ORIGINAL INVESTIGATION

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Adherence to nicotine replacement therapy versus quitting smoking among Chinese smokers: a preliminary investigation

Abstract *Rationale:* There are over 300 million Chinese smokers, but use of nicotine replacement therapy (NRT) is rare. On the other hand, data on the factors associated with quitting and adherence to NRT use are scarce in the East. *Objectives:* To describe adherence and other predictors of quitting smoking at the 12-month follow-up amongst Chinese smokers in Hong Kong. *Methods:* Chinese smokers (1186) who attended the Smoking Cessation Health Centre from August 2000 through January 2002 were studied. Trained counsellors provided individual counselling and carried out follow-up interviews. We used structured questionnaires at baseline and at 1, 3 and 12 months and an intention-to-treat approach for analysis.

Results: Among those who received NRT (1051/1186), the prevalence of adherence (self-reported NRT use for at least 4 weeks) was 16% (95% confidence interval 14–18%). The 7-day point prevalence quit rate at 12 months (not smoking any cigarette during the past 7 days at the 12 month follow-up) was 27% (95% CI, CI 24–29%). Stepwise logistic regression model showed that adherence to NRT use, a higher income, good perceived health and having more confidence in quitting were significant predictors of quitting. The quit rate in the adherent group (40%) was greater than that of the non-adherent group (25%) (*P*<0.001). Older age, male, higher education, experience of NRT use, perceiving quitting as more difficult and willingness to pay were significant predictors of adherence. *Conclusions:* Clinically significant smoking cessation rates can be achieved among Chinese smokers in a clinic-based smoking cessation service. The NRT adherence was low and low adherence was associated with a lower quit rate. Trials of interventions to improve adherence and increase quit rates are needed.

Keywords Quitting smoking · Adherence · Chinese · Predictors

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Introduction

China has the world's largest number of smokers but smoking cessation is uncommon and use of nicotine replacement therapy (NRT) is rare. Hong Kong is the most urbanised and westernised city of China and smoking is the biggest preventable cause of death. Its smoking prevalence of about 15% (27% male and 3% female) (Census and Statistics Department 1998) is the lowest among Chinese cities but smoking kills about 6000 people per year, accounting for about one-fifth of all deaths (Lam et al. 2001). The most effective way of reducing the harmful effects in smokers is to quit smoking (Public Health Service 2000). NRT is an effective pharmacological support for smokers attempting to quit (Imperial Cancer Research Fund 1993; Public Health Service 2000)

and clinical guidelines in the West recommend that NRT should routinely be used to support quitting attempts (Raw et al. 1998; Fiore et al. 2000). Although nicotine patches have been available in Hong Kong since 1993, few physicians and doctors have used it. At present four types of NRT (patch, gum, inhaler and lozenge) are available in Hong Kong as an over the counter drug. There were no formal smoking cessation services available in the public sector until the setting up of the Smoking Cessation Health Centre (SCHC) in 2000, which was the first pilot clinic to provide individualized smoking cessation services on a regular part-time basis.

Studies in the West have identified several predictors of quitting smoking (Etter et al. 2002). These included low nicotine dependence, male gender, higher education, being married and not having any other smokers in the household. Several Western studies showed a positive linear correlation between adherence to NRT and cessation rates (Russell et al. 1993; Sachs et al. 1993; Killen et al. 1999; Solomon et al. 2000; Fornai et al. 2001), but they did not present detailed data of adherence measurements or its predictors. Different definitions were used to describe adherence in different studies (Transdermal Nicotine Study Group 1991; Imperial Cancer Research Fund 1993; Fornai et al. 2001). In the East, there is a lack of studies on the factors associated with quitting and adherence to NRT use, and we found no such data for Chinese in the literature. This paper describes adherence and other predictors of quitting smoking at the 12-month follow-up amongst Chinese smokers in Hong Kong, which is at a more advanced state of the tobacco epidemic than mainland China (Lam et al. 2001).

Materials and methods

Study setting and services

The SCHC based in the Specialist Outpatient Department of a district hospital (Ruttonjee Hospital) started its operation in August 2000. The clinic operates three evening sessions, each of 3 h each week. The clinic was publicised in the local media through press conference and interview and by posters with a hotline number displayed in different healthcare settings. Clients made appointments by calling the hotline during which the nature of the service and follow-up procedures were briefly explained. The smoking cessation programme provided in the SCHC included one individual specialist counselling on smoking cessation which lasted for 20–30 min and the use of NRT (Fiore et al. 2000). Counselling was provided based on the queries and the needs of individual clients which was determined by their smoking status, physical dependence and the perceived barriers to quitting. The counsellors adopted a non-directive approach, which is based on Prochaska's transtheoretical model (Prochaska and Goldstein 1991). These included advancing clients' stage of readiness in quitting smoking, strengthening clients' motivation to quit smoking using "5R" (Relevance, Risks, Rewards, Roadblocks and Repetition) approach (Public Health Service 2000), and addressing physiological craving, psychological dependence and socio-cultural factors in relation to tobacco dependency.

Services, provided free of charge, included assessment of client's smoking status and nicotine dependence level, provision of individually tailored counselling provided by trained nurse counsellors, prescription of NRT (with a free 1 week supply) and follow-up at 1, 3 and 12 months after the first visit. At each follow-up, we collected data, encouraged them for their efforts in quitting and provided problem-oriented suggestions or advice as appropriate. We gave 1 week free supply to help smokers starting the treatment with an assumption that they would continue using it upon realising the benefit. We made a follow-up call at 1 week to assess if they are having any problem with NRT use and encourage further use. The 1 week free supply was also given in the smoking cessation services (Health Action Zones) of the United Kingdom in 1999 (Department of Health 2001). The prescription of NRT was tailored to the client's level of nicotine dependency and their daily cigarette consumption (Dale et al. 2000). In general, smokers who were moderately or severely dependent on nicotine as measured by the Fagerstrom Test for Nicotine Dependency (Heatherton et al. 1991) were recommended to use NRT for 8 weeks. A higher dose was recommended to those who were severely dependent. We prescribed nicotine patch or gum or inhaler according to the choice of clients. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, the University of Hong Kong.

Subject recruitment and data collection

Clients were current smokers who called the SCHC booking hotline to make an appointment and attended the SCHC during the study period (21 August 2000 to 17 January 2002). All clients were motivated to quit smoking completely and signed an informed consent form to participate in the program. Those who were using other cessation aids (e.g. smoking cessation programmes, herbal remedies, acupuncture) or on regular psychotropic medications (drugs prescribed to stabilise or improve mood, mental status or behaviour) were excluded.

Data collection was done at first visit and at each follow-up using standard questionnaires. The questionnaire was developed referring to other previously validated questionnaires (Heatherton et al. 1991; Sonderskov et al. 1997; Dale et al. 2000; Hurt et al. 2000). Most subjects were able to complete the self-administered questionnaire. For the few who encountered difficulties, assistance was available from clinic staff. Those who did not return for follow-up were followed up by a counsellor over the telephone. The counsellor asked questions over the telephone following the standard follow-up questionnaire. The questionnaire used in the follow-up visit/interview was the shortened version of the baseline questionnaire and collected following information: demographics, smoking and quitting history, details of NRT use and clients' satisfaction to the service.

The baseline questionnaire included demographic information, perceived health status in the last three months (very good, good, bad, very bad), smoking history (smoking status, other household members' smoking status, the age started smoking regularly and the average number of cigarettes smoked per day), nicotine dependence level (based on the six question Fagerstrom Test for Nicotine Dependence Questionnaire (Heatherton et al. 1991), past quitting history (whether ever seriously tried to stop smoking, the number of serious attempts made at stopping smoking and longest duration of not smoking during the latest quitting attempt), intention to quit based on Prochaska's model (classified as precontemplation, contemplation, preparation, action and maintenance) (Prochaska and Goldstein 1991) and perceived motivation, confidence and difficulty of quitting smoking. Motivation was measured by asking the smokers how important it was for them to quit smoking, on a scale of 1–10 (1 being least important and 10 being very important). We categorized responses into more important (scoring above the mean) and less important (scoring below the mean). Similar questions were asked to measure respondents' confidence and difficulty in quitting.

Other information collected included NRT use (experience of using NRT, type and duration of NRT use and side-effects (Sonderskov et al. 1997); willingness to pay for smoking cessation services and whether suffering from chronic or serious illness. Exhaled air carbon monoxide level at first visit was measured using

the "Bedfont Micro II Smokerlizer". NRT use was based on the number of weeks during which the client used nicotine gum, patch or inhaler at 3 month follow-up interview. Clients who self-reported using NRT daily for at least 4 weeks during the first 3 months were defined as adherent to NRT use.

Successful quitting was estimated by asking whether the subjects had smoked any cigarette (whole cigarette or a puff) during the past 7 days at the 12 month follow-up interview (point prevalence quit rate). We chose the criterion of 7 day abstinence as it was used in a recent United States Clinical Practice Guideline as the main outcome measure for smoking cessation (Fiore et al. 2000). Those who answered "no" were defined as quitters, with no biochemical validation. All subjects who could not be contacted at 12 month follow-up were considered as smokers. As a secondary outcome, we also measured continuous abstinence rate (abstinence from tobacco smoking continuously for the whole year prior to the interview at 12 months (Hughes et al. 2003)) and reduction in smoking rate (reduction of the amount smoked by at least 50% at 12 month follow-up (Hurt et al. 2000)).

Analysis

Data were entered into Epi Info and analysed using SPSS for Windows. The characteristics of quitters and non-quitters, and adherent and non-adherent subjects were compared by chi-square test. The variables which were significant in the univariate analysis were tested by forward stepwise logistic regression modelling to identify predictors for either adherence to NRT use or quitting and to estimate adjusted odds ratios and 95% confidence intervals (CI). We used an intention-to-treat analysis to assess quit rates or adherence rates. In this analysis, follow-up variables with missing data were set to their baseline values (e.g. current smoker or not using NRT). A P-value (two-tailed) of <0.05 was considered statistically significant.

Results

Profile of subjects

Of the 1186 Chinese smokers who attended the SCHC during the 17 months, 80% were male, 85% aged 20–59, 10% aged ≥60 and 5% aged under 20; 85% had received education to secondary school or above; 72% smoked more than 10 cigarettes daily; the 30-day average daily consumption was 18 cigarettes. Forty-three percent were severely dependent on nicotine with a mean Fagerstrom score of 5 (range 0–10). Eighty-nine percent were prescribed NRT.

Use of NRT and adherence

Of 1051/1186 clients who were prescribed NRT (135 clients were not given NRT because they were very light smokers and our counsellor thought that NRT would not be necessary, or because the clients did not want to use NRT), 78% were given nicotine patch, 12% nicotine gum and 4% nicotine inhaler, and 6% were given a combination of any two. However, 22% (235/1051) did not use NRT at all (including 73 who reported that they did not use, and 162 who could not be contacted at 3 month follow-up were also considered as non-users), 44% reported that they had used NRT for 1 week or less, 13% for 1–2 weeks, 5%

for 2–3 weeks, and 16% (95% CI 14–18%) for 4 weeks or more (i.e. adherent).

Amongst the 819 NRT users, 19% (95% CI 16–22) reported side effects. Eighteen percent, 15% and 12% experienced side effects while using patch, gum and inhaler, respectively. The side effects reported were mild and relevant to the type of NRT used (data not shown).

The quit rate in the adherent group (40%) was significantly greater than that of the non-adherent group (25%) (P<0.001). There was no significant difference in reported quit rates among different NRT users (P=0.30). Twelve variables were found to be significantly associated with NRT adherence (Table 1). Logistic regression (forward stepwise) modelling of the 12 variables indicated that being aged 41 years or older, male gender, receiving education to grade 12 or above, past experience of using any type of NRT, perceiving quitting smoking as more difficult, and willing to pay more for smoking cessation service were significant predictors after adjusting for each other (Table 2).

Smoking status at 12 months

At 12 month follow-up, 353 clients could not be reached (telephone number changed, left Hong Kong, refused to come to the SCHC or be interviewed over the phone, could not be contacted after five telephone calls) and they were considered as non-quitters. Of the clients, 15% (95% CI 13–17%) reported that they did not quit completely but reduced daily smoking by at least 50%, 58% (95% CI 56–61%) were able to quit for more than 24 h, 27% (95% CI 24–29%) did not smoke any cigarettes during the 7 day prior to the interview (point prevalence), and 18% (95% CI 16–21%) did not smoke any cigarettes for the whole year prior to the interview (12 month continuous abstinence rate).

Factors associated with quitting

With the inclusion of those who did not return for follow-up as non-quitters, nine factors were significantly associated with quitting (Table 3). Stepwise logistic regression modelling on these nine factors showed that being adherent to NRT use for 4 weeks or more, a higher income, good perceived health and having more confidence in quitting were significant independent predictors of quitting (Table 4). When examined predictors by excluding all those who did not return for follow-up so that known quitters were compared with known non-quitters, we identified the same predictors in Table 4 but the P-values increased for three variables and decreased for one variable.

Table 1 Demographic, lifestyle and quitting related factors in adherence and non-adherence subjects (*n*=1186)

Characteristics	Non-adherent (*n*=1019) %	Adherent (*n*=167) %	*P*-value for χ^2 test
Demographics			
Gender			
Male	78	90	<0.001
Female	22	10	
Occupational status			
Housewife	5	3	0.48
Full time student/retired/unemployed	25	23	
Currently employed	70	74	
Age			
30 or below	32	18	<0.001
31–40	31	28	
41–50	21	28	
51 or above	16	26	
Educational attainment			
Primary school (grade 6) or below	16	13	<0.01
Secondary school (grade 7-11)	61	51	
Matriculation (grade 12) or above	23	36	
Personal income			
HK$0-9999	51	40	<0.05
HK$10,000 or more	49	60	
Household income[a]			
HK$0-19,999	57	42	<0.001
HK$20,000 or more	43	58	
Daily cigarette consumption			
0–10	29	21	0.05
11–20	49	50	
>20	22	29	
Number of years as daily smoker			
Less than 20 years	54	42	<0.01
20 years or more	46	58	
Nicotine dependency level[b]			
Low	30	22	0.06
Moderate	27	29	
Severe	43	49	
Number of other smokers in household			
Nil	74	79	0.19
One or more	26	21	
Smoking status of spouse			
No spouse/spouse not smoker	89	92	0.31
Spouse is smoker	11	8	
Quitting history (number of previous quitting attempts)			
Nil	25	18	<0.05
One attempt	31	26	
More than one attempt	44	56	
Length of abstinence in the last quitting attempt			
Less than a day or not at all	40	31	<0.05
≥1 day	60	69	
Type of NRT used this time[c]			
Patch	78	77	0.71
Gum	10	13	
Inhaler	3	2	
Combination of any two	9	8	

Total percentage may be more or less than 100 due to rounding of the figures, US$1=HK$7.8

[a]Total 21 missing (15 for non-adherent group and 6 for adherent group)

[b]Nicotine dependency level was measured by Fagerstrom scale, then further divided into 3 levels: low (score 0–3), moderate (score 4–5) and severe (score 6–10)

[c]Total *n*=813, 373 missing (not using any NRTs)

[d]Total *n*=1076, 110 missing (the question was not included in the initial stage of the study)

[e]Total *n*=981, 205 clients unable to give a value for an imaginary smoking cessation treatment

Table 1 (continued)

Characteristics	Non-adherent (n=1019) %	Adherent (n=167) %	P-value for χ^2 test
Experience of using NRT in the past			
No	86	72	<0.001
Yes	14	28	
Other factors			
Perceived importance on quitting (mean score=82)			
Less important (< mean)	49	44	0.27
More important (≥mean)	51	56	
Perceived difficulties on quitting (mean score=76)[d]			
Less difficult (< mean)	42	27	<0.01
More difficult (≥mean)	58	73	
Perceived confidence on quitting (mean score=63)[d]			
Less confident (< mean)	53	54	0.78
More confident (≥mean)	47	46	
Willingness to pay for smoking cessation (median=HK$1000)[e]			
Less willing to pay (< median: $1000)	52	33	<0.001
More willing to pay (≥median: $1000)	48	67	
Exhaled CO level at first visit			
Lower than mean (<21.7 ppm)	56	41	<0.001
Higher than mean (≥21.7 ppm)	44	59	
Perceived health status at the first visit to SCHC			
Very good or good	68	69	0.67
Very bad or bad	32	31	

Discussion

This study provides important new information regarding NRT adherence and predictors of quitting smoking among Chinese. Acceptance of a limited supply of free NRT amongst Chinese smokers in Hong Kong was high (87% accepted the offer of NRT), but adherence to the recommended course of treatment of NRT for at least 4 weeks was low at 16%. A recent WHO publication reported wide variations in the prevalence of adherence (5–96%) to smoking cessation therapy among studies (Sabaté et al. 2003), which were all from developed countries. The variation was due to the differences in the definition of adherence, the nature of the interventions, adjunctive supports and the populations studied (Sabaté 2003). In the present study, one likely reason for low NRT

usage was that our clients had to buy NRT after the initial week since a free supply was available only for 1 week, and some clients told us that the price was too high. The high short-term cost of NRT (US$38 for 1 week's supply) compared with the cost of purchasing cigarettes (US$4.1–4.49 per pack of 20 cigarettes; but illegal/smuggled cigarettes, which were readily available in some districts, cost only US$0.77) could also be an issue. There is evidence that overall cessation rates are the highest when costs of treatment are fully reimbursed (Curry et al. 1998), and this may be a result of a higher NRT use rate. Another reason could be that those who did not use NRT after 1 week might be those who were not successful in their quit attempt during the first week of therapy.
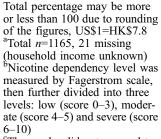
Our smoking cessation service (individual counselling and 1 week free supply of NRT) resulted in a self-reported

Table 2 Summary of logistic regression (forward stepwise) model to predict NRT adherence. *OR* odds ratio, *CI* confidence interval

Independent variables	OR (95% CI)	P-value
Age (reference=30 years or under)		<0.01
31–40 years	1.09 (0.62–1.93)	0.77
41–50 years	2.16 (1.21–3.87)	<0.05
51 years or over	2.45 (1.29–4.64)	<0.01
Male	2.38 (1.25–4.55)	<0.01
Educational attainment (reference=primary school (grade 6) or below)		<0.05
Secondary school (grade 7–11)	1.33 (0.69–2.57)	0.40
Matriculation (grade 12) or above	2.29 (1.14–4.62)	<0.05
Experience of using NRT in the past	2.35 (1.49–3.71)	<0.001
Perceived quitting smoking as more difficult	2.04 (1.30–3.21)	<0.01
Willing to pay more for smoking cessation service	1.67 (1.10–2.55)	<0.05

Table 3 Demographic, lifestyle and quitting related factors among quitters and non-quitters (*n*=1186)

Characteristics	Quitters (*n*=325) %	Non-quitters (*n*=861) %	*p*-value for χ^2 test
Gender			
Male	83	79	0.08
Female	17	21	
Occupational status			
Housewives	4	5	<0.05
Full times student/retired/unemployed	19	27	
Currently employed	77	68	
Age			
30 or below	28	31	0.54
31–40	30	31	
41–50	24	21	
51 or above	18	17	
Educational attainment			
Primary school (grade 6) or below	14	16	0.31
Secondary school (grade 7–11)	58	60	
Matriculation (grade 12) or above	28	24	
Personal income			
HK$0-9999	38	53	<0.001
HK$10,000 or more	62	47	
Household income[a]			
HK$0-19,999	50	57	<0.05
HK$20,000 or more	50	43	
Marital status			
Single	30	37	0.05
Married and cohabiting	64	56	
Divorced, separated and widowed	6	7	
Daily cigarette consumption			
0–10	32	26	0.12
11–20	49	50	
>20	19	24	
No. of years as a daily smoker			
Less than 20 years	51	53	0.55
20 years or more	49	47	
Nicotine dependency level[b]			
Mild	34	27	<0.55
Moderate	28	27	
Severe	38	46	
Number of other smokers in household			
Nil	77	74	0.26
One or more	23	26	
Smoking status of spouse			
No spouse/spouse not smoker	90	89	0.46
Spouse is smoker	10	11	
Number of previous quitting attempt(s)			
Nil	24	24	0.67
One attempt	28	31	
More than one attempt	48	45	
Length of abstinence in the last quitting attempt			
Less than a day or not at all	34	41	<0.05
≥1 day	66	59	
Use of NRT for at least 1 day			
No	25	34	<0.01
Yes	75	66	

Total percentage may be more or less than 100 due to rounding of the figures, US$1=HK$7.8
[a]Total *n*=1165, 21 missing (household income unknown)
[b]Nicotine dependency level was measured by Fagerstrom scale, then further divided into three levels: low (score 0–3), moderate (score 4–5) and severe (score 6–10)
[c]Those who did not respond to the question about NRT adherence or were not available at 3 month follow-up were considered non-adherent to NRT use
[d]Total *n*=245 for quitters and 568 for non-quitters group due to missing responses (or not using any NRTs)
[e]Total *n*=110 missing (38 for quitters and 72 for non-quitters group), because the question was not included in the initial stage of the study
[f]Total *n*=277 for quitters and 789 for the non-quitters group, because 205 clients were unable to give a value for an imaginary smoking cessation treatment

Table 3 (continued)

Characteristics	Quitters (n=325) %	Non-quitters (n=861) %	p-value for χ^2 test
NRT adherence[c]			
No	79	88	<0.001
Yes	21	12	
Type of NRT used this time[d]			
Patch	81	76	0.30
Gum	8	12	
Inhaler	3	3	
Combination	8	9	
Perceived importance on quitting (mean score=82)			
Less important (< mean)	45	49	0.25
More important (≥mean)	55	51	
Perceived difficulties on quitting (mean score=76)[e]			
Less difficult (< mean)	44	38	0.07
More difficult (≥mean)	56	62	
Perceived confidence on quitting (mean score=63)[e]			
Less confident (< mean)	45	56	<0.01
More confident (≥mean)	55	44	
Willingness to pay for smoking cessation (median=HK\$1000)[f]			
Less willing to pay (< median: \$1000)	46	50	0.23
More willing to pay (≥median: \$1000)	54	50	
Exhaled CO level at first visit			
Lower than mean (< 21.7 ppm)	57	53	0.17
Higher than mean (≥21.7 ppm)	43	47	
Perceived health status at the first visit to SCHC			
Very good or good	73	66	<0.05
Very bad or bad	27	34	

12-month point prevalence quit rate of 27%, which was identical with the 1 year point prevalence quit rate (27.5%) among American smokers who used nicotine patch (Hurt et al. 1994), and higher than the 6 month quit rate (14.4%) in clinic based smoking cessation services in New Zealand (Town et al. 2000) and the United States (22%) (Croghan et al. 1997). Our quit rate was also comparable with the point prevalence abstinence rates associated with NRT (24% for nicotine gum, 23% nicotine inhaler, 18% for nicotine patch) at 5 or more months as reported in the "US Clinical Practice Guidelines-Treating Tobacco Use and Dependence" (Fiore et al. 2000). However due to the methodological differences (e.g. frequency and intensity of counselling) and differences in the provision of NRT

supply (e.g. full course NRT was provided in the above American (Hurt et al. 1994; Croghan et al. 1997) and New Zealand (Town et al. 2000) studies), caution needs to be exercised when comparing quit rates among different studies.

We found four independent predictors of quitting, which were adherence to NRT use, good self perceived health, greater confidence in quitting and a higher income. Other significant predictors in univariate analysis could have been excluded from stepwise modelling because they were strongly associated with the predictors in the final model. In addition to the predictors which we identified, some studies (McWhorter et al. 1990; Razavi et al. 1999; Etter et al. 2002) have reported other predictors of successful

Table 4 Summary of logistic regression (forward stepwise) model to predict quitting smoking

Independent variables	OR[a] (95% CI)	OR[b] (95% CI)
Adhered to use NRT for 4 weeks or more	1.97 (1.35–2.88)[c]	1.76 (1.17–2.67)[d]
Higher personal income (> HK\$10,000 monthly)	1.82 (1.38–2.41)[c]	1.45 (1.07–1.98)[e]
Perceived health status as good or very good at the first visit	1.48 (1.09–2.02)[e]	1.62 (1.16 - 2.26)[d]
More confidence in their ability to quit	1.53 (1.16–2.02)[c]	1.69 (1.25–2.29)[d]

OR odds ratio, CI confidence interval, US\$1=HK\$7.8
[a]Including those who did not return for follow-up as non-quitters
[b]Excluding those who did not return for follow-up
[c]Chi square test, P-value<0.001
[d]Chi square test, P-value<0.01
[e]Chi square test, P-value <0.05

quitting such as quitting for at least a day in the latest quitting attempt, nicotine dependency level, daily cigarette consumption, and educational attainment. We also found that the former two factors were significant predictors in univariate analysis.

Most of the previous studies (Killen et al. 1999; Razavi et al. 1999; Borrelli et al. 2002; Etter et al. 2002) which reported quit rates based on the intention-to-treat analysis, also examined predictors based on the assumption that those who did not return for follow-up were non-quitters. If the rate of non return for follow-up was high, the predictors identified might be affected by misclassification error as some of those who did not return for follow-up could have quitted smoking but were not interested in follow-up. In this study, the increase of P-values after excluding those who did not return for follow-up (Table 4) could be due to the reduction in sample size and indicated that most of those who did not return for follow-up were indeed non-quitters. We suggest that in future studies, predictors of quitting should be examined with the inclusion and exclusion of those who did not return for follow-up and the results of both should be compared and reported.

Our higher quit rate in the adherent (40%) than the non-adherent group (25%) was consistent with other studies, some of which reported a positive linear correlation between NRT adherence and cessation rates (Russell et al. 1993; Alterman et al. 1999; Killen et al. 1999; Solomon et al. 2000). This suggests that efforts to increase NRT adherence rates are needed to improve quit rates. We identified six predictors of NRT adherence, which were being older, male and better educated, experience of using NRT, perceiving quitting smoking as more difficult and willing to pay more for smoking cessation service. Most of the predictors of adherence that we identified were identical to those in some other reports (Sachs et al. 1993; Alterman et al. 1999; Fornai et al. 2001]. No previous studies have reported willingness to pay in relation to NRT adherence but we found that willingness to pay for smoking cessation services was a significant predictor. This suggests that smokers who are less willing to pay should be targeted with additional interventions to motivate them to make a short-term investment in smoking cessation service rather than tobacco.

Our study also confirmed the safety of NRT use amongst the Chinese smokers as reflected from the low prevalence of mild symptoms. Our reported side-effects (19%) are much lower than those reported (50%) in the United States (Transdermal Nicotine Study Group 1991). Moreover, many of the side-effects (i.e. headache, dizziness, insomnia) reported might be due to withdrawal symptoms rather than NRT use.

Several limitations of this study should be noted. First, our sample comprised smokers who volunteered to receive smoking cessation service. As such, they may be different than those who did not attend the clinic or those who quit entirely on their own. Those who attended the clinic may be more motivated, or less confident of their ability to quit without professional help. Second, the findings of the study are not based on a randomised controlled trial. Although we used historical information from previously published studies for comparison purposes, caution is needed while extrapolating the findings. Third, the average daily consumption in our subjects (18 cigarettes) is slightly more than that in smokers in the general population (16 cigarettes) (Census and Statistics Department 1998). Fourth, free NRT was only provided for 1 week and individuals who were unable to afford a full course of NRT could have chosen not to start using or to discontinue. In contrast, most studies elsewhere have provided free NRT throughout. We thought in the real world situation smokers would need to buy NRT, and our findings, therefore, could be more applicable. Future studies should explore the reasons for non-use of NRT (i.e. cost, safety concern, not clear about the importance of NRT in quitting). Fifth, the reported quit rate and adherence rate in this study were based on self-reporting. However, the misreported rates for self-reporting are relatively low (<5%) (Velicer et al. 1992) and self-reporting has been used extensively as an outcome measure for studies on smoking cessation and exposure (Velicer et al. 1992; Gourlay et al. 1997). It is worth mentioning that we invited all quitters to come back for biochemical validation. Of the few (about 10%) who came back, exhaled carbon monoxide and urinary cotinine (measured by Nicalert) confirmed quitting status of over 95%. Finally, about 30% of the clients were not available at 12 months follow-up. This is related to the high mobility and busy lifestyles of the Hong Kong population. However, we conservatively used intention-to-treat analysis for quit rate and adherence rate.

This study is the first to examine the predictors of quitting and NRT adherence amongst Chinese smokers. The findings suggest that the use of NRT has a potentially major role in harm reduction from tobacco in Chinese populations. Our findings have implications to the promotion of smoking cessation service in the Asia Pacific region, particularly mainland China where there are over 300 million smokers. NRT use is rare in developing countries, and NRT often costs more than cigarettes. Our study is based on a pilot smoking cessation clinic, which is one of the first in the Asia Pacific region. Our results should encourage other Asia Pacific countries to develop quitting service as a clinical speciality within the current healthcare system.

In conclusion, we found a low adherence of NRT among the Chinese smokers and a low adherence rate was associated with a low quit rate. The predictors of quitting smoking and adherence that we have identified in the current study should be considered in the future intervention, research and service planning. However given the lack of evidence on effective adherence interventions on NRT use, testing of different interventions by randomised controlled trials should be a new focus of future studies. Methods such as telephone reminders on a daily basis (Piette et al. 2000; Howells et al. 2002) and use of a logbook (Ryff-de-Leche et al. 1992) which have been found to be effective in increasing adherence rate of drug use in

other chronic conditions can be tested for smoking cessation. Other methods such as strong emphasis during counselling that we shall count the empty boxes (Hughes et al. 1989) (for patch and gum users) or cartridges (for inhaler users) or examine the patch on the body (for patch users) during the follow-up visits could also be assessed.

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