

# Smoking Characteristics and Readiness-to-Quit Status Among Smokers Attending Preoperative Assessment Clinic – A Prospective Cohort Study

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**Background:** Perioperative smoking is associated with an increased incidence of general postoperative morbidity and mortality. The perioperative period is recognized as an important “teachable moment” that can motivate patients to adopt health changing behaviors.

**Objective:** In this study, we aimed to determine the prevalence of smokers among elective surgical patients in an Asian tertiary hospital. We also investigated their smoking characteristics, previous quitting attempts, readiness-to-quit status as well as knowledge of smoking-related postoperative complications.

**Methods:** We conducted a single-center prospective cohort study among all patients who attended a preoperative assessment clinic within a 2-month period (August to September 2020) using a preoperative smoking questionnaire.

**Results:** A total of 3362 patients participated in the study, of which 348 (10.4%) were current smokers. More than half (65.6%) of the smokers had previously attempted to quit smoking, with most (78%) having made more than one attempt. Forty-nine percent of current smokers were in the pre-contemplation stage of quitting and thirty-one percent were in the contemplation stage. Only twenty-one percent were in the preparation stage of quitting. Thirty-eight percent of patients recognized the importance of smoking cessation perioperatively but only twenty-eight percent were confident of quitting perioperatively. Less than sixty percent of smokers were aware of at least one type of smoking-related postoperative complication. Less than half of the patients (45%) had ever received advice on perioperative smoking cessation from the surgeons.

**Conclusion:** A thorough understanding of smokers’ smoking characteristics, barriers to quit and readiness-to-quit status are crucial to establishing a successful multidisciplinary perioperative smoking cessation program. Counselling should address knowledge deficits and be tailored to a patient’s stage-of-change in order to seize this precious perioperative “teachable moment”.

**Keywords:** perioperative smoking cessation, readiness-to-quit status, barriers to quit perioperatively

## Introduction

Despite decades of effort to reduce smoking prevalence, smoking still remains the number one cause of preventable morbidity and mortality.<sup>1</sup> Studies have shown that around 30% of elective surgical patients in the western population are smokers.<sup>2,3</sup> Several meta-analyses have demonstrated that preoperative smoking is associated with increased risks of general postoperative morbidity, impaired wound healing, infection, pulmonary and neurological complication.<sup>4,5</sup> Smokers also tend to have higher post-operative opioid consumption with an increased incidence of chronic pain.<sup>6,7</sup>

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More importantly, the perioperative period is a potential “teachable moment” to achieve long-term abstinence by motivating individuals to adopt healthy behaviors.<sup>4,8–10</sup> Current evidence suggests that when patients are faced with significant health-related predicaments such as the need to undergo surgery, efforts to quit smoking may increase as much as two-fold once they understand the benefits of smoking cessation.<sup>11,12</sup> This holds true for smoking-related diseases, such as coronary artery bypass grafting or lung resection for cancer, as well as surgeries unrelated to smoking.<sup>8,13–16</sup> Smokers who quit more than 3–4 weeks before surgery have a lower risk of respiratory complications as well as postoperative wound infection.<sup>13</sup> Hence, efforts to promote perioperative smoking cessation have significant impact on the wellbeing of individual patients as well as the healthcare system.

A preoperative assessment clinic (PAC) with a multimodal preoperative optimization and pre-habilitation program may identify smokers and offer a tailored smoking cessation intervention program.<sup>17</sup> However, there are limited data available on the smoking characteristics among elective surgical patients attending PAC, their readiness-to-quit, as well as potential barriers for the implementation of a perioperative smoking cessation program. In addition, little data exist regarding patients’ awareness of smoking-related perioperative risks and smoking cessation services available.<sup>18</sup>

The primary aim of this study is to bridge these knowledge gaps. We aimed to determine the prevalence of smokers among elective surgical patients attending PAC in an Asian tertiary hospital. We further investigated their smoking characteristics, previous quitting attempts, current readiness-to-quit as well as knowledge of smoking-related postoperative complications. These findings will aid the design and incorporation of a robust, effective PAC-based perioperative smoking cessation program to improve surgical outcomes. Such a program capitalizes on the crucial “teachable moment” and is likely to increase successful abstinence rates in the long term.

## Methods

### Study Design

This single-center, prospective observational cohort study was conducted at the PAC of the Singapore General Hospital (SGH), an 1800-bed tertiary public hospital in Singapore.

All consecutive patients over a 2-month period (August to September 2020) who visited the PAC and were able to

communicate in either English, Mandarin, Malay or Tamil were eligible to be enrolled in the study. No patients were excluded.

### Preoperative Smoking Questionnaire

A 3-part preoperative smoking questionnaire in English, pre-designed by the authors, including a clinical psychologist, was administered to patients upon arrival at the clinic. Part A included questions on patient demographics and current smoking status. A non-smoker was defined as a person who had never smoked, an ex-smoker was defined as a person who had quit smoking for more than one month, and an active smoker was defined as a person who was still smoking or had only stopped for less than a month.<sup>19</sup> This part of the questionnaire was administered by the PAC nurses during the initial nursing assessment of the patient.

Part B was a patient self-administered questionnaire, with verbal translation (to Mandarin, Malay, or Tamil) available from the nurses if required. It assessed in detail a patient’s smoking history including smoking habits and previous quitting attempts (defined as abstaining from cigarettes for at least one day with the intention to quit definitively). Reasons for failed quitting, and current readiness and confidence to stop smoking before surgery were further explored. A list of reasons for attempting to quit smoking and reasons for failed attempts at quitting were provided based on existing literature.<sup>20–23</sup> This list of reasons in the questionnaire was derived in consultation with a clinical psychologist specializing in smoking cessation. Their readiness to quit status was also assessed using a stage-of-change model which has been widely used for smoking-cessation treatments.<sup>24,25</sup> Based on their answers to a set of standardized questions, smokers were categorized into three stages of smoking cessation — pre-contemplation (does not perceive smoking as a problem and not think of quitting in the next 6 months), contemplation (aware of smoking as a problem and has committed to quit in the next 6 months) and preparation (intends to quit within the next month).

Part C assessed their awareness of smoking-related postoperative complications as well as smoking cessation services available. It also included questions about any smoking cessation advice they may have received from surgeons preoperatively. Part C was administered by anaesthetists during preoperative assessment and counselling in PAC.

Patients would only be invited to participate in Part B and C of the questionnaire if they declared themselves as a smoker in Part A.

## Sample Size Calculation

The prevalence of smokers in the general population in Singapore is estimated to be 10.6%.<sup>26</sup> A calculated sample size of at least 1300 patients is required to estimate the prevalence of smokers among the surgical population, assuming a precision of 0.02, dropout rate of 20% and p-value of 0.05.

## Statistical Analysis

Descriptive analysis was conducted and reported as means and standard deviations (SD) for continuous variables, and frequencies and percentages for categorical variables. One-way ANOVA was performed using IBM SPSS Statistics V.21 to assess the differences in continuous variables including age, and categorical variables, eg, gender, race, marital status, employment status and education level. A p-value of  $<0.05$  was used to determine statistical significance.

## Ethical Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the SingHealth Centralised Institutional Review Board (CIRB) (CIRB Ref: 2020/2269). Written Informed consent from the participants was waived by CIRB as the questionnaire was conducted anonymously with no interventions performed and no deviations from the standard treatments patients received. Verbal consent was considered adequate by CIRB, which is

determined by willingness to voluntarily participate in the study questionnaire.

## Results

### Demographics

A total of 3362 patients participated in the study, of which 348 were current smokers. Out of the total number of smokers, 95 (27%) dropped out before completing part B and C of the questionnaire. Hence, 253 smokers completed the entire questionnaire (Figure 1).

The prevalence of smoking among patients seen in the PAC was 10.4% (348/3362). Smokers were predominantly male (81.6%) and Chinese (66%). Females had a significantly lower prevalence of smoking compared to males (3.9% vs 16.6%,  $p<0.0001$ ). (Table 1) The mean age of smokers was 51.8 years (SD 15.5). Smokers were more likely to be single or divorced compared to non-smokers or ex-smokers ( $p<0.0001$ ). They were also less likely to have achieved a higher education level ( $p<0.0001$ ) (Table 1).

### Smoking Characteristics

Majority (60.8%) of smokers had started smoking before the age of 20 and most smokers smoked daily (86.2%). Almost 80% of smokers smoked 10 or less cigarettes a day and 10% of smokers smoked more than 30 cigarettes a day (Table 2).

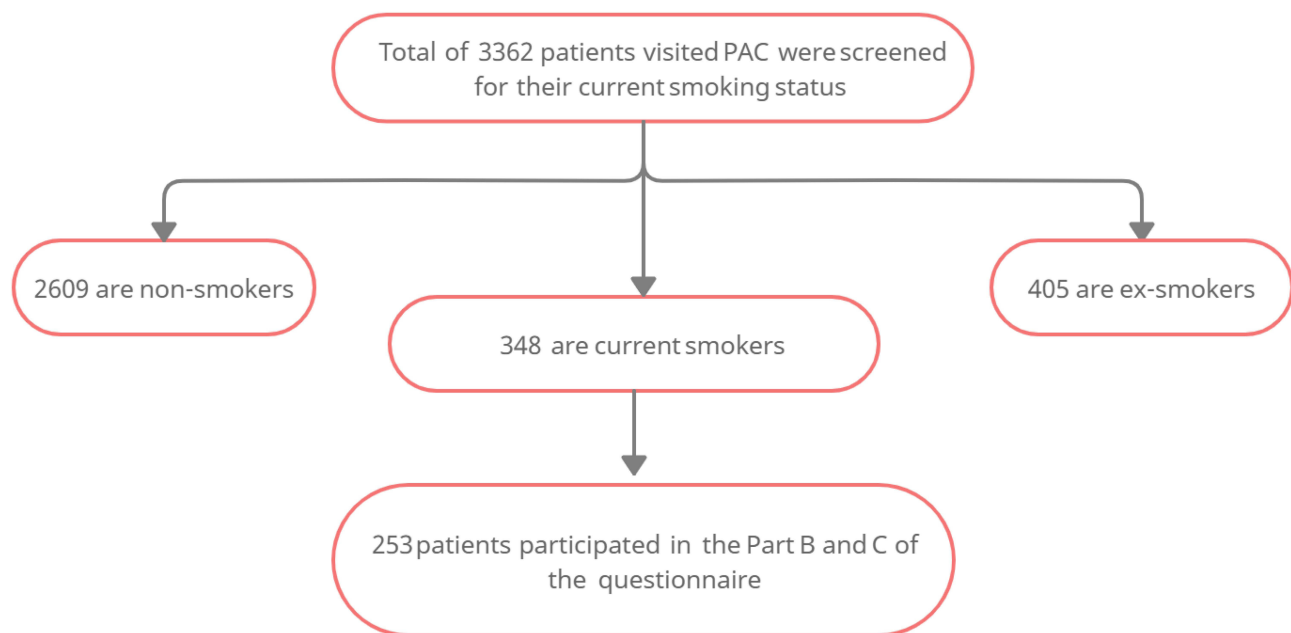


Figure 1 Study flowchart.

**Table 1** Patient demographics Among Non-Smoker, Ex-Smoker and Smokers

|                          | Non-Smoker<br>(N=2609) | Ex-Smoker (N=405) | Smoker (N=348) | P value |
|--------------------------|------------------------|-------------------|----------------|---------|
| <b>Age (Mean (SD))</b>   | 57.47 (16.10)          | 59.66 (15.72)     | 51.79 (15.46)  | <0.0001 |
| <b>Gender</b>            |                        |                   |                |         |
| Female                   | 1533 (93.1%)           | 50 (3.0%)         | 64 (3.9%)      | <0.0001 |
| Male                     | 1076 (62.7%)           | 355 (20.7%)       | 284 (16.6%)    |         |
| <b>Race</b>              |                        |                   |                |         |
| Chinese                  | 2042 (79.5%)           | 298 (11.6%)       | 230 (8.9%)     | <0.0001 |
| Malay                    | 225 (71.0%)            | 33 (10.4%)        | 59 (18.6%)     |         |
| Indian                   | 230 (72.6%)            | 39 (12.3%)        | 48 (15.1%)     |         |
| Others                   | 111 (81.6%)            | 15 (11.0%)        | 10 (7.4%)      |         |
| <b>Marital status</b>    |                        |                   |                |         |
| Married                  | 2001 (79.4%)           | 296 (11.7%)       | 223 (8.8%)     | <0.0001 |
| Single                   | 509 (75.5%)            | 69 (10.2%)        | 96 (14.2%)     |         |
| Divorced                 | 91 (66.4%)             | 17 (12.4%)        | 29 (21.1%)     |         |
| <b>Employment status</b> |                        |                   |                |         |
| Employed                 | 1366 (75.2%)           | 209 (11.5%)       | 241 (13.3%)    | <0.0001 |
| Unemployed               | 472 (81.1%)            | 47 (8.1%)         | 63 (10.8%)     |         |
| Retired                  | 765 (81.6%)            | 129 (13.8%)       | 43 (4.6%)      |         |
| <b>Education level</b>   |                        |                   |                |         |
| Postgraduate and above   | 150 (91.0%)            | 9 (5.5%)          | 6 (3.6%)       | <0.0001 |
| University               | 411 (85.3%)            | 43 (8.9%)         | 28 (5.8%)      |         |
| Diploma                  | 307 (76.8%)            | 45 (11.3%)        | 48 (12.0%)     |         |
| Secondary                | 563 (79.5%)            | 85 (12%)          | 60 (8.5%)      |         |
| Primary                  | 1173 (74.1%)           | 203 (12.8%)       | 206 (13.0%)    |         |

## Previous Quitting Attempts

More than half (65.6%) of the smokers had previously attempted to quit, with most (78%) having made more than 1 attempt. Only 26.4% of smokers were able to quit smoking for more than 6 months. “Advice from healthcare professionals” (84.2%), “Personal health reasons” (68.0%) and “Family health concerns” (33.2%) were the top three reasons for previous attempts at quitting. The most cited reasons for relapse were physical withdrawal symptoms (41.5%), followed by psychological symptoms (feeling stressed/depressed after quitting; 34.0%) and external factors (being surrounded by friends or family who smoke). (Table 3)

## Intention to Quit Perioperatively

Forty-nine percent of current smokers were in the precontemplation stage and 30% were in the contemplation stage. Only 21% were in the preparation stage of quitting (Table 4).

While only 38.4% of patients recognized the importance of smoking cessation perioperatively (rated 7 or

**Table 2** Smoking Characteristics

| Age Started Smoking           | Number of Patients (Total 253) |
|-------------------------------|--------------------------------|
| <20 years old                 | 155 (61.3%)                    |
| 20–30 years old               | 83 (32.8%)                     |
| 30–40 years old               | 8 (3.2%)                       |
| >40 years old                 | 7 (2.8%)                       |
| <b>Frequency of smoking</b>   |                                |
| Daily                         | 218 (86.2%)                    |
| 1–2 days/week                 | 29 (11.5%)                     |
| 1–2 days/month                | 3 (1.2%)                       |
| Once a few months             | 3 (1.2%)                       |
| <b>Number of sticks a day</b> |                                |
| 0–10                          | 123 (48.6%)                    |
| 10–20                         | 88 (34.8%)                     |
| 20–30                         | 16 (6.3%)                      |
| >30                           | 26 (10.3%)                     |

more on a scale of 0 to 10), and only 28.1% of patients were confident of doing so (rated 7 or more on a scale of 0 to 10), more than half (56.5%) of patients were keen to

**Table 3** Previous Quitting Attempts, Reasons for Quitting and Failed Quitting Attempts

| Attempted Quitting Before  | Percentage of Patients (Total 253) |
|--|------------------------------------|
| Yes  | 166 (65.6%)                        |
| No   | 87 (34.4%)                         |
| <b>Number of quitting attempts</b>   |                                    |
| 1  | 36 (22%)                           |
| 1–5  | 109 (66.9%)                        |
| >5   | 21 (12.8%)                         |
| <b>Longest duration of quitting</b>  |                                    |
| Less than 1 month  | 76 (46.7%)                         |
| 1–6 months   | 47 (28.8%)                         |
| 6 months–1 year  | 16 (9.8%)                          |
| >1 years   | 27 (16.6%)                         |
| <b>Reasons for previous thoughts/action of quitting among all current smokers (more than one reason may be reported by each smoker)*</b> |                                    |
| Personal health reasons  | 172 (68.0%)                        |
| Advice from doctors/nurses   | 213 (84.2%)                        |
| Family health concerns   | 84 (33.2%)                         |
| Pressure from friends/family   | 21 (8.3%)                          |
| Family planning  | 9 (3.6%)                           |
| Financial concerns   | 15 (6.0%)                          |
| Desire for self control  | 52 (20.6%)                         |
| <b>Reasons for failed previous quitting attempts (more than one reason may be reported by each smoker)*</b>                              |                                    |
| Withdrawal symptoms (physical)   | 105 (41.5%)                        |
| Lack of guidance/support   | 14 (5.5%)                          |
| No medications available (eg NRT)  | 11 (4.3%)                          |
| Worry about NRT side effects   | 13 (5.1%)                          |
| High cost of NRT   | 7 (2.8%)                           |
| Friends/family who smoke (behavior)  | 79 (31.2%)                         |
| Feel stressed/depressed after quitting (psychological)   | 86 (34.0%)                         |
| Worry about weight gain  | 22 (8.7%)                          |

**Note:** \*Percentages do not add up to 100% due to the multiple-answer question.

stop smoking preoperatively if it could improve recovery from surgery (Table 4).

## Awareness of Smoking Related Post Op Complications and Smoking Cessation Services

Majority of patients were aware of smoking-related post-operative respiratory (59%) and cardiovascular (51%) complications. However, only a fifth were aware of other

**Table 4** Intention to Quit Perioperatively

| Readiness-to-Quit Stages Among Smokers                               | Percentage of Patients (Total 253) |
|--|------------------------------------|
| Pre-contemplation (not even thinking of quitting)                    | 124 (49%)                          |
| Contemplation (thinking of quitting but no commitment)               | 76 (30%)                           |
| Preparation (planning on making a change)                            | 53 (21%)                           |
| <b>Keen to stop smoking preoperatively if this improves recovery</b> |                                    |
| Yes  | 143 (56.5%)                        |
| No   | 110 (43.4%)                        |
| <b>Importance of quitting perioperatively (rate 0–10)</b>            |                                    |
| 0  | 34 (13.4%)                         |
| 1–3  | 35 (13.8%)                         |
| 4–6  | 87 (34.4%)                         |
| 7–9  | 49 (19.4%)                         |
| 10   | 48 (19.0%)                         |
| <b>Confidence of quitting perioperatively (rate 0–10)</b>            |                                    |
| 0  | 56 (22.1%)                         |
| 1–3  | 50 (19.8%)                         |
| 4–6  | 76 (30%)                           |
| 7–9  | 40 (15.8%)                         |
| 10   | 31 (12.3%)                         |

complications such as increased pain and infection. Less than half (43.1%) were aware of the smoking cessation services and only 12.3% had ever received smoking-cessation-related counselling (Table 5).

## Quitting Advice Received from the Surgeons

Most of our patients were scheduled to undergo either general surgery or orthopedic surgery (32% each). Other surgical disciplines included obstetrics and gynaecology, urology and Ear, Nose, Throat (ENT). Fewer than half of patients ever received advice on perioperative smoking cessation from surgeons (45%). Among those who had received any advice, 48% were unaware of the minimum duration of smoking abstinence preoperatively (Table 6).

## Discussion

The prevalence of smokers among patients undergoing elective surgery in our population is similar to the general



**Table 5** Knowledge on Smoking Related Postoperative Complications and Smoking Cessation Service

| Types of Postoperative Complications (More Than One Answer May Be Chosen by Each Smoker)* | Percentage of Patients (Total 253) |
|---|------------------------------------|
| Resp  | 150 (59.3%)                        |
| CVS   | 129 (51%)                          |
| Increased pain  | 50 (20.2%)                         |
| Wound infection   | 72 (28.5%)                         |
| <b>Awareness of smoking cessation service</b>   | 109 (43.1%)                        |
| <b>Received smoking cessation counselling</b>   | 31 (12.3%)                         |

**Note:** \*Percentages do not add up to 100% due to the multiple-answer question.

population in Singapore (10.4% vs 10.6%). The majority of our smokers smoke less than 20 sticks a day (83.4%). This is consistent with a meta-analysis of smokers in Singapore where the mean number of cigarettes smoked was 16 sticks per day.<sup>27</sup>

This study is the first to assess the readiness-to-quit status among smokers in the Asian perioperative population as well as their attitudes towards perioperative smoking cessation. Almost half (49%) of the smokers were in the precontemplation stage and only 38.4% realized the importance of perioperative smoking cessation. Compared to other perioperative studies done in Canada and US,

**Table 6** Surgical Disciplines of Smokers and Advice Received from Surgeons

| Surgical Disciplines of Smokers                  | Percentage of Patients (Total 253) |
|--|------------------------------------|
| GS/CLR   | 81 (32%)                           |
| Orthopedic/Hand                                  | 80 (31.9%)                         |
| OG   | 10 (4%)                            |
| Urology  | 32 (12.6%)                         |
| ENT  | 24 (9.5%)                          |
| Others   | 26 (10.2%)                         |
| <b>Surgeons advised quitting perioperatively</b> | 114 (45.1%)                        |
| <b>Duration of abstinence advised by surgeon</b> |                                    |
| Less than 1 day (day of operation)               | 5 (4.4%)                           |
| 1–2 weeks  | 24 (21%)                           |
| More than 1 month                                | 25 (22%)                           |
| Not specified                                    | 55 (48.2%)                         |

a significantly higher proportion of patients in our population was observed to be in the precontemplation stage, as opposed to the contemplation or preparation stage.<sup>28,29</sup> This might be due to the fact that the majority (78%) of patients in our study had experienced multiple failed attempts at quitting smoking, with most relapsing within one month of quitting. These failed attempts may have adversely affected their confidence of quitting as only 28% of patients surveyed expressed confidence in quitting pre-operatively. There is ample evidence supporting the utility and predictive value of the stage-of-change model for smokers.<sup>30</sup> Patient counselling and treatment strategies should be guided not just by a patient's smoking status, but also their readiness to quit status. For example, it has been demonstrated that smokers in the preparation stage are twice as likely to quit smoking in the next 6 months as compared to smokers in the pre-contemplation stage.<sup>24</sup> Preparers may benefit from a behavior-based strategy where pharmacotherapy and supportive counselling are employed to deal with withdrawal symptoms, whereas pre-contemplators may benefit from a more cognitive-based strategy that aims to increase their awareness of the harms of smoking and benefits of quitting.<sup>31</sup>

Interestingly, only 59% of the smokers in our study were aware of any smoking-related postoperative complications. This echoes an Australian survey by Webb et al which found that less than 40% of smokers were aware of any type of smoking-related complications.<sup>18</sup> Many smokers tend to undermine the detrimental consequences of smoking, displaying unrealistic optimism.<sup>31</sup> This is important as having better knowledge about the magnitude and nature of health risks can strongly influence the decisions to quit among smokers.<sup>32</sup> Smokers are more likely to attempt quitting when they are aware of the acute consequences of smoking (such as the increased risk of serious postoperative complications), when compared to just being aware of the chronic consequences (such as cardio-respiratory illnesses).<sup>16,32,33</sup> The immediate risks of surgical complications and benefits of perioperative cessation serve as tangible motivators to advance patients from pre-contemplation to contemplation stage, and those contemplating to act.<sup>33</sup>

In our study, fewer than half of our surgeons advised patients on quitting before the surgery (45%), and among these surgeons, nearly half (48%) did not specify the duration of abstinence recommended. This is a concerning finding that warrants further intervention. Based on a survey conducted in Australia, surgeons were

consistently rated as the most convincing source of advice, with 43% of patients being able to recall quitting advice given to them by their surgeon.<sup>18</sup> In the same vein, patients in our study rated advice received from healthcare professionals as their top reason for smoking cessation. Though raising awareness among surgeons to advocate smoking cessation during the patients' perioperative journey is paramount, other healthcare professionals including nurses, family physicians, pharmacists and anaesthetists all have a role to play in motivating and inspiring patients on this journey.<sup>18</sup>

Earlier studies have demonstrated that the PAC is an ideal setting to initiate smoking cessation programs, with anaesthetists playing a leading role in this multidisciplinary approach.<sup>16,34</sup> However, few have investigated potential barriers to this intervention.<sup>35</sup> Understanding the reasons for previous failed attempts can guide the development of specific interventions for an effective smoking cessation pathway in PAC. Our study provides the data for planning such a programme in the elective surgery setting. For example, the more common reasons for relapse in our study population were the experience of withdrawal symptoms and low mood after quitting. Other reasons included a lack of awareness of available smoking cessation services and poor accessibility to these services. Holistic interventions that target these reasons such as brief counselling, stop-smoking brochures and referral to a smoking cessation hotline, in addition to pharmacotherapy, may double the rate of abstinence at 30 days post-surgery.<sup>16</sup> Although the intensity of counselling correlates positively to the rate of abstinence, even brief cessation advice delivered on multiple occasions can significantly impact a patient's readiness status.<sup>33</sup> Close follow up through face-to-face perioperative counselling and post-discharge telephone support can also identify difficulties that smokers encounter during the quitting process and allow timely intervention.

To our knowledge, this is the first prospective study in Asia assessing readiness-to-quit status among smokers as well as barriers to smoking cessation in the perioperative population. This study has provided valuable insight on smokers in the perioperative setting. The strength of this study includes a detailed preoperative smoking questionnaire that described smoking characteristics and previous quitting attempts among smokers. More importantly, this information was collected through an anonymous self-reported questionnaire due to the sensitive nature of

some of the questions. However, the generalizability of our findings may be limited as this is a single center cross-sectional study.

## Conclusion

Understanding of the surgical patients' smoking characteristics, readiness-to-quit status and knowledge deficits on smoking-related postoperative complications are important to ensure the success of a perioperative smoking cessation program. A multidisciplinary, stage-of-change matched approach should be used to capitalize on this precious "teachable moment".

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## Disclosure

The authors report no competing interest or conflict of interest.

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