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# Smoking behaviours of Hong Kong Chinese hospitalised patients and predictors of smoking abstinence after discharge: a cross-sectional study

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## ABSTRACT

**Objectives** Patients admitted to hospitals represent an excellent teachable moment for smoking cessation, as they are required to abstain from tobacco use during hospitalisation. Nevertheless, smoking behaviours of hospitalised patients, and factors that lead to smoking abstinence thereafter, remain relatively underexplored, particularly in a Hong Kong Chinese context. This study aimed to examine the smoking behaviours of hospitalised patients and explore factors leading to their abstaining from cigarette use after being hospitalised.

**Design** A cross-sectional design was employed.

**Setting** This study was conducted in three outpatient clinics in different regions in Hong Kong.

**Participants** A total of 382 recruited Chinese patients.

**Primary and secondary outcome measures** The patients were asked to complete a structured questionnaire that assessed their smoking behaviours before, during and after hospitalisation.

**Results** The results indicated 23.6% of smokers smoked secretly during their hospital stay, and about 76.1% of smokers resumed smoking after discharge. Multivariate logistic regression analysis found that number of days of hospitalisation admission in the preceding year (OR 1.02; 95% CI 1.01 to 1.27; p=0.036), patients' perceived correlation between smoking and their illness (OR 1.08; 95% CI 1.01 to 1.17; p=0.032), withdrawal symptoms experienced during hospitalisation (OR 0.75; 95% CI 0.58 to 0.97; p=0.027) and smoking cessation support from healthcare professionals (OR 1.18; 95% CI 1.07 to 1.36; p=0.014) were significant predictors of smoking abstinence after discharge.

**Conclusions** The results of this study will aid development of appropriate and innovative smoking cessation interventions that can help patients achieve more successful smoking abstinence and less relapse.

**Trial registration number** NCT02866760.

## Strengths and limitations of this study

- This is the first study to investigate the smoking behaviours of hospitalised patients in a Chinese context.
- This is the first study to identify contributing factors that lead to smoking abstinence after patients are discharged.
- Biochemical validation was not conducted to verify self-reported abstinence; therefore, results could be biased by social desirability.
- Participants were asked to provide details on their smoking behaviour during their hospital stay and after discharge, which may have resulted in recall bias.

## INTRODUCTION

Cigarette smoking, responsible for around 7 million deaths annually worldwide, is the single greatest preventable cause of death.[1] It harms nearly every organ in the body and is associated with numerous diseases, including stroke, diabetes, cancer, coronary heart disease and respiratory disease,[2] all of which contribute to substantial amounts of hospitalisation and healthcare expenditure, posing a serious challenge to medical systems.[3] Although the prevalence of daily cigarette smoking in Hong Kong has decreased from 23.3% in 1982 to 10.5% in 2015, 641 300 everyday smokers remain,[4] and 400 000 hospitalisations per year are attributable to smoking.[5] Such compelling numbers cannot be overlooked or neglected.

Hospitalisation represents an excellent teachable moment for smoking cessation.[6] This is because being hospitalised with a smoking-related disease may impel change in smokers' perceptions of their personal vulnerability, which in turn can greatly enhance their motivation to quit.[7] Furthermore, hospitalised smokers may have more available time to receive intensive smoking cessation interventions, which can remarkably increase their chances of successful abstinence after discharge.[8] Additionally, a smoke-free policy

has been implemented in all public hospitals in Hong Kong since 2007. Violating the policy results in a fixed fine of HK$1500 (~US$192).[9] Implementation of such a policy may promote smoking cessation, as it prompts smokers, on hospital admission, to undergo an abrupt stop from their habitual use of tobacco. It also creates a smoke-free environment that temporarily facilitates abstinence by separating hospitalised smokers from smoking cues.[10]

Given that habitual smoking in patients who have diseases can reduce the efficacy of clinical and medical treatments, and increase the risk of treatment-related side effects,[11] and that smoking abstinence is enforced during hospitalisation, it is of paramount importance for healthcare professionals to seize this golden opportunity to promote cessation and help patients quit. The clinical guidelines for treating tobacco use and nicotine dependence also emphasise the importance of targeting smoking cessation interventions at hospitalised smokers.[12] Nevertheless, cigarette smoking is addictive, quitting is extremely difficult and the rate of relapse is high, especially among patients with diseases.[13] It is therefore crucial that healthcare professionals first understand how hospitalised smokers perceive the risks of smoking, and their behaviour towards smoking, before any effective, appropriate smoking cessation intervention can be planned, developed and evaluated.

Numerous studies in the West have investigated smoking behaviours of hospitalised patients.[10 14 15] In a secondary analysis of data from a randomised control trial on 650 adult smokers admitted to an urban teaching hospital, 4% self-reported violating policy by smoking indoors.[10] Another cross-sectional study of 229 hospitalised smokers found 60%–70% complied with the smoke-free policy.[14] A study of 79 hospitalised smokers revealed about 75% intended to quit after discharge.[15] However, the majority perceived their symptoms associated with nicotine cravings would be a primary barrier towards maintaining abstinence.[15] Indeed, a study revealed smokers with nicotine cravings were more likely to smoke while hospitalised than those who did not report cravings.[10] Additionally, withdrawal symptoms and patients' perceived correlation between smoking and their illness were found to be factors significantly associated with compliance with the smoke-free policy during hospitalisation.[14]

There is scarce evidence on key factors that lead to post-hospitalisation smoking abstinence. While some studies have examined smoking behaviours of hospitalised patients, they primarily focused on understanding patients' compliance with smoke-free policies.[14 15] One study explored predictors of continued abstinence after discharge, though it was a secondary analysis of data from a randomised controlled trial in which hospitalised smokers had already received some degree of intensive counselling on smoking cessation; that might confound the results, especially those regarding smoking behaviours after discharge.[10] The present study aimed to address the gap in existing literature by examining the smoking behaviours of hospitalised patients in hospitals with smoke-free policies. It also sought to identify factors leading to smoking abstinence after discharge.

## METHODS

### Study design

A cross-sectional study was conducted in outpatient clinics of three acute hospitals in different regions in Hong Kong. All participating hospitals had been awarded full accreditation status by the Australian Council on Healthcare Standards.[16] These three hospitals were chosen because they are the largest acute regional hospitals and patients were normally referred back for medical follow-up in the outpatient clinics after discharge.

### Participants

Patients were eligible for this study, if they were (1) aged ≥18 years, (2) able to speak Cantonese, (3) current smokers who resumed smoking or ex-smokers who had quit smoking after hospitalisation, and (4) hospitalised in either a medical or surgical unit for ≥48 hours in the previous 3 months. 'Ex-smokers' in this study referred to patients who reported not having smoked in the preceding 7 days. We excluded patients with mental illnesses or cognitive and learning problems noted in their medical records because previous studies suggest such people possess smoking characteristics different from those of smokers in general.[17] Including them in the study might therefore bias the results, impeding generalisability to all hospitalised smokers.

The sample size was calculated based on the results of previous literature that indicated 46%–56.8% of smokers were willing to quit during hospitalisation.[2 18] We assumed a similar proportion of our participants were willing and adopted a 95% confidence level. The sample size could be obtained using the following formula:

$$N = [Z^2 \times p\ (1 - p)]/e^2$$

where Z represents the number of SD from the mean, which is 1.96; p refers to the expected proportion, which is 0.46 in this case; and e is the margin of error, which is 0.05. The sample size required for the study was therefore 382.

### Measure

#### Smoking behaviours

An expert panel developed a structured questionnaire to explore smoking behaviours during and after hospitalisation. The panel included a chair professor, associate professor, assistant professor and research assistant professor from a local university, all of whom had extensive knowledge on smoking cessation. The questionnaire collected data on experience of withdrawal symptoms and nicotine cravings during and after hospitalisation. Withdrawal symptoms were assessed using the Minnesota Nicotine Withdrawal Scale (MNWS). This scale includes 15 items evaluated on a 5-point Likert scale (0, not present; 1, slight; 2, mild; 3, moderate; 4, severe). The possible

range of scores was 0–60, with higher scores indicating more severe withdrawal symptoms.[19] Intensity of physical addiction to nicotine was assessed using the Fagerström Test for Nicotine Dependence (FTND). This test contains six items, with scores of 0–3, 4–5 and 6–10, representing mild, moderate and high levels of nicotine dependence, respectively.[20] The questionnaire also covered four other main areas: (1) whether participants received smoking cessation advice from healthcare professionals during hospitalisation; (2) smoking and quitting behaviours before, during and after hospitalisation; (3) intention to quit; (4) risk perception towards smoking by a binary scale (ie, yes or no). All questions in the questionnaire were written in Chinese.

### Sociodemographic and clinical characteristics

A sociodemographic sheet was administered to collect participants' background information, including their age, sex, educational attainment and marital status. A research assistant also accessed the participants' medical records and extracted number of admissions in the previous year, diagnosis of the most recent admission, comorbidities and length of stay of the most recent admission.

## Data collection

Data were collected from March to August 2017. Convenience sampling was used. A research assistant approached patients who had a medical follow-up in the outpatient clinics, and clearly explained the study in detail. The patients were told their participation was completely voluntary, and refusal to join or answer would in no way influence the care they received. Those who were eligible and willing to participate were asked to provide written consent and complete the questionnaire with a demographic sheet. The entire consent process took 10–15 min, causing only minimal disturbance to the clinical routine.

## Data analysis

Data analysis was performed using IBM SPSS Statistics for Windows, V.23.0 (IBM). Descriptive statistics were used to detail participants' sociodemographic and clinical characteristics, and their smoking profiles. Continuous variables were presented in either mean with SD or median with IQR, while categorical variables were presented in frequency and proportion. Multivariate logistic regression analysis was conducted to identify predictors of post-hospitalisation smoking abstinence, with smokers as the reference group. The selection of variables in multivariate analysis was based on a theory-driven approach. Despite there was a little understanding of smoking behaviours of hospitalised patients in the Hong Kong Chinese context, variables that were potentially associated with quitting according to previous literature were entered into the regression analyses to build the model.[10 14 15]

**Table 1** Demographic, socioeconomic and clinical characteristics of participants (n=382)

| | |
|---|---|
| **Sex, n (%)** | |
| Male | 370 (96.9) |
| Female | 12 (3.1) |
| Age, mean (SD) | 54.7 (12.7) |
| Marital status, n (%) | |
| Married | 260 (68.0) |
| Unmarried | 60 (15.7) |
| Divorced, widowed, separated | 49 (12.8) |
| Missing | 13 (3.5) |
| Highest educational attainment, n (%) | |
| Primary school or below | 99 (25.9) |
| Lower secondary school | 144 (37.7) |
| Upper secondary school | 104 (27.2) |
| Tertiary education | 26 (6.8) |
| Missing | 9 (2.4) |
| Employment status, n (%) | |
| Employed | 204 (53.4) |
| Unemployed | 62 (16.2) |
| Retired | 110 (28.8) |
| Missing | 6 (1.6) |
| Reason for hospital admission, n (%) | |
| Diabetes | 100 (26.2) |
| Hypertension | 156 (40.8) |
| Heart disease | 84 (22.0) |
| Respiratory disease | 22 (5.8) |
| Cancer | 14 (3.6) |
| Missing | 6 (1.6) |
| Length of stay in hospital (days), median (IQR) | 5.0 (2.0–10.0) |
| No of admissions in the preceding year, median (IQR) | 1.0 (1.0–2.0) |

## Patient and public involvement

Patients and public were not included in the development, design, implementation or dissemination of the research. The results would be disseminated to the participants through patient forums.

# RESULTS

A total of 13 848 patients were screened in the three outpatient clinics; of them, 468 were eligible and 382 subsequently agreed to participate in this study.

Table 1 shows the mean age of participants was 54.7 (SD 12.7) years. About 96.9% (370/382) were men, 68.0% (260/382) were married, 37.7% (144/382) had received lower secondary education and 53.4% (204/382) were employed. Concerning clinical characteristics, participants were admitted to hospitals for 1.0

Table 2 Smoking profiles of participants before and during hospitalisation (n=382)

| | |
|---|---|
| **Before hospitalisation** | |
| Daily cigarette consumption, median (IQR) | 20.0 (10.0–20.0) |
| Previous quit attempt(s), n (%) | |
| Yes | 216 (56.5) |
| No | 166 (43.5) |
| Previous reduction attempt(s), n (%) | |
| Yes | 151 (39.5) |
| No | 231 (60.5) |
| Nicotine dependency by Fagerström Test for Nicotine Dependence, n (%) | |
| Low | 165 (43.2) |
| Moderate | 102 (26.7) |
| High | 115 (30.1) |
| During hospitalisation | |
| Complied with smoke-free policy, n (%) | |
| Yes | 292 (76.4) |
| No | 90 (23.6) |
| Withdrawal symptoms by Minnesota Nicotine Withdrawal Scale, mean (SD) | 4.2 (5.4) |
| Made committed attempt(s) to reduce cigarette consumption*, n (%) | |
| Yes | 77 (85.7) |
| No | 13 (14.3) |
| Daily cigarette consumption*, mean (SD) | 1.3 (5.0) |
| Received smoking cessation support from healthcare professionals, n (%) | |
| Yes | 254 (66.5) |
| No | 128 (33.5) |

*Calculation based on participants who smoked during hospitalisation (n=90).

Table 3 Smoking profile of participants after hospitalisation (n=382)

| | |
|---|---|
| **Quit smoking** | |
| Yes | 93 (24.3) |
| No | 289 (75.7) |
| Daily cigarette consumption after hospitalisation*, mean (SD) | 10.1 (11.4) |
| Intended to quit smoking after hospitalisation*, n (%) | |
| Yes | 143 (49.5) |
| No | 146 (50.5) |

*Calculation based on participants who were smoking after discharge (n=289).

(IQR 1.0–2.0) times on average in the preceding year. For the most recent admission, 40.8% (156/382) were for hypertension (156/382), followed by 26.2% (100/382) for diabetes, 22.0% (84/382) for heart disease, 5.8% for respiratory disease and 3.6% (14/382) for cancer. The average length of period of hospitalisation was 5.0 (IQR 2.0–10.0) days.

Table 2 shows participants smoked 20.0 (IQR 10.0–20.0) cigarettes per day on average before hospitalisation. Approximately 43.5% (166/382), 26.7% (102/382) and 30.1% (115/382) had mild, moderate or high nicotine dependency, respectively, as gauged by the FTND.

Around 56.5% (216/382) and 39.5% (151/382) had previously attempted to quit or reduce smoking, respectively. Regarding smoking behaviours in hospitals, 76.4% (292/382) of the participants complied with the smoke-free policy, while 23.6% (90/382) admitted to having smoked. Of those who continued smoking during hospitalisation, 85.7% (77/90) reduced their smoking amount, with mean daily cigarette consumption of 1.3 (SD 5.0). The mean score of withdrawal symptoms as gauged by the MNWS was 4.2 (SD 5.4). Additionally, 66.5% (254/382) of the participants received smoking cessation support from healthcare professionals.

Table 3 shows the smoking behaviours of participants after hospital discharge. About 24.3% (93/382) had successfully quit smoking. Among those who did not, 49.5% (143/289) reported intention to quit; their mean daily cigarette consumption was 11.6 (SD 11.5).

### Predictors of smoking abstinence following hospitalisation

Table 4 shows the results of univariate logistic regression analysis. Married (OR 2.46; 95% CI 1.03 to 5.87; p=0.043), retired (OR 2.08; 95% CI 1.06 to 4.00; p=0.032), daily cigarette consumption before hospitalisation (OR 0.98; 95% CI 0.97 to 1.00; p=0.036), number of days of hospitalisation (OR 1.03; 95% CI 1.00 to 1.05; p=0.040), number of hospital admissions in the preceding year (OR 1.02; 95% CI 1.01 to 1.03; p=0.005), diabetes (OR 0.46; 95% CI 0.21 to 0.99; p=0.046), hypertension (OR 0.52; 95% CI 0.32 to 0.87; p=0.012), patients' perceived correlation between smoking and their illness (OR 1.11; 95% CI 1.04 to 1.18; p=0.002), withdrawal symptoms experienced during hospitalisation (OR 0.72; 95% CI 0.58 to 0.89; p=0.003) and whether patients received smoking cessation support from healthcare professional (OR 1.19; 95% CI 1.07 to 1.33; p<0.001) were shown to be statistically significantly associated with post-discharge smoking abstinence. Table 5 presents the results of that multivariate logistic regression analysis. Participants' sociodemographic and smoking characteristics—including age, sex, educational attainment, and marital and employment status—were controlled. Only number of days of hospitalisation admission in the preceding year (OR 1.02; 95% CI 1.01 to 1.27; p=0.036), patients' perceived correlation between smoking and their illness (OR 1.08; 95% CI 1.01 to 1.17; p=0.032), withdrawal symptoms experienced during hospitalisation (OR 0.75; 95% CI 0.58 to 0.97; p=0.027) and whether patients received smoking cessation support from healthcare professional during

**Table 4** Univariate logistic regression analyses on predictors of smoking abstinence after discharge (n=382)

| Unadjusted model | OR (95% CI) | P value |
|---|---|---|
| Age | 0.99 (0.96 to 1.02) | 0.596 |
| Sex | 0.28 (0.03 to 2.34) | 0.239 |
| Highest educational attainment | | |
| Primary school or below | 0.51 (0.19 to 1.38) | 0.184 |
| Lower secondary school | 0.45 (0.17 to 1.19) | 0.107 |
| Upper secondary school | 0.48 (0.18 to 1.29) | 0.147 |
| Tertiary education | Ref | |
| Marital status | | |
| Married | 2.46 (1.03 to 5.87) | 0.043* |
| Unmarried | 0.89 (0.27 to 2.91) | 0.842 |
| Divorced, widowed, separated | Ref | |
| Employment status | | |
| Employed | Ref | |
| Awaiting employment/ unemployed | 0.97 (0.48 to 1.94) | 0.920 |
| Retired | 2.08 (1.06 to 4.00) | 0.032* |
| Daily cigarette consumption before hospitalisation | 0.98 (0.97 to 1.00) | 0.036* |
| Quit attempts before hospitalisation | 0.63 (0.34 to 1.20) | 0.162 |
| Reduction attempts before hospitalisation | 0.83 (0.34 to 2.01) | 0.828 |
| No of days of hospitalisation | 1.03 (1.00 to 1.05) | 0.040* |
| No of hospital admissions in the preceding year | 1.02 (1.01 to 1.03) | 0.005* |
| Reason for hospital admission | | |
| Diabetes | 0.46 (0.21 to 0.99) | 0.046* |
| Hypertension | 0.52 (0.32 to 0.87) | 0.012* |
| Heart disease | 0.86 (0.50 to 1.49) | 0.600 |
| Respiratory disease | 0.81 (0.25 to 2.64) | 0.730 |
| Cancer | Ref | |
| Perceived correlation between smoking and illness | 1.11 (1.04 to 1.18) | 0.002* |
| Received smoking cessation support from healthcare professionals | 1.19 (1.07 to 1.33) | <0.001** |
| Withdrawal symptoms experienced during hospitalisation | 0.72 (0.58 to 0.89) | 0.003* |

*Significant at p<0.05; **significant at p<0.001.

**Table 5** Multivariate logistic regression analyses on predictors of smoking abstinence after discharge (n=382)

| Adjusted model | OR (95% CI) | P value |
|---|---|---|
| Age | 0.99 (0.97 to 1.02) | 0.701 |
| Sex | 0.30 (0.03 to 2.69) | 0.282 |
| Highest educational attainment | | |
| Primary school or below | 0.53 (0.17 to 1.52) | 0.225 |
| Lower secondary school | 0.49 (0.17 to 1.39) | 0.177 |
| Upper secondary school | 0.49 (0.15 to 1.37) | 0.162 |
| Tertiary education | Ref | |
| Marital status | | |
| Married | 2.12 (0.88 to 5.82) | 0.092 |
| Unmarried | 0.92 (0.28 to 3.03) | 0.894 |
| Divorced, widowed, separated | Ref | |
| Employment status | | |
| Employed | Ref | |
| Awaiting employment/ unemployed | 0.89 (0.40 to 1.97) | 0.772 |
| Retired | 1.85 (0.92 to 3.71) | 0.084 |
| Daily cigarette consumption before hospitalisation | 0.98 (0.96 to 1.00) | 0.050 |
| Quit attempts before hospitalisation | 0.70 (0.41 to 1.21) | 0.202 |
| Reduction attempts before hospitalisation | 0.81 (0.49 to 1.51) | 0.603 |
| No of days of hospitalisation admission in the preceding year | 1.02 (1.01 to 1.27) | 0.036* |
| Reason for hospital admission | | |
| Diabetes | 0.51 (0.24 to 1.81) | 0.297 |
| Hypertension | 0.55 (0.36 to 1.37) | 0.147 |
| Heart disease | 0.65 (0.18 to 2.32) | 0.507 |
| Respiratory disease | 0.52 (0.11 to 2.41) | 0.400 |
| Cancer | Ref | |
| Perceived correlation between smoking and illness | 1.08 (1.01 to 1.17) | 0.032* |
| Received smoking cessation support from healthcare professionals | 1.18 (1.07 to 1.36) | 0.014* |
| Withdrawal symptoms experienced during hospitalisation | 0.75 (0.58 to 0.97) | 0.027* |

The model was adjusted by sex, age, highest educational attainment, marital status and employment status.
*Significant at p<0.05.

hospitalisation (OR 1.18; 95% CI 1.07 to 1.36; p=0.014) were continuously found to be significant predictors of post-discharge smoking abstinence.

## DISCUSSION

To the best of our knowledge, this is the first study to investigate the smoking behaviours of hospitalised patients in a Chinese context. It is also the first study to identify contributing factors that lead to smoking abstinence after patients are discharged. In this study, almost all the participants were men. This indeed reflected a usual phenomenon in Hong Kong. According to the latest statistics from the Census and Statistics Department, Hong Kong, about 86% of daily cigarette smokers were men.[21]

The results show most participants complied with the hospital's policy to stop smoking; however, 23.6% did not, and smoked secretly during hospitalisation. Most had either moderate or high nicotine dependency before admission, which aggravated their ability to abstain, despite the hospital's policy.

The study showed 23.9% of the participants quit smoking after being discharged. Multivariate logistic regression analyses were conducted to aid in understanding the contributing factors leading to smoking abstinence of the patients after hospitalisation. The results revealed patients' perception of the relationship between smoking and disease was one of the most significant predictors of smoking abstinence. This finding is in line with that in a previous study showing that medically ill smokers who regarded themselves as more vulnerable to health consequences of smoking were more likely to quit.[7] In addition, the number of hospital admissions in the preceding year was found to be a significant predictor of smoking abstinence after hospitalisation. This was probably due to the fact that smokers were required to temporarily abstain in hospitals, which provided a golden opportunity to initiate smoking cessation. However, as observed in the regression models, reasons for hospital admission could not be used to predict post-hospitalisation smoking abstinence. A possible explanation is that a majority of the participants had misconceptions and believed smoking was not a cause of their disease, and they resumed smoking after discharge. However, evidence shows smoking poses serious adverse effects to nearly every organ in the body.[2] Quitting smoking can also help slow disease progression[22] and improve treatment efficacy.[2] In this regard, dispelling misconceptions about smoking and increasing smokers' perception of the risks of continued smoking, and the benefits of quitting, is a potential strategy for promoting smoking cessation for hospitalised smokers.

The multivariate analysis results revealed that withdrawal symptoms experienced during hospitalisation serve as a significant barrier to continued abstinence thereafter. These results are consistent with previous studies indicating withdrawal symptoms induced by nicotine dependence are a common reason for smokers continue to smoking after discharge.[23] Rigotti *et al*[10] suggested withdrawal symptoms are less prominent in hospital settings, as smoking was completely banned there, resulting in a lack of environmental cues. However, it was expected that smoking patients may suffer more severe withdrawal symptoms when they were discharged and returned to an environment with different smoking cues. Therefore, equipping smokers with the skills to overcome cravings and withdrawal symptoms during hospitalisation is another crucial strategy for assisting them in continuing abstinence after discharge.

The multivariate logistic regression analyses indicated patients' receiving smoking cessation support during hospitalisation was a significant predictor of smoking abstinence. This finding further supports the WHO recommendation that healthcare professionals bear a continued responsibility for promoting smoking cessation, as their advice can strongly affect motivating of hospitalised smokers to quit.[24] Nevertheless, inadequate cessation support of hospitalised smokers by healthcare professionals in Hong Kong was observed. About 30% of participants in the present study received no support for smoking cessation during their hospitalisation. This could owe to the fact many healthcare professionals in Hong Kong have never received formal training on smoking cessation and therefore lacked competence to provide adequate support or concrete methods for hospitalised smokers to quit smoking. Another potential reason is the problematic healthcare professional shortage highly prevalent in Hong Kong. The nurse:patient ratio in most public hospitals is 1:12, which is far below the international standard of 1:6 for developed economies.[25] Providing comprehensive smoking cessation advice for hospitalised smokers therefore appears infeasible in this study setting that has inadequate healthcare human resources.

## Limitations

This study did have some limitations. First, we did not conduct biochemical validation to verify self-reported abstinence. This was because the participating hospitals implemented strict infection control policies. When we prepared this study, we discussed with our clinical partners to see whether we could conduct such validation. However, they expressed concern about the possibility of spreading infection in their facilities, especially when the procedures involved patients' saliva. Despite our suggestion to verify patients' smoking status by means of exhaled carbon monoxide, the necessary equipment needed to be shared, which might also have presented chances of infection. As biochemical validation was not conducted to verify self-reported abstinence, therefore, results could be biased by social desirability. Notably, there was potential for under-reporting of smoking during hospitalisation and over-reporting of abstinence after discharge. Biochemical validation was suggested for future research to minimise such bias. The participants were also asked to provide details on their smoking behaviours during their hospital stay and after discharge, which may have resulted in recall bias. Additionally, the study sample size was small compared with those from previous studies on hospitalised smokers,[26 27] which in turn might have lowered the power to predict abstinence. We also were unable to obtain any data for comparison between our participants and non-respondents with regard to their demographics and clinical and smoking characteristics, thus working against representativeness among participants. Furthermore, because of the length of the questionnaire, we were not able to include other correlates of quitting, including attitudes towards tobacco use. Finally, although the participating hospitals had similar attributes and settings, certain potentially unobservable differences may have made our results less clear.

### Implications for clinical practice and research

Despite the above limitations, the present findings have important implications for research and clinical practice. As provision of smoking cessation support is inadequate in clinical settings, hospitals should take the initiative to change their systems. This would motivate more healthcare professionals to assess health behaviours of hospitalised smokers and implement evidence-based interventions to help them quit. In particular, healthcare professionals should be given relevant training to enhance their self-efficacy and confidence in promoting smoking cessation to patients. A systematic review indicated numerous barriers to provision of smoking cessation interventions in hospital settings.[28] More studies should be conducted to identify barriers specific to the Hong Kong Chinese context.

The results also provide useful recommendations for guiding development of smoking cessation interventions for hospitalised smokers. Our previous studies demonstrated the success of using brief advice, based on the AWARD (Ask, Warn, Advise, Refer and Do-it-again) model, in helping community smokers achieve abstinence.[29 30] This aids smokers in quitting by warning them about the high risk of premature death resulting from tobacco use, while referring those who require more counselling to existing smoking cessation services.[31] Compared with intervention using the '5A's' (Ask, Advise, Assess, Assist and Arrange) approach, that based on the AWARD model is shorter, deliverable within 1 min[31] and therefore feasible for adoption by healthcare professionals, and even by healthcare assistants, in busy hospital environments. Our study also found >80% of the participants who continued to smoke during hospitalisation reduced their tobacco use. This shows a decrease in daily cigarette consumption from 19.5 to 10.1 among those who continued to smoke after discharge. In fact, in other smoking cessation projects, we have found smokers not interested in quitting may be interested in reducing the number of cigarettes they smoke.[12 32] Those findings suggest smoking reduction can be an acceptable and feasible alternative approach for starting cessation, especially for hospitalised smokers who do not want to achieve abstinence through abrupt quitting. Future studies are recommended to compare the effectiveness of using two approaches—immediate and progressive—in achieving smoking abstinence among hospitalised smokers.

## CONCLUSION

Some smokers continued to smoke during hospitalisation despite smoke-free policies having been implemented in hospitals. A majority of smokers even resumed their smoking habits after discharge. While there is room for improvement in coverage of cessation support among hospitalised smokers, in particular for those in hospitals with a high nurse:patient ratio, a more innovative intervention therefore needs to be developed and evaluated. This should aim for greater effectiveness and feasibility in healthcare professionals' efforts to promote smoking cessation for this population.

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**Contributors** HCWL, KYH, KKWL, MPW and THL conceived and designed the study and monitored the whole research process. HCWL, KYH, KKWL, WX and LYH searched the literature, reviewed the literature and extracted data. HCWL, KYH, KKWL, MPW, LYH and THL analysed and interpreted the data. HCWL and KYH drafted the manuscript. HCWL, KYH, KKWL, MPW, LYH, KCBT, HKMS, EC, MPHM and THL critically revised the manuscript for important intellectual content. All authors approved the final version of the manuscript. We all agree to be accountable for all aspects of the work.

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## REFERENCES

1. World Health Organization. Tobacco. 2018 http://www.who.int/mediacentre/factsheets/fs339/en/ (accessed 1 Mar 2018).
2. U.S. Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General*. Atlanta: U.S: Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.
3. Rice DP, Hodgson TA, Sinsheimer P, *et al*. The economic costs of the health effects of smoking, 1984. *Milbank Q* 1986;64:489–547.
4. Census & Statistics Department. *Pattern of Smoking. Thematic Household Survey Report No. 59: Pattern of Smoking*. Hong Kong: Hong Kong Census & Statistics Department, 2016.
5. McGhee SM, Ho LM, Lapsley HM, *et al*. Cost of tobacco-related diseases, including passive smoking, in Hong Kong. *Tob Control* 2006;15:125–30.
6. Lando H, Hennrikus D, McCarty M, *et al*. Predictors of quitting in hospitalized smokers. *Nicotine Tob Res* 2003;5:215–22.
7. Gregor K, Borrelli B. Barriers to quitting smoking among medically ill smokers. *J Behav Med* 2012;35:484–91.
8. Kim SH, Lee JA, Kim KU, *et al*. Results of an inpatient smoking cessation program: 3-month cessation rate and predictors of success. *Korean J Fam Med* 2015;36:50–9.
9. The Government of the Hong Kong Special Administrative Region. Quitting smoking & tobacco control. 2017 https://www.gov.hk/en/residents/health/addictions/smoking/tobaccocontrol.htm (accessed 1 Mar 2018).
10. Rigotti NA, Arnsten JH, McKool KM, *et al*. Smoking by patients in a smoke-free hospital: prevalence, predictors, and implications. *Prev Med* 2000;31:159–66.
11. Lucas C, Martin J. Smoking and drug interactions. *Aust Prescr* 2013;36:102–4.

12. Fiore MC, Jaén CR, Baker TB, *et al*. *Treating Tobacco Use and Dependence: 2008 Update*. Rockville, MD: US Department of Health and Human Services, 2008.
13. Ho KY, Li WHC, Wang MP, *et al*. Comparison of two approaches in achieving smoking abstinence among patients in an outpatient clinic: a phase 2 randomized controlled trial. *Patient Educ Couns* 2018;101:885–93.
14. Sabidó M, Sunyer J, Masuet C, *et al*. Hospitalized smokers: compliance with a nonsmoking policy and its predictors. *Prev Med* 2006;43:113–6.
15. York NL, Kane C, Beaton K, *et al*. Identifying barriers to hospitalized patients' participation in a free smoking cessation support program. *Medsurg Nurs* 2017;26:25–32.
16. Quality and Safety Division, Hospital Authority. Report on hospital accreditation in hospital authority 2013–2015. 2016 https://accred.ha.org.hk/hosp_accred/overview/160126_Report%20on%20Hospital%20Accreditation%202013-2015.pdf (accessed 14 Jul 2018).
17. Gelenberg AJ, de Leon J, Evins AE, *et al*. Smoking cessation in patients with psychiatric disorders. *Prim Care Companion J Clin Psychiatry* 2008;10:52–8.
18. Doll R, Peto R, Wheatley K, *et al*. Mortality in relation to smoking: 40 years' observations on male British doctors. *BMJ* 1994;309:901–11.
19. Toll BA, O'Malley SS, McKee SA, *et al*. Confirmatory factor analysis of the Minnesota Nicotine Withdrawal Scale. *Psychol Addict Behav* 2007;21:216–25.
20. Huang CL, Lin HH, Wang HH. The psychometric properties of the Chinese version of the Fagerstrom Test for Nicotine Dependence. *Addict Behav* 2006;31:2324–7.
21. Census and Statistics Department. *Thematic Household Survey Report No. 64: Pattern of Smoking*. Hong Kong, 2018. https://www.statistics.gov.hk/pub/B11302642018XXXXB0100.pdf. (accessed 15 Aug 2018).
22. Wu J, Sin DD. Improved patient outcome with smoking cessation: when is it too late? *Int J Chron Obstruct Pulmon Dis* 2011;6:259–67.
23. Greenhalgh EM, Stillman S, Ford C. Factors that predict success or failure in quit attempts. In: Scollo MM, Winstanley MH, eds. *Tobacco in Australia: facts and issues*. Melbourne: Cancer Council Victoria, 2016.
24. World Health Organization. *Framework Convention on Tobacco Control*. Switzerland, Geneva: the WHO Document Production Services, 2003.
25. The Government of the Hong Kong Special Administrative Region. Nursing manpower in public hospitals. 2016 http://www.info.gov.hk/gia/general/201605/18/P201605180556.htm (accessed 1 Mar 2018).
26. Cummins SE, Gamst AC, Brandstein K, *et al*. Helping hospitalized smokers: a factorial RCT of nicotine patches and counseling. *Am J Prev Med* 2016;51:578–86.
27. Richter KP, Faseru B, Shireman TI, *et al*. Warm handoff versus fax referral for linking hospitalized smokers to quitlines. *Am J Prev Med* 2016;51:587–96.
28. Sharpe T, Alsahlanee A, Ward KD, *et al*. Systematic review of clinician-reported barriers to provision of smoking cessation interventions in hospital inpatient settings. *J Smok Cessat* 2018:1–11.
29. Chan SS, Wong DC, Cheung YT, *et al*. A block randomized controlled trial of a brief smoking cessation counselling and advice through short message service on participants who joined the Quit to Win Contest in Hong Kong. *Health Educ Res* 2015;30:609–21.
30. Wang MP, Li WH, Cheung YT, *et al*. Brief advice on smoking reduction versus abrupt quitting for smoking cessation in chinese smokers: a cluster randomized controlled trial. *Nicotine Tob Res* 2017;20:67–72.
31. Suen YN, Wang MP, Li WH, *et al*. Brief advice and active referral for smoking cessation services among community smokers: a study protocol for randomized controlled trial. *BMC Public Health* 2016;16:387.
32. Lam TH, Cheung YT, Leung DY, *et al*. Effectiveness of smoking reduction intervention for hardcore smokers. *Tob Induc Dis* 2015;13:9.