Journal of Applied Pharmaceutical Science Vol. 16(04), pp 369-381, April, 2026
Available online at http://www.japsonline.com
DOI: 10.7324/JAPS.2026.290131
ISSN 2231-3354

Profiling hospitalized smokers in Malaysia: Insights into health, tobacco use, and cessation readiness

Kit Yeng Toh[1,2], Chee Ping Chong[2*], Nur Hafzan Md. Hanafiah[2], Mohamad Haniki Nik Mohamed[3]

[1]Department of Pharmacy, Hospital Sultan Haji Ahmad Shah, Ministry of Health, Putrajaya, Malaysia.
[2]Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Minden, Malaysia.
[3]Kulliyyah of Pharmacy, International Islamic University Malaysia, Kuantan, Malaysia.

ARTICLE HISTORY

Received on: 13/11/2025
Accepted on: 31/01/2026
Available Online: 05/03/2026

Key words:
Sociodemographic factors, tobacco use disorder, hospitalized smokers, Malaysia, smoking cessation.

ABSTRACT

A cross-sectional study was conducted from 2022 to 2023 among adult smokers admitted to the medical and cardiology wards of a Malaysian tertiary hospital to profile their health status, tobacco use behaviours, and cessation readiness. Data collection involved the use of the Depression, Anxiety, and Stress Scales, the Fagerström Test for Nicotine Dependence (FTND), and the transtheoretical model of behavioural change. The median age of the 488 recruited patients was 50 years, and the majority were male (99.8%). The median body mass index was 24.8 kg/m^2, with 63.8% classified as either pre-obese or obese. Cardiology-related diagnoses were the most common reason for admission (38.1%). Psychological assessments revealed that most patients had normal scores for depression (88.1%), anxiety (78.1%), and stress (88.3%). The majority of patients (71.7%) had attempted smoking cessation, with 64.9% reporting abrupt quitting and 8.3% utilising pharmacotherapy. Approximately half of the patients (54.5%) had low nicotine dependence (Median FTND score = 3), and 78.5% expressed cessation readiness within the next month. Prior quit attempts adjusted odds ratios (aOR 1.73, $p = 0.019$) and Malay ethnicity (aOR 1.85, $p = 0.028$) were significant predictors of cessation readiness. The findings provide valuable insights into tailoring targeted interventions among hospitalized smokers.

1. INTRODUCTION

Smoking remains one of the leading causes of preventable morbidity and mortality globally. In Malaysia, tobacco use continues to impose a substantial health burden, contributing to an estimated 27,000 smoking-related deaths annually [1]. Evidence from the National Health and Morbidity Surveys (NHMS) and the Global Adult Tobacco Surveys (GATS) consistently demonstrates a high prevalence of tobacco use across diverse demographic groups in the country [2–6]. Despite these comprehensive population-level assessments, a critical knowledge gap persists regarding the characteristics and clinical profiles of smokers admitted to healthcare facilities.

The Malaysian National Strategic Plan for the Control of Tobacco and Smoking Products 2021–2030 highlights the provision of hospital-based integrated cessation services under Strategy 3.3. However, the extent to which this strategy has been operationalized remains uncertain [7]. Although evidence demonstrates the effectiveness of hospital-based cessation interventions [8], their implementation in Malaysian hospitals appears limited, and locally generated data remain scarce. Hospitalization is widely recognised as a "teachable moment" for smoking cessation, as acute health events have been shown to increase motivation to quit by 20%–30% [9]. In addition, approximately 70% of smokers report a desire to quit during hospital admission, driven by enforced abstinence and heightened awareness of their health status [10]. Integrating cessation interventions into hospital care can therefore leverage existing healthcare infrastructure to reach a large, underserved population of medically compromised smokers. This approach

*Corresponding Author
Chee Ping Chong, Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Minden, Malaysia.
E-mail: jjueping @ gmail.com

© 2026 Kit Yeng Toh *et al*. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0/).

represents a timely and impactful opportunity to reduce tobacco-related harm.

Pharmacist-led interventions at Malaysian smoking cessation clinics have demonstrated variable outcomes. A study in Penang reported a 6-month abstinence rate of 71.7% among adults who received free nicotine gum and additional counselling via phone calls, compared to a 48.6% abstinence rate with standard care [11]. In contrast, a study in Sabah found a 42.6% success rate in the Pharmacist-led Integrated Quit Smoking Service, where pharmacotherapy and counselling were provided for up to 3 months [12]. Findings from these clinic-based studies may not be generalizable to the hospitalized smoker population, as individuals seeking treatment at cessation clinics are likely to differ in motivation and health status from those facing acute conditions.

Numerous international studies have consistently documented pronounced gender disparities in smoking prevalence, with men smoking at substantially higher rates than women. This pattern is particularly evident across many Asian countries, where entrenched social and cultural norms strongly influence smoking behaviours [13]. In Malaysia, smoking remains most prevalent among adults aged 25–44 years (59.3%) and individuals with lower educational attainment (25.2%) [5]. Evidence on cessation outcomes among hospitalized smokers also varies across settings. For example, a study in Singapore reported higher quit rates among patients admitted with cardiovascular diagnoses compared to those hospitalized for other medical conditions [14]. Similarly, a study conducted in Barcelona found that 44.9% of hospitalized smokers demonstrated medium nicotine dependence, three-quarters expressed an interest in quitting, and 25% continued smoking during hospitalization [15]. In contrast, smokers in community settings exhibit markedly lower quit intentions. The GATS reported that only 6.3% of smokers intended to quit within the next month in 2011, rising modestly to 9.0% in 2023, indicating a gradual but limited increase in cessation intent over time [4,16].

This study aims to assess the sociodemographic and health-related characteristics of hospitalized smokers in Malaysia. In addition, it evaluates their tobacco use profiles, cessation readiness, psychological status, and level of nicotine dependence. By identifying these key characteristics, the study provides essential insights to inform the design and implementation of tailored smoking cessation interventions within hospital settings. These findings offer foundational evidence needed to guide the development of targeted strategies, which are critical for achieving Malaysia's national goals of reducing smoking prevalence to 15% by 2025 and further to 5% by 2040 [7].

2. MATERIALS AND METHODS

2.1. Study design

This single-centre, cross-sectional study was conducted at Hospital Tengku Ampuan Afzan, a tertiary government hospital located in Pahang, Malaysia, between October 2022 and 2023. This study adhered to the ethical principles outlined in the Declaration of Helsinki and the Malaysian Good Clinical Practice Guidelines. It was registered with the National Medical Research Register (NMRR) and received ethical approval from the Medical Review & Ethics Committee (MREC), Ministry of Health Malaysia (Approval No.: NMRR ID-22-00820-FOD). In addition, approval was obtained from the Human Research Ethics Committee of Universiti Sains Malaysia (JEPeM) (JEPeM Code: USM/JEPeM/22110680).

2.2. Response rate

All patients admitted to the medical and cardiology wards were asked about their smoking status. The response rate for this study was calculated using the following formula:

$$\text{Response rate} = \frac{\text{Numbers of patients who consented and participated}}{\text{Number of eligible patients}} \times 100\%$$

A total of 503 eligible patients were screened, and 488 consented and completed the questionnaires, resulting in a response rate of 97.0%. Fifteen patients (3.0%) declined participation, a refusal rate unlikely to introduce significant bias into the study findings.

2.3. Inclusion and exclusion criteria

The study included adult patients aged 18 years and above who were admitted to the cardiology and medical wards of the hospital, where the medical wards covered a wide range of specialties, including nephrology, infectious diseases, endocrinology, pulmonology, neurology, rheumatology, and gastroenterology. Only the medical and cardiology wards were included in this study due to limited resources, particularly the availability of trained personnel, which restricted the study's scope. Moreover, data from the NHMS and the GATS indicate a higher burden of smoking-related diseases among patients admitted to these wards [3–6], thereby justifying their prioritization.

Only current smokers were included, defined as individuals who had smoked at least one tobacco product per day for a minimum of 1 month before hospital admission. Individuals who were concurrent users of electronic cigarettes or smoking-cessation medications at the time of admission were excluded from the study. This decision was made to maintain a homogeneous study population and to simplify the assessment of nicotine dependence. Including these individuals would have required the use of additional measurement tools, such as the e-Cigarette Dependence Scale, the Vaping Dependence Scale, or modified versions of the Fagerström Test for Nicotine Dependence (FTND) for dual users, thereby complicating the evaluation process. By focusing solely on conventional cigarette smokers and using the FTND as the single measure of nicotine dependence, the study achieved clearer, more consistent results and facilitated more straightforward analysis.

Smokers were excluded from the study if they were clinically unstable or had documented psychiatric conditions, including schizophrenia, depression, bipolar disorder, other psychotic disorders, or anxiety disorders such as panic disorder, generalized anxiety disorder, and post-traumatic stress disorder, due to the practical difficulties in conducting effective communication. These diagnoses were verified through records in the appointment book or the Pharmacist Information System.

2.4. Data collection

Smoking status was determined through direct inquiry with patients upon admission. Eligibility was assessed according to predefined inclusion and exclusion criteria. Informed consent was obtained from all patients before enrolment in the study. A universal sampling method was used, where all smokers who met the eligibility criteria were invited to participate. To ensure comprehension and comfort, interviews were conducted in the patient's preferred language, which included Malay, Mandarin, or Cantonese. The interviews were conducted by the principal investigator and a co-investigator, both of whom are practising hospital pharmacists and Certified Smoking Cessation Service Providers (CSCSP).

Data were collected using structured questionnaires consisting of three main components. The first component gathered sociodemographic information, including age, gender, ethnicity, education level, religion, marital status, employment status, and living arrangement. The second component focused on health profiles, including calculated body mass index (BMI), medical history, and the primary diagnosis for hospitalization, which were obtained from medical records. For psychological assessment, the Depression Anxiety Stress Scales-21 (DASS-21) [17] was self-administered. Assistance was provided when necessary to support understanding. The third component explored the tobacco use profile. This included age at smoking initiation, duration of smoking, daily cigarette consumption, average daily expenditure on cigarettes, nicotine dependence assessed using the self-administered FTND [18,19], history of previous quit attempts and methods used, tobacco brand preference (legal or illicit), and cessation readiness. Cessation readiness was evaluated using the Transtheoretical Model of Behaviour Change (TTM) as the conceptual framework [20].

A counter-checking procedure was conducted by the principal investigator to address any missing data. All data collection forms were reviewed for completeness and accuracy, and any uncertainties were clarified. Missing or incomplete responses were identified and promptly resolved through same-day follow-up with participants to minimize recall bias. All missing data were fully addressed following this counter-checking process.

2.5. Assessment of cessation readiness

The assessment of cessation readiness was conducted by investigators who had completed the CSCSP training, ensuring consistency and accuracy in data collection. Patients were classified into stages of change based on the operational definitions of the TTM, specifically precontemplation, contemplation, and preparation. Selected items adapted from the GATS Malaysia 2011 [4] were used to guide this classification. Patient responses regarding quit attempts in the past year and intentions to quit smoking were used to determine their stage. Those with no intention to quit within the next 12 months were categorized as being in the precontemplation stage. Patients who intended to quit within 12 months but not within the next month were placed in the contemplation stage. Those planning to quit within the next month were classified under the preparation stage. The action and maintenance stages were excluded, as the study focused exclusively on current smokers.

2.6. Psychological assessment

The DASS-21, a validated instrument developed by Lovibond and Lovibond and later translated for the Malaysian population by Musa *et al.* [21], was used to assess the psychological profiles of the patients. This self-administered tool measures levels of depression, anxiety, and stress, and is not intended for diagnostic purposes. Permission to use the Malay version of the DASS-21 was obtained from the copyright holder before the commencement of the study. The DASS-21 classifies symptom severity into five categories (normal, mild, moderate, severe, and extremely severe) based on established cutoff scores for each domain. For the depression domain, the cutoff scores are: normal (0–5), mild (6–7), moderate (8–10), severe (11–14), and extremely severe (≥15). In the anxiety domain, the scores are: normal (0–4), mild (5–6), moderate (7–8), severe (9–10), and extremely severe (≥11). The stress domain uses the following cutoff scores: normal (0–7), mild (8–9), moderate (10–13), severe (14–17), and extremely severe (≥18) [21].

Patients who scored beyond normal for any domain will be referred to medical doctors. In consultation with institutional psychiatrists, patients who scored in the moderate or higher categories in any domain were identified and referred to psychological support to facilitate timely diagnosis and intervention. The inclusion of this validated tool was in accordance with ethical board requirements to ensure patient safety and to explore potential psychological factors influencing smoking behaviour and quit attempts. A systematic review and meta-analysis have shown that symptoms of depression and anxiety are associated with poorer smoking cessation outcomes and higher relapse rates [22]. Therefore, addressing these symptoms may significantly improve cessation success.

2.7. Assessment of nicotine dependence

Nicotine dependence was assessed using the Malay version of the FTND, a validated six-item questionnaire with a total score of 10. Scores were obtained through patient's self-administration and categorized into three levels of dependence: low (0 to 3), moderate (4 to 6), and high (7 to 10). These categories provide predictive value for withdrawal severity and treatment outcomes, which are relevant for tailoring smoking cessation program [23]. Higher FTND scores have been associated with lower success rates in smoking cessation in patients [24] and may require more intensive support, including pharmacotherapy, to effectively manage nicotine dependence.

2.8. Statistical analysis

Data analysis was performed using SPSS version 26. Descriptive statistics were used to summarize all the variables. Categorical variables were presented as frequencies and percentages, while continuous variables that deviated from normal distribution were reported as medians with interquartile ranges (IQR).

Factors associated with illicit cigarette use were examined using univariable and multivariable logistic

regression, comparing illicit versus legal tobacco brands. To minimise outcome misclassification and heterogeneity, smokers who reported unspecified cigarette brands or who used other tobacco products were excluded. Univariable and multivariable logistic regression were also conducted to assess the association between readiness to quit smoking ("ready to quit" *vs.* "not ready to quit") and sociodemographic, health, and tobacco use factors. Due to small numbers in the precontemplation and contemplation stages, these stages were combined into the "not ready to quit" category, while smokers in the preparation stage were classified as "ready to quit." Variables with $p < 0.25$ in univariable analyses were included in the multivariable model. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported. Multicollinearity was assessed using Variance Inflation Factors (VIFs), and model fit was evaluated using the Hosmer–Lemeshow goodness-of-fit test.

3. RESULTS

3.1. Sociodemographic characteristics

A total of 488 hospitalized patients were recruited for the study. The median age of the patients was 50 years (IQR 38–60) and were predominantly male (99.8%). Most of the patients were married (72.5%) and had attained secondary-level education (58.8%). Employment status showed that

Table 1. Sociodemographic characteristics of hospitalized smokers.

Sociodemographic characteristic	*N* (%)
Age (year)	
18–29	52 (10.7)
30–39	86 (17.6)
40–49	104 (21.3)
50–59	123 (25.2)
60–69	87 (17.8)
70 and above	36 (7.4)
Gender	
Male	487 (99.8)
Female	1 (0.2)
Ethnicity	
Malay	413 (84.6)
Chinese	41 (8.4)
Indian	24 (4.9)
Others	10 (2.0)
Marital status	
Married	354 (72.5)
Single	86 (17.6)
Widowed/divorced	48 (9.8)
Educational status	
No formal education	10 (2.0)
Primary	116 (23.8)
Secondary	287 (58.8)
Tertiary	75 (15.4)
Employment status	
Employed	232 (47.5)
Self-employed	139 (28.5)
Student	3 (0.6)
Unemployed	114 (23.4)
Staying with family	
Yes	429 (87.9)
No, stay alone	31 (6.4)
No, stay with friends	28 (5.7)

Continued

Table 2. DASS-21 assessment results of hospitalized smokers.

DASS-21 categories (score reference range)	*N* (%)
Depression	
Normal (0–9)	430 (88.1)
Mild (10–13)	25 (5.1)
Moderate (14–20)	18 (3.7)
Severe (21–27)	10 (2.0)
Very severe (≥ 28)	5 (1.0)
Anxiety	
Normal (0–7)	381 (78.1)
Mild (8–9)	55 (11.3)
Moderate (10–14)	22 (4.5)
Severe (15–19)	10 (2.0)
Very severe (≥20)	20 (4.1)
Stress	
Normal (0–14)	431 (88.3)
Mild (15 - 18)	25 (5.1)
Moderate (19–25)	14 (2.9)
Severe (26–33)	12 (2.5)
Very severe (≥ 34)	6 (1.2)

DASS-21: Depression, Anxiety and Stress Scales.

Table 3. Health-related characteristics of hospitalized smokers.

Health-related characteristics	*N* (%)
BMI (kg/m²) categories	
Underweight (< 18.5)	51 (10.5)
Normal (18.5–22.9)	126 (25.8)
Pre-obese (23.0–27.4)	165 (33.8)
Obese I (27.5–34.9)	94 (19.3)
Obese II (35.0–39.9)	37 (7.6)
Obese III (≥ 40.0)	15 (3.1)
Comorbidities	
Hypertension	174 (35.7)
Diabetes mellitus	114 (23.4)
COPD or BA	80 (16.4)
Dyslipidaemia	65 (13.3)

Continued

Health-related characteristics	*N* (%)
Ischemic heart disease (without MI)	45 (9.2)
MI	27 (5.5)
Chronic kidney disease	24 (4.9)
Gout	22 (4.5)
Cerebrovascular disease	17 (3.5)
Congestive heart failure	9 (1.8)
Tuberculosis	7 (1.4)
Moderate or severe liver disease	7 (1.4)
Peptic ulcer disease	3 (0.6)
Carcinoma or cancer	3 (0.6)
RVD	3 (0.6)
Peripheral vascular disease	2 (0.4)
Connective tissue disease	1 (0.2)
Hemiplegia or paraplegia	1 (0.2)
Others	68 (13.9)
Number of comorbidities	
0 (Not known medical illness)	165 (33.8)
1	142 (29.1)
2	71 (14.5)
3	69 (14.1)
≥ 4	41 (8.3)
Diagnosis of admission	
Cardiology	186 (38.1)
Infectious disease	86 (17.6)
Pulmonary	85 (17.4)
Neurology	68 (13.9)
Endocrinology	11 (2.3)
Gastroenterology	11 (2.3)
Nephrology	9 (1.8)
Cancer	6 (1.2)
Haematology	4 (0.8)
Rheumatology	4 (0.8)
Others/unknown	18 (3.7)
OTC product intake	
Yes	106 (21.7)

nearly half were employed (47.5%), while 28.5% were self-employed. The majority of patients (87.9%) were living with family (Table 1).

3.2. Psychological assessment using DASS-21

A total of 488 hospitalized smokers were assessed using the DASS 21. The majority of patients scored within the normal range for depression (88.1%), anxiety (78.1%), and stress (88.3%) (Table 2). The median score for the depression domain was 1 (IQR: 0–3), while the anxiety domain had a median score of 2 (IQR: 1–4). The stress domain showed a slightly higher median score of 3 (IQR: 1–5), indicating a relatively elevated level of stress among hospitalized smokers compared to depression and anxiety. Despite the overall normal scores, a small proportion of patients were classified in the severe or very severe categories for depression (3.0%), anxiety (6.1%), and stress (3.7%). These individuals were referred to medical doctors in the ward for further assessment and appropriate psychological intervention.

Table 4. Cigarette choices and brand preferences among hospitalized smokers.

Tobacco brand	*N* (%)
Tobacco brand categories	
Legal	152 (31.1)
Illicit	263 (53.9)
Unspecified	62 (12.7)
Others	11 (2.3)
Brand details	
Legal brands	
Dunhill	83 (17.0)
LD	23 (4.7)
Rothmans	13 (2.7)
Peter	10 (2.1)
Winston	6 (1.2)
Benson	5 (1.0)
Sampoerna A	3 (0.6)
Chesterfield	2 (0.4)
Marlboro	2 (0.4)
Pallmall	2 (0.4)
Mevious	1 (0.2)
Salem	1 (0.2)
Missing data	1 (0.2)
Illicit brands	
John D-blend	146 (29.9)
Suria	27 (5.5)
U2	21 (4.3)
Bosston	13 (2.7)
Gudanggaram	13 (2.7)
Canyon	12 (2.5)
Concept	11 (2.3)
Metro	5 (1.0)
Toro	3 (0.6)
Promax	2 (0.4)
Harvest	1 (0.2)
Lee	1 (0.2)
Masco	1 (0.2)
Misto	1 (0.2)
No 6	1 (0.2)
No 9	1 (0.2)
Nusantara	1 (0.2)
Paragon	1 (0.2)
Saat	1 (0.2)
Vision	1 (0.2)

Table 5. Factors associated with illicit cigarette use: univariable and multivariable logistic regression results.

Variable	Univariable logistic regression			Multivariable logistic regression		
	Regression coefficient (*b*)	Crude odds ratio (95% CI)	*p* value	Regression coefficient (*b*)	aOR (95% CI)	*p* value
Age (years)	−0.02	0.98 (0.97, 1.00)	0.015	−0.03	0.97 (0.95, 0.98)	< 0.001
Duration of smoking (years)	−0.013	0.99 (0.97, 1.00)	0.071	-	-	-
Employment status						
Self employed	0	1		0	1	
Employed	0.61	1.85 (1.15, 2.96)	0.011	-	-	-
Unemployed/student	0.25	1.29 (0.75, 2.22)	0.363	-	-	-
Educational status						
Tertiary	0	1		0	1	
Primary/no formal education	1.14	3.13 (1.61, 6.07)	0.001	1.998	7.25 (3.33, 15.80)	< 0.001
Secondary	0.79	2.20 (1.26, 3.83)	0.005	1.03	2.8 (1.56, 5.02)	0.001
Ethnicity						
Non-Malay	0	1		0	1	
Malay	0.81	2.25 (1.25, 4.04)	0.007	1.08	2.94 (1.56, 5.53)	0.001

CI: confidence interval.

Table 6. Tobacco use characteristics and cessation readiness among hospitalized smokers.

Tobacco use characteristics	*N* (%)
Duration of smoking (years)	
0–5 years	14 (2.9)
6–10 years	24 (4.9)
11–20 years	82 (16.8)
> 20 years	368 (75.4)
Age at smoking initiation (years)	
< 15 years	160 (32.8)
15–19 years	226 (46.3)
≥ 20 years	102 (20.9)
Numbers of cigarettes per day	
1–10 (Light smokers)	241 (49.4)
11–20 (Moderate smokers)	193 (39.5)
> 20 (Heavy smokers)	54 (11.1)
Daily expenditure on cigarettes (RM)	
< RM 5 per day	194 (39.8)
RM 5 - RM 10.99 per day	189 (38.7)
RM 11 -RM 19.99 per day	79 (16.2)
> RM 20 per day	26 (5.3)
History of dual use	
Yes	25 (5.1)
No	463 (94.9)
History of quit attempts	
Yes	350 (71.7)
No	138 (28.3)
Methods of quit attempt	
Abruptly	227 (64.9)
Gradually	123 (35.1)
History of smoking cessation medication use	
Yes	29 (8.3)
No	321 (91.7)
FTND categories (Score range)	
Low (0–3)	266 (54.5)
Moderate (4–6)	166 (34)
High (7–10)	56 (11.5)
TTM categories (Cessation readiness)	
Precontemplation	22 (4.5)
Contemplation	83 (17)
Preparation	383 (78.5)

FTND: Fagerström Test for Nicotine Dependence; TTM: Transtheoretical Model.

3.3. Health profile

The data showed that the median BMI among hospitalized smokers was 24.8 kg/m² (IQR: 21–43), which falls within the pre-obese category (BMI: 23–27.4 kg/m²) as defined by the Clinical Practice Guideline for the Management of Obesity in Malaysia [25]. Overall, 63.8% of patients were classified as either pre-obese (BMI: 23–27.4 kg/m²) or obese (BMI ≥ 27.5 kg/m²), whereas only 25.8% fell within the normal BMI range (BMI: 18.5–22.9 kg/m²) [25]. The detailed distribution of BMI categories is presented in Table 3.

Notably, 33.8% of patients had no known medical illness. Among those with comorbidities, hypertension was the most prevalent condition (35.7%), followed by diabetes mellitus (23.4%) and chronic obstructive pulmonary disease or asthma (16.4%). The most common reasons for hospital admission were cardiology-related conditions (38.1%), followed by infectious diseases (17.6%) and pulmonary

Table 7. Factors associated with cessation readiness: univariable and multivariable logistic regression analysis.

Variable	Univariable logistic regression			Multivariable logistic regression		
	Regression coefficient (*b*)	Crude odds ratio (95% CI)	*p* value	Regression coefficient (*b*)	aOR (95% CI)	*p* value
DASS-21 stress (scores)	−0.04	0.96 (0.91, 1.02)	0.161	-	-	-
Age (years)	0.01	1.01 (1.00, 1.03)	0.199	-	-	-
FTND (scores)	−0.10	0.91 (0.83, 0.99)	0.025	-	-	-
Ethnicity						
Non-Malay	0	1	-	0	1	-
Malay	0.66	1.93 (1.21, 3.32)	0.018	0.61	1.85 (1.07, 3.19)	0.028
Prior quit smoking attempts						
No	0	1	-	0	1	
Yes	0.58	1.79 (1.13, 2.82)	0.012	0.55	1.73 (1.09, 2.74)	0.019
Educational status						
Primary/no formal education	0	1	-	0	1	-
Secondary	0.407	1.50 (0.91, 2.48)	0.110	-	-	-
Tertiary	−0.066	0.94 (0.49, 1.79)	0.842	-	-	-
Marital status						
Single	0	1	-	0	1	-
Widowed/divorced	0.52	1.68 (0.71, 3.98)	0.241	-	-	-
Married	0.42	1.52 (0.89, 2.60)	0.129	-	-	-
Employment status						
Unemployed/student	0	1		0	1	-
Self employed	−0.37	0.69 (0.37, 1.29)	0.242	-	-	-
Employed	−0.36	0.70 (0.39, 1.23)	0.214	-	-	-
Diagnosis						
Others	0	1		0	1	-
Cardiology	−0.23	0.79 (0.37, 1.71)	0.550	-	-	-
Pulmonology	−0.22	0.80 (0.34, 1.91)	0.618	-	-	-
Neurology	−0.63	0.54 (0.23, 1.27)	0.155	-	-	-
Infectious disease	−0.79	0.45 (0.20, 1.03)	0.059	-	-	-

CI: confidence interval; DASS-21: Depression, Anxiety and Stress Scales; FTND: Fagerström Test for Nicotine Dependence.

disorders (17.4%) (Table 3). The median length of hospital stay was 3 days (IQR: 2–5), indicating a relatively short duration of hospitalization.

3.4. Cigarette brands preference and illicit cigarette use

Illicit cigarette use was common among the study population, with 53.9% of patients reporting consumption of illicit tobacco products (Table 4). A total of 20 illicit cigarette brands were identified. In comparison, 31.1% of patients reported using legal tobacco brands, comprising 12 distinct brands, while 12.7% indicated no specific brand preference. The three most consumed brands were John D-blend (29.9%), Dunhill (17.0%), and Suria (5.5%). Notably, both John D-blend and Suria are illicit brands, reflecting their significant presence in the market, likely due to their more affordable pricing. In Malaysia, illicit cigarettes typically refer to products that fail to comply with national legal requirements, such as mandatory packaging, labelling, registration, excise duty, and sales restrictions [26].

Table 5 presents the factors associated with illicit cigarette use. In the multivariable logistic regression model, lower educational attainment, Malay ethnicity, and younger age were independently associated with higher odds of using illicit cigarettes. Individuals with primary or no formal education had substantially higher odds of illicit cigarette use compared with those with tertiary education (aOR 7.25, 95% CI 3.33–15.80). Similarly, individuals with secondary education had higher odds than those with tertiary education (aOR 2.80, 95% CI 1.56–5.02). Each additional year of age was associated with a 3% reduction in the odds of illicit cigarette use (aOR 0.97, 95% CI 0.95–0.98). Malay smokers had nearly threefold higher odds of illicit cigarette use compared with non-Malay smokers (aOR 2.94, 95% CI 1.56–5.53). The final model showed minimal multicollinearity (VIF 1.05–1.22) and demonstrated good overall fit (Hosmer–Lemeshow $p = 0.995$).

3.5. Tobacco use characteristics and cessation readiness

The median duration of smoking history among hospitalized patients was 33 years (IQR: 21–43), with a

mean starting age of 16 years (IQR: 13–18). Approximately half (49.4%) of the patients were light smokers, consuming between 1 and 10 cigarettes per day, while 39.5% were moderate smokers and 11.1% were heavy smokers. The median number of cigarettes smoked per day was 12 (IQR: 6–20). The median daily expenditure on tobacco products was RM 6.09 (IQR: 3–10). Slightly more than half of the patients (54.5%) exhibited low nicotine dependence, with a median FTND score of 3 (IQR: 1–5). A substantial proportion of patients (71.7%) had attempted to quit smoking before hospital admission, most commonly through abrupt cessation (64.9%). However, the use of pharmacotherapy during previous quit attempts was low (8.3%), suggesting a willingness to quit but limited access to cessation support. Based on the TTM classification, the majority of patients (78.5%) expressed cessation readiness within 1 month of hospitalization (Table 6).

The factors associated with cessation readiness are presented in Table 7. In the multivariable logistic regression analysis, Malay smokers were more likely to be ready to quit compared with non-Malay smokers (aOR 1.85, 95% CI 1.07–3.19, p = 0.028). In addition, smokers with a history of previous quit attempts had significantly higher odds of being ready to quit (aOR 1.73, 95% CI 1.09–2.74, p = 0.019). Collinearity diagnostics indicated the absence of multicollinearity (VIF = 1.005). Model calibration was satisfactory, as demonstrated by the Hosmer–Lemeshow test (χ^2 = 0.181, p = 0.914).

4. DISCUSSION

4.1. Sociodemographic characteristics

This study examined the sociodemographic, health, and tobacco use profiles of hospitalized smokers, providing valuable insights into a vulnerable population that is often overlooked in smoking cessation services in Malaysia. The majority of hospitalized smokers were male, of whom only one female smoker was identified. This trend aligned with the findings from the NHMS (5,6), in which 43.0% of males and 1.4% of females were current smokers within their respective gender groups in 2015, decreasing slightly to 40.5% and 1.2% in 2019 (5,6). In this study, the age group of 50–59 years demonstrated the highest prevalence among hospitalized smokers (25.2%), while only 7.4% of smokers were above 70 years. This age distribution reflects the long-term health effects of chronic smoking, which increase the risk of premature death [27,28]. These findings contrasted with the NHMS results, in which the age group of 25–44 years had the highest smoking prevalence (28.3%) [5]. This discrepancy may be due to NHMS covering a broader age range among the general population, whereas hospitalized smokers tend to be older and affected by health consequences of cumulative tobacco use.

In this study, 15.4% of smokers had attained tertiary education, while more than half had completed secondary education. This notable level of educational attainment underscores the importance of tailoring smoking cessation materials to be accessible and comprehensible for individuals with varying educational backgrounds. Higher education is linked to greater success in smoking cessation, while educational disparities contribute to unequal outcomes [6,29]. In addition, most smokers in this study were married and lived with their families, highlighting the potential value of incorporating family-based behavioural approaches into smoking cessation interventions. This notion was supported by recent systematic evidence, particularly when combined with counselling and pharmacotherapy, which can significantly increase cessation rates among low-income households [30].

Among hospitalized smokers in this study, 23.4% were unemployed and might have relied on others for their tobacco supply and daily living needs. This socioeconomic vulnerability suggests that cessation strategies should incorporate financial assistance and psychosocial support, including subsidized pharmacotherapy and transportation to healthcare facilities. It was further supported by research showing that unemployment is associated with higher smoking prevalence and lower quit rates, highlighting the importance of workplace supports [31]. Nearly half of the smokers in this study were employed in either the government or private sector, indicating a need to strengthen workplace-based smoking cessation programmes. Meta-analysis showed that workplace interventions combining behavioural counselling, digital tools, and financial incentives have demonstrated significant short-term impacts on smoking cessation [32].

4.2. Health profile

In the present study, the majority of smokers exhibited normal scores on the DASS-21 assessment. However, a small proportion were classified as experiencing severe to very severe levels of depression, anxiety, and stress. These findings warrant further investigation. Evidence suggests that individuals with psychiatric disorders are more likely to engage in smoking [33]. These smokers tend to have higher levels of nicotine dependence, which makes quitting more difficult. These individuals also experience more intense withdrawal symptoms, contributing to lower success rates in smoking cessation efforts [33]. Previous studies have also identified several barriers to smoking cessation. These include the high prevalence of smoking within social networks, lack of social support, limited motivation, and restricted access to healthcare services [33,34]. In contrast, pharmacotherapy has demonstrated significantly improved outcomes in smoking cessation, particularly when combined with behavioural therapy [35,36]. These findings underscore the importance of evaluating the mental health of hospitalized patients and integrating behavioural therapies with appropriate mental health support for those in need.

It is concerning that 63.8% of hospitalized smokers in this study were classified as either overweight or obese. This trend is consistent with findings from the NHMS, which reported that more than 60% of smokers in Malaysia fall into these categories [6]. These observations challenge the conventional belief that smoking contributes to lower body weight through mechanisms such as increased metabolic rate, estimated between 3.3% and 10%, and nicotine-induced appetite suppression [37,38]. However, emerging evidence suggests that smoking may lead to visceral fat accumulation, insulin resistance, and an increased risk of metabolic diseases [37]. In addition, the coexistence of smoking

and obesity has been shown to worsen cardiovascular risk factors, including reduced levels of HDL-cholesterol and elevated concentrations of C-reactive protein [39]. This dual burden of smoking and obesity presents a significant public health concern and underscores the need for integrated policies that target smoking cessation alongside weight management. Incorporating lifestyle modifications, healthy dietary practices, and regular physical activity may enhance the overall effectiveness of these interventions. In addition, providing targeted support to address weight gain following smoking cessation may further improve their impact.

In this study, cardiology, pulmonary, and infectious diseases were among the most common reasons for hospital admission among smokers. These findings are consistent with both global and local public health data [40,41]. The U. S. Centers for Disease Control and Prevention has reported that smoking and exposure to second-hand smoke contribute to approximately one-third of deaths from coronary heart disease, lung cancer, and chronic obstructive pulmonary disease [40]. Similarly, Malaysian public health data from 2021 identified smoking as a leading cause of mortality, particularly due to cardiovascular disease and lung cancer [41]. A retrospective cohort study further confirmed a significant association between smoking and all-cause mortality in the Malaysian adult population [27]. Smokers are also at increased risk of contracting tuberculosis [42] and COVID-19, with evidence indicating that smoking negatively affects treatment outcomes for these conditions [43,44].

Notably, 33.8% of smokers in this study reported no known prior medical illness. Although these individuals may not have been formally diagnosed or have exhibited overt symptoms, this does not rule out the presence of underlying pathology. Subclinical or unrecognized health conditions associated with chronic smoking may still have been present. Routine health screenings are essential for the early detection of such conditions and can play a pivotal role in reinforcing the importance of smoking cessation [45]. Policymakers should address misconceptions about the perceived safety of smoking in the absence of apparent illness through targeted public health campaigns, alongside comprehensive health assessments and preventive health education. Evidence-based strategies, including mass media interventions and community education, have proven effective in correcting such misconceptions and promoting cessation efforts [46]. These findings provide a strong foundation for understanding the extensive impact of smoking on cardiovascular, respiratory, and infectious diseases. In Malaysia, smoking-related illnesses remain among the top causes of death in Ministry of Health hospitals, accounting for more than 15% of mortality [47].

In this study, 21.7% of hospitalized smokers reported using over-the-counter (OTC) products. Among Malaysians, OTC use is mainly for minor ailments, with common products including supplements, vitamins, analgesics, and flu remedies [48]. Although data on OTC use specifically among smokers is limited, the findings from this study raise important safety concerns. Self-medication without professional guidance may lead to misuse or delayed treatment, particularly in managing smoking-related symptoms or addressing barriers to healthcare access. However, the availability of OTC products offers an opportunity to broaden the uptake of nicotine replacement therapy (NRT). This includes nicotine patches and gums, which became accessible OTC in Malaysia following recent regulatory changes by the Ministry of Health [49]. These products have been shown to effectively manage withdrawal symptoms and support smoking cessation when used appropriately [50]. This underscores the importance of a multifaceted public health approach. Improving awareness and access to cessation treatments, along with equipping healthcare providers with appropriate skills, is vital for enhancing smoking cessation outcomes. These findings support Malaysia's National Strategic Plan for the Control of Tobacco and Smoking Products 2021–2030. The plan advocates integrating smoking cessation services into hospital care to improve the reach and effectiveness of treatment [7,8].

4.3. Tobacco use characteristics

The median smoking initiation age in this study was 16 years, with a median smoking duration of 33 years. This aligns with GATS 2023, which reported a median initiation age of 18 and noted that nearly half of smokers started before 18 years [2]. This underscores the critical need for early and sustained tobacco education and prevention programmes targeting both adolescents and adults. Regarding nicotine dependence, the median FTND score among hospitalized smokers in this study was 3, indicating low nicotine dependence in the majority of patients. Specifically, 54.5% of smokers fell into the low dependence category. This aligns with findings from an outpatient smoking cessation clinic, where 73.9% of smokers were classified as having low to moderate nicotine addiction [12]. While the FTND is a valuable measure of nicotine dependence, it does not independently predict cessation success. Effective smoking cessation typically requires a combination of pharmacotherapy and behavioural interventions, especially among smokers with higher FTND scores [51,52]. A thorough understanding of an individual's level of nicotine dependence is essential for tailoring appropriate and effective cessation strategies.

In this study, most patients had attempted to quit smoking within the past year, mainly through abrupt cessation. Many were ready to quit within the same month, likely due to immediate health concerns. Evidence shows that interventions during hospitalization are more effective than those at later stages [53]. However, in Malaysia, inpatient cessation counselling is often unstructured, with patients typically referred to external services like clinics or quitlines [7] and left to seek help independently. The availability of pharmacotherapy during hospitalization remains unclear. In this study, only 8.3% of patients used cessation pharmacotherapy during their most recent quit attempt, underscoring substantial gaps in awareness, access, and support. These findings reinforce the need to enhance the availability of cessation pharmacotherapies such as NRT within hospital settings, particularly for low-income populations, as emphasized in the National Strategic Plan for the Control of Tobacco and Smoking Products 2021–2030 [7]. No pharmacotherapy was initiated in the ward due to limited resources, including staff shortages and NRT supply issues. For post-myocardial infarction patients, NRT should be used with caution or deferred

during the immediate 1–2-week post-event period, in line with contemporary cardiology guidance [54]. Therefore, behavioural approaches were prioritised in this study.

A low median daily smoking expenditure was reported (RM 6.09, IQR: 3–10) among hospitalized smokers in this study, which might partly be attributable to the high prevalence of illicit cigarette use among them. 53.9% of patients reported to consume illicit cigarettes, which were generally cheaper. This aligns with national data showing illicit cigarettes account for 38.2%–52.5% of the market share in Malaysia [55]. The affordability and easy access to unregulated tobacco products hinder cessation efforts, especially when compared to the higher cost of legal cigarettes due to taxation. This affordability may also contribute to increased youth smoking, a concerning public health issue.

4.4. Association factors for illicit cigarette use

While previous research has focused primarily on predictors of general tobacco use [2–6], studies specifically examining the determinants of illicit cigarette consumption remain limited. The present study found that lower education levels, Malay ethnicity, and younger age were all significantly associated with illicit cigarette use. Smokers with lower educational attainment may have reduced exposure to health campaigns, resulting in lower health awareness and literacy [2–6,29]. This may increase their vulnerability to cheaper, unregulated, and potentially adulterated illicit cigarette products [26,55]. Differences in residential settings may also contribute to varying levels of access to illicit products, particularly in rural areas where regulatory enforcement tends to be weaker [26,55]. Younger smokers are additionally more likely to consume illicit cigarettes, potentially due to economic constraints, limited health awareness, and peer influence [2,5,6,16]. Future research should incorporate measures of income and geographical location to provide a more comprehensive understanding of how affordability and place-based factors influence illicit cigarette use.

The present study underscores the need for policy interventions within the education sector to mandate smoking prevention and cessation education in schools. This should include lessons on the risks associated with illicit tobacco, such as unknown additives, inconsistent nicotine levels, and potential contaminants. In addition, the findings call for stronger collaboration between public health and regulatory sectors to enhance enforcement against illicit cigarette trade, as outlined in Strategy 2.3 of the National Strategic Plan for the Control of Tobacco and Smoking Products 2021–2030 [7]. Providing incentives for evidence-based cessation pharmacotherapy may also encourage smokers to transition away from cheaper, harmful alternatives.

4.5. Association factor for cessation readiness

Cessation readiness reflects smokers' motivation to quit and is shaped by sociodemographic, psychological, and environmental factors. However, high readiness alone does not ensure sustained abstinence, which typically requires integrated behavioural and pharmacological support [51,52]. Hospitalization due to acute illness may further increase motivation to quit [9]. Hospitalization often heightens patients' awareness of their health risks, which enhances their motivation to quit smoking. The acute nature of illness and enforced abstinence during hospital stay can prompt smokers to re-evaluate their smoking habits and increase their readiness to attempt cessation [10].

The higher cessation readiness observed among Malay smokers is consistent with findings by Hasan *et al*. [56] who reported greater quit likelihood among Malays compared with other ethnic groups. Cultural and religious influences, including increased self-discipline during Ramadan, may strengthen motivation to quit [57]. These factors, combined with perceived vulnerability during illness [9,10], likely enhance cessation readiness. Nonetheless, the lower readiness observed among non-Malay groups warrants further investigation. Future research should examine cultural differences in health beliefs to inform more culturally and religiously sensitive cessation interventions.

The multivariable logistic regression analysis in this study showed that previous quit attempts were significantly associated with higher readiness to quit again. This finding is consistent with Hyland *et al.* [58] who reported that smokers with prior cessation experiences are generally more prepared for subsequent quit attempts. Previous attempts may enhance smokers' insight into cessation strategies and strengthen their self-efficacy, in addition to increasing their exposure to health campaigns and support services. However, experiences of failure, relapse, or withdrawal symptoms can also diminish motivation and reduce readiness to try again [58]. Interventions should therefore acknowledge both the positive and negative aspects of past quit attempts to better support smokers in future cessation efforts.

4.6. Strengths and limitations of the study

This study's strength lies in its focus on hospitalized smokers, a population often overlooked yet offering a critical window for cessation interventions. Universal sampling across medical and cardiology wards enhanced representativeness, while the use of validated tools (DASS-21 and FTND) and the application of TTM framework ensured reliable assessments. The large sample size (n = 488) adds robustness, providing meaningful insights into smoking behaviour and cessation readiness. Importantly, the study highlights strong motivation to quit smoking among hospitalized smokers, low access of pharmacotherapy, and offers valuable evidence to guide hospital-based cessation strategies in Malaysia.

This study was conducted in a single tertiary hospital in Pahang, located on the east coast of Malaysia, in cardiology and medical wards and among medically and psychologically stable patients, which may limit the generalizability of findings due to potential differences in sociodemographic, health-seeking behaviour, and smoking behaviours in other states, wards, and medical status. Besides, the findings may not capture the full spectrum of cigarette-use patterns, particularly among patients admitted to orthopaedic, surgical, or emergency wards. The exclusion of medically or psychologically unstable individuals may have resulted in the omission of heavier smokers or those

with greater psychological morbidity, potentially introducing selection bias and limiting generalisability.

Data on smoking history, quit attempts, DASS scores, and nicotine dependence may be subject to recall bias, particularly as patients were unwell during data collection. In addition, social stigma surrounding smoking, especially among women, may have led to underreporting, as smokers often conceal their habits. This stigma can also negatively impact motivation to quit and willingness to seek help.

5. CONCLUSION

This study highlights the significant burden of smoking among hospitalized patients in Malaysia, particularly those with obesity and high use of illicit cigarettes. Missing the opportunity to intervene in this group, despite their low nicotine dependence and high cessation readiness, represents a significant gap in cessation support. The limited accessibility of pharmacotherapy remains an area needing attention. Addressing these challenges through targeted interventions and improved access to cessation support could strengthen national efforts to reduce smoking-related morbidity and mortality. Understanding association factors for cessation readiness guides the efficiency of resource allocation to these vulnerable populations.

6. ACKNOWLEDGMENTS

The authors would like to thank the Director General of Health for permission to publish this paper.

7. AUTHOR CONTRIBUTIONS

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be author as per the International Committee of Medical Journal Editors (ICMJE) requirements/guidelines..

8. FINANCIAL SUPPORT

There is no funding to report.

9. CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

10. ETHICAL APPROVAL

Ethical approval details are given in the 'Materials and Methods' section.

11. DATA AVAILABILITY

All data generated and analysed are included in this research article.

12. PUBLISHER'S NOTE

All claims expressed in this article are solely those of the authors and do not necessarily represent those of the publisher, the editors and the reviewers. This journal remains neutral with regard to jurisdictional claims in published institutional affiliation.

13. USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that they have not used artificial intelligence (AI)-tools for writing and editing of the manuscript, and no images were manipulated using AI.

REFERENCES

1. Ministry of Health Malaysia. 2022 Annual Report [Internet]. Putrajaya, Malaysia: Ministry of Health Malaysia; 2023 [cited 2025 May 1]. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/Penerbitan%20Utama/2._MOH_Annual_Report_2022-compressed_.pdf
2. Institute for Public Health, National Institutes of Health. Global Adult Tobacco Survey (GATS), Malaysia 2023 [Internet]. Shah Alam, Malaysia: National Institutes of Health; 2024 [cited 2025 May 1]. Available from: https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/data-reporting/malaysia/mys-gats2023-factsheet.pdf
3 Institute for Public Health, National Institutes of Health. National health and morbidity survey (NHMS) 2023: non-communicable diseases and healthcare demand – key findings [Internet]. Shah Alam, Malaysia: National Institutes of Health; 2024 [cited 2025 May 1]. Available from: https://iku.nih.gov.my/images/nhms2023/key-findings-nhms-2023.pdf
4. Institute for Public Health, National Institutes of Health. Report of the global adult tobacco survey (GATS) Malaysia 2011 [Internet]. Kuala Lumpur, Malaysia: National Institutes of Health; 2012 [cited 2025 May 2]. Available from: https://iku.moh.gov.my/images/teknikal-report/gats-2011.pdf
5. Institute for Public Health, National Institutes of Health. Health and morbidity survey 2015: report on smoking status among Malaysian adults [Internet]. Kuala Lumpur, Malaysia: National Institutes of Health; 2015 [cited 2025 May 1]. Available from: https://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2015-VolumeV.pdf
6. National Institutes of Health, Ministry of Health Malaysia. National Health and Morbidity Survey (NHMS) 2019: Volume I: NCDs – non-communicable diseases, risk factors and other health problems [Internet]. Shah Alam, Malaysia: National Institutes of Health; 2020 [cited 2025 Aug 23]. Available from: https://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2019/Report_NHMS2019-NCD_v2.pdf
7. Ministry of Health Malaysia. National strategic plan for the control of tobacco and smoking products 2021–2030 [Internet]. Putrajaya, Malaysia: Ministry of Health Malaysia; 2021 [cited 2025 May 23]. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/Rujukan/NCD/National%20Strategic%20Plan/NCDTembakau20212030.pdf
8. Epton L, Patman S, Coventry T, Bulsara C, Ward K. Hospitalised smokers' and staff perspectives of inpatient smoking cessation interventions and impact on smokers' quality of life: an integrative review of the qualitative literature. J Smok Cessat. 2023;2023:8. doi: https://doi.org/10.1155/2023/6544215
9. McBride CM, Emmons KM, Lipkus IM. Understanding the potential of teachable moments: the case of smoking cessation. Health Educ Res. 2003;18(2), 156–70. doi: https://doi.org/10.1093/her/18.2.156
10. Lawson PJ, Flocke SA. Teachable moments for health behavior change: a concept analysis. Patient Educ Couns. 2009;76(1):25–30. doi: https://doi.org/10.1016/j.pec.2008.11.002
11. Blebil AQ, Sulaiman SAS, Hassali MA, Dujaili JA, Zin AM. Impact of additional counselling sessions through phone calls on smoking cessation outcomes among smokers in Penang State, Malaysia. BMC

Public Health. 2014;16;14:460. doi: https://doi.org/10.1186/1471-2458-14-460
12. Fai SC, Yen GK, Malik N. Quit rates at 6 months in a pharmacist-led smoking cessation service in Malaysia. Can Pharm J (Ott). 2016;149(5):303–12. doi: https://doi.org/10.1177/1715163516662894
13. World Health Organization. World health statistics 2023: monitoring health for the SDGs, sustainable development goals [internet]. Geneva, Switzerland: World Health Organization; 2023 [cited 2025 Aug 25]. Available from: https://www.who.int/publications/i/item/9789240074323
14. See JJH, See KC. Impact of admission diagnosis on the smoking cessation rate: a brief report from a multi-centre inpatient smoking cessation programme in Singapore. J Prev Med Public Health. 2020;53(5):381–6. doi: https://doi.org/10.3961/jpmph.20.134
15. Martínez C, Fu M, Castellano Y, Riccobene A, Fernández P, Cabrera S, *et al.* Smoking among hospitalized patients: a multi-hospital cross-sectional study of a widely neglected problem. Tob Induc Dis. 2018;16:34. doi: https://doi.org/10.18332/tid/92927
16. Institute for Public Health, National Institutes of Health. Global adult tobacco survey (GATS) Malaysia 2023 - key findings [internet]. Shah Alam, Malaysia: National Institutes of Health; 2024 [cited 2025 Aug 25]. Available from: https://iku.nih.gov.my/images/gats2023/gats-key-findings-booklet1.pdf
17. Musa R, Ramli R, Abdullah K, Sarkarsi R. Concurrent validity of the depression and anxiety components in the Bahasa Malaysia version of the Depression Anxiety and Stress scales (DASS). ASEAN J Psychiatr. 2011;12(1):66–70.
18. Fagerström K, Russ C, Yu CR, Yunis C, Foulds J. The Fagerström test for nicotine dependence as a predictor of smoking abstinence: a pooled analysis of varenicline clinical trial data. Nicotine Tob Res. 2012;14(12):1467 -73. doi: https://doi.org/10.1093/ntr/nts018
19. Yee HAA, Ng CG, Rusdi AR. Validation of the Malay version of Fagerstrom test for nicotine dependence (FTND-M) among a group of male staffs in a university hospital. Malays J Psychiatry. 2011;20(1):30–6.
20. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. Am J Health Promot. 1997;12(1):38–48. doi: https://doi.org/10.4278/0890-1171-12.1.38
21. Musa R, Fadzil A, Zain Z. Translation, validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS). ASEAN J Psychiatr. 2007;8(2):82–9.
22. Hitsman B, Papandonatos GD, Mcchargue DE, Demott A, Herrera MJ, Spring B, *et al.* Past major depression and smoking cessation outcome: a systematic review and meta-analysis update. Addiction. 2013;108(2):294–306. doi: https://doi.org/10.1111/add.12009
23. Lim KH, Yun YX, Cheong YL, Sulaiman N, Mahadzir ME, Lim JH, *et al.* Construct validity and reliability of the Malay version of the Fagerström test for nicotine dependence (FTND): a confirmatory factor analysis. Tob Induc Dis. 2023;21:36. doi: https://doi.org/10.18332/tid/159624
24. Ikonomidis I, Thymis J, Kourea K, Kostelli G, Neocleous A, Katogiannis K, *et al.* Fagerstrom score predicts smoking status six months after hospitalization for acute myocardial infarction: a prospective study. Hellenic J Cardiol. 2022;67:28–35. doi: https://doi.org/10.1016/j.hjc.2022.05.007
25. Ministry of Health Malaysia, Malaysia Endocrine & Metabolic Society. Clinical practice guidelines: management of obesity. 2nd ed. Putrajaya, Malaysia: Ministry of Health Malaysia; 2023.
26. Ministry of Health Malaysia. Control of smoking products for Public Health Act 2024. Putrajaya, Malaysia: Ministry of Health Malaysia; 2024.
27. Thomson B, Emberson J, Lacey B, Peto R, Woodward M, Lewington S. Childhood smoking, adult cessation, and cardiovascular mortality: prospective study of 390 000 US adults. J Am Heart Assoc. 2020;9(21):e018431. doi: https://doi.org/10.1161/JAHA.120.018431
28. Lim KH, Cheong YL, Lim HL, Kee CC, Mohd Ghazali S, Pradmahan Singh BSG, *et al.* Assessment of association between smoking and all-cause mortality among Malaysian adult population: findings from a retrospective cohort study. Tob Induc Dis. 2022;20:50. doi: https://doi.org/10.18332/tid/147656
29. Hiscock R, Bauld L, Amos A, Fidler JA, Munafò M. Socioeconomic status and smoking: a review. Ann N Y Acad Sci. 2012;1248:107–23. doi: https://doi.org/10.1111/j.1749 6632.2011.06202.x
30. Li MY, Luk TT, Cheung YT, Lam TH, Chan SS. Effectiveness of family-based behavioral intervention for smoking cessation in low-income households: a systematic review and meta-analysis. EClinicalMedicine. 2025;87:103420. doi: https://doi.org/10.1016/j.eclinm.2025.103420
31. Ayaz D, Asi E, Meydanlioglu A, Oncel S. Effectiveness of smoking cessation interventions in the workplace: a systematic review and meta-analysis. Am J Ind Med. 2024; 67(8), 712–22. doi: https://doi.org/10.1002/ajim.23627
32. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Smoke-free series: workplace cessation interventions. Toronto, Canada: Queen's Printer for Ontario; 2020 [cited 2025 Aug 27]. Available from: https://www.publichealthontario.ca/-/media/documents/s/2020/synthesis-smoke-free-series-workplace-cessation.pdf?la=en
33. Olando Y, Kuria M, Mathai M, Huffman MD. Barriers and facilitators to cessation among tobacco users with concomitant mental illness attending group behavioral tobacco cessation: a qualitative study. Tob Prev Cessat. 2020;6:46. doi: https://doi.org/10.18332/tpc/125354
34. Kerr S, Woods C, Knussen C, Watson H, Hunter R. Breaking the habit: a qualitative exploration of barriers and facilitators to smoking cessation in people with enduring mental health problems. BMC Public Health. 2013;13:221. doi: https://doi.org/10.1016/j.eclinm.2025.103420
35. Roberts E, Eden Evins A, Mcneill A, Robson D. Efficacy and tolerability of pharmacotherapy for smoking cessation in adults with serious mental illness: a systematic review and network meta-analysis. Addiction. 2016;111(4):599–612. doi: https://doi.org/10.1111/add.13236
36. Loreto AR, Carvalho CFC, Frallonardo FP, Ismael F, Andrade AG, Castaldelli-Maia JM. Smoking cessation treatment for patients with mental disorders using CBT and combined pharmacotherapy. J Dual Diagn. 2017;13(4):238–46. doi: https://doi.org/10.1080/15504263.2017.1328149
37. Chiolero A, Faeh D, Paccaud F, Cornuz J. Consequences of smoking for body weight, body fat distribution, and insulin resistance. Am J Clin Nutr. 2008;87(4):801–9. doi: https://doi.org/10.1093/ajcn/87.4.801
38. Hofstetter A, Schutz Y, Jéquier E, Wahren J. Increased 24-hour energy expenditure in cigarette smokers. N Engl J Med. 1986;314(2):79–82. doi: https://doi.org/10.1056/NEJM198601093140204
39. Akbartabartoori M, Lean MEJ, Hankey CR. Smoking combined with overweight or obesity markedly elevates cardiovascular risk factors. Eur J Cardiovasc Prev Rehabil. 2006;13(6):938–46. doi: https://doi.org/10.1097/01.hjr.0000214613.29608.f5
40. US Centers for Disease Control and Prevention. Health problems caused by secondhand smoke [Internet]. Atlanta, GA: US Centers for Disease Control and Prevention; 2025 [cited 2025 May 5]. Available from: https://www.cdc.gov/tobacco/secondhand-smoke/health.html
41. Global Action to End Smoking. State of smoking and health in Malaysia [Internet]. New York, NY: Global Action to End Smoking; 2024 [cited 2025 Aug 27]. Available from: https://globalactiontoendsmoking.org/research/tobacco-around-the-world/malaysia/
42. Lin HH, Ezzati M, Chang HY, Murray M. Association between tobacco smoking and active tuberculosis in Taiwan: prospective cohort study. Am J Respir Crit Care Med. 2009;180(5):475–80. doi: https://doi.org/10.1164/rccm.200904-0549OC

43. Umnuaypornlert A, Kanchanasurakit S, Lucero-Prisno DE, Saokaew S. Smoking and risk of negative outcomes among COVID-19 patients: a systematic review and meta-analysis. Tob Induc Dis. 2021;19:09. doi: https://doi.org/10.18332/tid/132411
44. Khan AH, Sulaiman SAS, Hassali MA, Khan KU, Ming LC, Mateen O, *et al.* Effect of smoking on treatment outcome among tuberculosis patients in Malaysia; a multicenter study. BMC Public Health. 2020;20(1):854. doi: https://doi.org/10.1186/s12889-020-08856-6
45. Vander Weg MW, Howren MB, Cai X. Use of routine clinical preventive services among daily smokers, non-daily smokers, former smokers, and never-smokers. Nicotine Tob Res. 2012;14(2):123–30. doi: https://doi.org/10.1093/ntr/ntr141
46. US Centers for Disease Control and Prevention. Public health strategies for tobacco prevention and control [internet]. Atlanta, GA: US Centers for Disease Control and Prevention; 2024 [cited 2025 Aug 22]. Available from: https://www.cdc.gov/reach/php/strategies/tobacco-prevention-control.html
47. Malaysian Health Technology Assessment Section. Quit smoking intervention [internet]. Putrajaya, Malaysia: Medical Development Division, Ministry of Health Malaysia; 2017. [cited 2025 Aug 27]. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/MAHTAS/HTA/QUIT_SMOKING-compressed.pdf
48. Azhar MIM, Gunasekaran K, Kadirvelu A, Gurtu S, Sadasivan S, Kshatriya BM. Self-medication: awareness and attitude among Malaysian urban population. Int J Collab Res Intern Med Public Health. 2013;5(6):436–43.
49. Leong A. Nicotine patches and gum can now be sold over-the-counter in Malaysia. The Rakyat Post. 2022 [cited 2025 Aug 27]. Available from: https://www.therakyatpost.com/news/2022/10/07/nicotine-patches-and-gum-can-now-be-sold-over-the-counter-in-malaysia/
50. US Centers for Disease Control and Prevention. Patient care settings: clinical interventions for tobacco use [Internet]. Atlanta, GA: US Centers for Disease Control and Prevention; [cited 2025 Aug 27]. Available from: https://www.cdc.gov/tobacco/hcp/patient-care-settings/clinical.html
51. World Health Organization. WHO clinical treatment guideline for tobacco cessation in adults. Geneva, Switzerland: World Health Organization; 2024 [cited 2025 Aug 27]. Available from: https://www.who.int/publications/i/item/9789240096431
52. World Health Organization. Toolkit for delivering the 5A's and 5R's brief tobacco interventions in primary care. Geneva, Switzerland: World Health Organization; 2014 [cited 2025 Aug 27]. Available from: https://iris.who.int/bitstream/handle/10665/112835/9789241506953_eng.pdf
53. Rigotti NA, Chang Y, Davis EM, Regan S, Levy DE, Ylioja T, *et al.* Comparative effectiveness of postdischarge smoking cessation interventions for hospital patients: the Helping HAND 4 randomized clinical trial. JAMA Intern Med. 2022;182(8):814–24. doi: https://doi.org/10.1001/jamainternmed.2022.2300
54. Ministry of Health Malaysia. Clinical practice guidelines on treatment of tobacco use disorder. Putrajaya, Malaysia: Ministry of Health Malaysia; 2016 [cited 2025 Aug 27]. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/CPG/Respiratory/CPG_TobacoDisorder.pdf
55. Bui WKT, Ross H, Mohamed Nor N. Magnitude of illicit cigarette trade in Malaysia: empirical evidence compared with industry studies. Tob Control. 2024;33(3):341–5. doi: https://doi.org/10.1136/tc-2021-057210
56. Hasan SI, Kaai SC, Amer Nordin AS, Mohd Hairi F, Danaee M, Yee A, *et al.* Who are more likely to have quit intentions among Malaysian adult smokers? Findings from the 2020 ITC Malaysia Survey. Int J Environ Res Public Health. 2022;19(5):3035. doi: https://doi.org/10.3390/ijerph19053035
57. Yong HH, Hamann SL, Borland R, Fong GT, Omar M. Adult smokers' perception of the role of religion and religious leadership on smoking and association with quitting: a comparison between Thai Buddhists and Malaysian Muslims. Soc Sci Med. 2009;69(7):1025–31. doi: https://doi.org/10.1016/j.socscimed.2009.07.042
58. Hyland A, Borland R, Li Q, Yong HH, Mcneill A, Fong GT, *et al.* Individual level predictors of cessation behaviours among participants in the International Tobacco Control (ITC) Four Country Survey. Tob Control. 2006;15(Suppl 3): iii83–iii94. doi: https://doi.org/10.1136/tc.2005.013516

How to cite this article:
Toh KY, Chong CP, Hanafiah NHM, Mohamed MHN. Profiling hospitalized smokers in Malaysia: Insights into health, tobacco use, and cessation readiness. J Appl Pharm Sci. 2026;16(04):369-381. DOI: 10.7324/JAPS.2026.290131