploom S/Ploom X/IQOS/glo/lil) to reduce confusion and increase the accuracy of respondents to survey questions. These product-specific questions are considered to have a high degree of face and construct validity for correctly identifying current tobacco product users. (National Center for Biotechnology, 2010).

2.3. **Denial of current tobacco use**

Preceding the product-specific questions, respondents were asked “Do you currently use tobacco? Think about the past 30 days.” Response categories included “every day”, “some days”, “I have used tobacco, but do not currently use it”, and “I have never used tobacco”. Given the validity of the product-specific questions, we assumed that respondents who answered in the affirmative to the product-specific questions (having used the respective products on ≥1 day in the past 30 days) but not to the question about general tobacco use (reporting “not currently” or “never” used tobacco) denied current tobacco use.

2.4. **Statistical analysis**

Prevalence of tobacco product use was computed for respondents overall and by gender, age, education (less than high school/high school [including current students]), and alcohol use. The percentage of respondents who denied current tobacco use was calculated for past-30-day users of at least one specific tobacco product (N = 6,343) and exclusive users of HTPs (N = 1,246), cigarettes (N = 3,048), and non-combustible tobacco products (N = 196), and dual users (N = 1,853). Along with the population characteristics listed above, the estimates were stratified by the number of days on which the respondent used tobacco products during the past 30 days (1–5/6–10/11–20/21–30) and tobacco dependence determined by the Tobacco Dependence Screener. (Kawakami et al., 1999) Between-group differences were assessed with chi-squared tests with the statistical significance level set at p < 0.05. Multivariable Poisson regression was used to examine the associated factors for denial of current tobacco use. Adjusted prevalence ratios (APRs) and 95% confidence intervals (CIs) were estimated by controlling for all the aforementioned characteristics. All analyses were weighted by applying the inverse probability weight (IPW) to account for the selectivity of the internet-based sample. (Tabuchi et al., 2019; Tabuchi et al., 2016) To obtain the IPW, we calculated propensity scores for “being an internet survey respondent” by fitting logistic regression models adjusted for basic demographic, socioeconomic, health-related, and tobacco-use-related factors between the 2022 JASTIS sample and a nationally representative sample. (Ministry of Health, Labour and Welfare, 2022) Further details regarding weighting have been reported elsewhere. (Tabuchi et al., 2019; Tabuchi et al., 2016) Statistical analyses were performed using R version 4.1.3.

3. **Results**

In 2022, current (past-30-day) tobacco product use was 11.8% for HTPs, 19.4% for cigarettes, 3.6% for non-cigarette combustible tobacco, and 6.8% for dual use (Table 1). 24.5% of all respondents reported having used at least one specific product in the past 30 days. Among the assessed non-cigarette combustible tobacco products, little cigars were most commonly reported by 2.5% of all respondents, followed by pipes (1.7%) and water pipes (1.5%) (data not shown). When stratified by population characteristics, the prevalence was higher among males (vs females) and current drinkers (vs never/non-current drinkers), and lower among young (aged 16–19 years) and old (aged 60 + years) individuals for all tobacco products assessed (all p < 0.05). By education, although not statistically significant, less-educated individuals had higher prevalence for cigarette smoking (22.4% vs 19.2%; those with less than high school education vs high school education, hereinafter) and non-cigarette combustible tobacco use (4.7% vs 3.5%) while the reverse pattern was seen for HTP use (10.2% vs 12.2%). For dual use of combustible tobacco and HTPs, less educated individuals had lower prevalence than those with high school or higher education (5.0% vs 7.1%) (p < 0.05).

Of all current (past-30-day) tobacco users, 19.5% denied current tobacco use (Table 2). The percentage was highest among exclusive users of non-cigarette combustible tobacco (53.3%), followed by exclusive cigarette smokers (21.7%), dual users (20.2%), and exclusive HTP users (10.0%). Among former and never tobacco users combined (N = 21,781), 99.4% denied current tobacco use (data not shown). In the multivariable analysis, exclusive users of HTPs and dual users had significantly lower likelihoods of denying current tobacco use (APR = 0.39 [95%CI = 0.31–0.50] and APR = 0.71 [95%CI = 0.61–0.82], respectively) compared to exclusive cigarette smokers. The likelihood was higher among females (APR = 1.33 [95%CI = 1.17–1.51]) than males, non-current or never alcohol drinkers (APR = 1.20 [95%CI = 1.05–1.36]) than current drinkers, less-frequent users of tobacco products (APR = 4.58 [95%CI = 3.82–5.49], APR = 2.45 [95%CI = 1.95–3.08], and APR = 2.22 [95%CI = 1.76–2.79] for those who used tobacco products on 1–5 days; 6–10 days; and 11–20 days during the past 30 days, respectively) compared to frequent tobacco users (21 + days), and those not reporting tobacco dependence (APR = 2.31 [95%CI = 1.91–2.81]).
In this study, current users of HTPs were, regardless of whether they classify themselves into binary categories of users versus non-users. Tobacco control efforts need targeted messages toward less-frequent, non-current users who do not consider themselves tobacco users are less motivated to quit compared to exclusive or dual users. This could be due to the social norms surrounding HTP use status as a current tobacco user.

In 2022, HTP use remained high at 11.8 % and unchanged since 2019. (Odani and Tabuchi, 2021; Hori, 2022) The use of other tobacco products was 19.4 % for cigarettes and 3.6 % for non-cigarette combustible tobacco products, resulting in 24.5 % of all respondents currently using any (at least one) tobacco product. We also found that nearly one-fifth of current users of any tobacco product denied current tobacco use, and this proportion varied depending on the type of tobacco product they used, frequency of use, and whether they were dependent on tobacco. Assessing tobacco use without specifying these details in surveys or clinical settings may result in underreporting or nondisclosure of tobacco use, posing challenges in implementing appropriate methods to monitor or screen for tobacco use. Policymakers and healthcare providers should be aware that those "light tobacco users" can be overlooked unless appropriate methods are used to monitor or screen for tobacco use. "Light tobacco users" may include individuals who think they have quit tobacco even though they only attempted to stop using tobacco for a short period of time and continue to use tobacco intermittently. Simply asking "Do you currently smoke/use tobacco?" or asking people to identify their smoking status may have contributed to higher social acceptance towards HTP use than that for smoking and more comfortable disclosure of HTP use status as a current tobacco user.

We also found demographic differences in denial of current tobacco use with higher likelihoods among females, never or non-current drinkers, less-frequent tobacco users, and those not dependent on tobacco. Our findings were largely consistent with those from previous studies suggesting that tobacco use frequency and dependence are the most influential factors for denial of tobacco use or self-identity as being a tobacco user. (Choi et al., 2010; Leas et al., 2015; Guilory et al., 2017; Agaku et al., 2018) Policymakers and healthcare providers should be aware that those "light tobacco users" can be overlooked unless appropriate methods are used to monitor or screen for tobacco use. "Light tobacco users" may include individuals who think they have quit tobacco even though they only attempted to stop using tobacco for a short period of time and continue to use tobacco intermittently. Simply asking "Do you currently smoke/use tobacco?" or asking people to identify their smoking status may have contributed to higher social acceptance towards HTP use than that for smoking and more comfortable disclosure of HTP use status as a current tobacco user.

In the 2022 revised Health Promotion Law, (Japan Ministry of Health, Labour and Welfare, 2018) which allows people to use HTPs in designated rooms while smoking is, in principle, banned in all indoor public places. This strategy of reinforcing non-smoking social norms may have inadvertently marginalized smokers with little advantage for them to disclose they are smokers or tobacco users. On the other hand, HTPs have often been marketed as a “cleaner alternative to cigarettes” or “reduced risk product”. (Bialous and Glantz, 2018; Philip Morris International, 2021) The health-conscious image of HTPs formed by the tobacco industry may have contributed to higher social acceptance towards HTP use than that for smoking and more comfortable disclosure of HTP use status as a current tobacco user.

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Table 2: Percentage and likelihood of denying current tobacco use among past-30-day users of any tobacco products, Japan Society and New Tobacco Internet Survey (JASTIS), 2022.

| Characteristics                                    | Distribution | Percentage – denying current tobacco use | Likelihood – denying current tobacco use |
|---------------------------------------------------|--------------|------------------------------------------|----------------------------------------|
|                                                   | N            | % (95 % CI)                              | APR (95 % CI)                          |
| Overall                                           | 6343         | 100.0                                    | 19.5 (17.9-21.1)                       | –                                      |
| Tobacco use status                                |              |                                         |                                        |
| Cigarette only                                    | 3048         | 49.8                                     | 21.7 (19.4-23.9)                       | Ref                                    |
| Non-cigarette combustible tobacco product only    | 196          | 2.0                                      | 53.3 (41.1-65.5)                       | 1.17 (0.93-1.46)                      |
| Heated tobacco product only                       | 1246         | 20.3                                     | 10.0 (7.0-13.1)                        | 0.39 (0.31-0.50)                      |
| Dual (combustible + heated tobacco) use           | 1853         | 27.9                                     | 20.2 (16.9-23.5)                       | 0.71 (0.61-0.82)                      |
| Sex                                               |              |                                         |                                        |
| Female                                            | 1928         | 28.3                                     | 26.0 (22.9-29.0)                       | 1.33 (1.17-1.51)                      |
| Male                                              | 4415         | 71.7                                     | 17.0 (15.1-18.9)                       | Ref                                    |
| Age, years                                        |              |                                         |                                        |
| 16-19                                             | 45           | 1.4                                      | 56.8 (34.1-79.5)                       | 1.27 (0.90-1.80)                      |
| 20-29                                             | 1093         | 12.0                                     | 30.6 (26.8-34.4)                       | 0.99 (0.81-1.22)                      |
| 30-39                                             | 943          | 20.1                                     | 18.0 (14.7-21.3)                       | 0.97 (0.78-1.21)                      |
| 40-49                                             | 1499         | 25.3                                     | 18.0 (15.1-20.9)                       | 1.01 (0.81-1.25)                      |
| 50-59                                             | 1312         | 21.9                                     | 16.2 (12.0-20.4)                       | 0.97 (0.76-1.23)                      |
| 60-74                                             | 1451         | 19.4                                     | 17.4 (14.3-20.6)                       | Ref                                    |
| Education                                         |              |                                         |                                        |
| Less than high school                             | 219          | 7.5                                      | 16.8 (9.2-24.3)                        | 1.03 (0.67-1.57)                      |
| High school or higher (including current students)| 6080        | 92.5                                     | 20.0 (18.5-21.4)                       | Ref                                    |
| Alcohol use                                       |              |                                         |                                        |
| Non-current/never                                 | 2463         | 40.6                                     | 24.0 (21.3-26.7)                       | 1.20 (1.05-1.36)                      |
| Current                                           | 3880         | 59.4                                     | 16.5 (14.5-18.4)                       | Ref                                    |
| Number days on which respondents used tobacco products (past 30 days) (Flair et al., 2018) |              |                                         |                                        |
| 1-5 days                                          | 1106         | 13.4                                     | 59.3 (54.6-64.1)                       | 4.58 (3.82-5.49)                      |
| 6-10 days                                         | 522          | 7.8                                      | 27.5 (21.6-33.3)                       | 2.45 (1.95-3.08)                      |
| 11-20 days                                        | 665          | 10.9                                     | 26.1 (20.3-32.0)                       | 2.22 (1.76-2.79)                      |
| 21-30 days                                        | 4050         | 67.9                                     | 9.7 (8.1-11.4)                         | Ref                                    |
| Tobacco dependence screening5                     |              |                                         |                                        |
| Not dependent                                     | 3701         | 54.3                                     | 29.1 (26.6-31.6)                       | 2.31 (1.91-2.81)                      |
| Dependent                                         | 2642         | 45.7                                     | 8.2 (6.8-9.6)                          | Ref                                    |

Note: Data were adjusted for “being a respondent in an internet survey” using a nationally representative sample of Japanese population. Within-group differences were assessed by chi-squared tests. Adjusted prevalence ratios (APRs) and 95% confidence intervals (CIs) were estimated through multivariable Poisson regression (adjusted for all the listed variables). Bold type indicates statistical significance (p < 0.05).
1. Cigarettes assessed in this study included manufactured cigarettes and roll-your-own cigarettes.
2. Non-cigarette combustible tobacco products assessed in this study included little cigars, pipes, water pipes, cigars, pipes, and water pipes.
3. Heated tobacco products assessed in this study included Ploom Tech, Ploom S, Ploom X, IQOS, gLo, and liL.
4. Defined as a higher number of days reported by respondents when they used multiple tobacco products.
5. Determined by the Tobacco Dependence Screener.

5. Conclusion

In 2022, HTP use remained high in Japan (11.8%) as the second most used tobacco product after cigarettes (19.4%). One in five current (past 30-day) tobacco product users denied current tobacco use. Given the complex tobacco product use patterns and changing tobacco-related social norms, increasing the sensitivity of questions to screen for tobacco use is important to reduce underreporting and nondisclosure of true tobacco use status.

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CRediT authorship contribution statement

Satomi Odani: Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Visualization. Takahiro Tabuchi: Conceptualization, Methodology, Validation, Investigation, Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition.

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.
Data availability

Data will be made available on request.

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