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Does free nicotine replacement improve smoking cessation rates in cancer patients?

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ABSTRACT

Background Cigarette smoking is carcinogenic and has been linked to inferior treatment outcomes and complication rates in cancer patients. Here, we report the results of an 18-month pilot smoking cessation program that provided free nicotine replacement therapy (NRT).

Methods In January 2017, the smoking cessation program at our institution began offering free NRT for actively cigarette-smoking patients with cancer. The cost of 4 weeks of NRT was covered by the program, and follow-up was provided by smoking cessation champions.

Results From January 2017 to June 2018, 8095 patients with cancer were screened for cigarette use, of whom 1135 self-identified as current or recent smokers. Of those 1135 patients, 117 enrolled in the program and accepted a prescription for NRT. The rates of patient referral and patients attending a referral appointment were significantly higher in 2018–2018 than they had been in 2015–2016 (100% vs. 80.3%, $p < 0.001$, and 27.6% vs. 11.3%, $p < 0.001$, respectively). Median follow-up was 9.0 months (25%–75% interquartile range: 5.7–11.6 months). Of the patients who accepted NRT and who also had complete data ($n = 71$), 25 (35.2%) reported complete smoking cessation, and 32 (45.1%) reported only decreased cigarette smoking. On univariable analysis, no factors were significantly predictive of smoking cessation, although initial cigarette use (>10 vs. ≤10 initial cigarettes) was significantly predictive of smoking reduction (odds ratio: 5.04; 95% confidence interval: 1.46 to 17.45; $p = 0.011$).

Conclusions This pilot study of free NRT demonstrated rates of referral and acceptance of NRT that were improved compared with historical rates, and most referred patients either decreased their use of cigarettes or quit entirely.

Key Words Nicotine replacement therapy, smoking cessation

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INTRODUCTION

Smoking cessation can be a difficult endeavor for patients and can require multiple attempts. However, smoking cessation confers numerous health benefits, including decreased risk of cancer and of all-cause mortality[1]. Even after a diagnosis of cancer, smoking cessation is associated with better oncologic outcomes and decreased treatment-related toxicities[2,3].

Smoking cessation interventions can be divided into behavioural, pharmacologic, and system changes[4–7]. Behavioural interventions include individual counselling, support groups, and multimedia resources. The pharmacologic agents most commonly used to aid smoking cessation include nicotine replacement therapy (NRT), bupropion (a nicotinic receptor antagonist and atypical antidepressant), and varenicline (a nicotinic receptor partial agonist). Current guidelines and clinical trials suggest combining behavioural and pharmacologic strategies to achieve optimal quit rates[5,7].

The diagnosis of cancer can provide an opportunity for patients to review their lifestyle and might allow them to be more receptive to smoking cessation counselling. We previously reported our institution's modest success with a pilot smoking cessation program that focused on patient counselling and follow-up in addition to government-provided telephone counselling and Internet resources, but that required patients to pay for NRT[8]. This present study

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examined enrolment data and smoking cessation outcomes for a subsequent iteration of our institution's smoking cessation program in which we began offering free NRT to patients in addition to counselling.

METHODS

In 2014, a smoking cessation program was piloted at the London Regional Cancer Program; it began offering free NRT to actively smoking patients in January 2017. Newly registered patients at the centre were asked to complete a questionnaire about their smoking status. If patients indicated tobacco use in the preceding 6 months, they were asked about cigarettes smoked in the preceding 7 days, forms of tobacco used, amount smoked daily, number of minutes from waking to first smoke, importance of quitting (Likert scale: 1–5), and confidence in their ability to quit (Likert scale: 1–5). They were then counselled by an intake clerk about the benefits of smoking cessation and offered referral to the smoking cessation program.

A referral created an appointment with a smoking cessation champion, defined as a health care professional with additional training in smoking cessation counselling. The appointments were scheduled within 2 weeks of referral and could be completed by telephone or in person. Health care professionals were provided a process map that facilitated physician prescription of NRT for patients motivated to quit smoking. The cost of 4 weeks of NRT was covered by the program, and follow-up was provided by the smoking cessation champions.

Institutional health research ethics approval was obtained to collect baseline patient characteristics and follow-up smoking-related data between January 2017 and June 2018. Two investigators contacted patients to determine cigarette use. Descriptive statistics were generated and compared using chi-square tests, Fisher exact tests, two-sample *t*-tests, or Wilcoxon rank sum tests, as appropriate. Univariable logistic regression was used to determine factors predictive of smoking cessation and reduction. All statistical analyses were performed in the SAS software application (version 9.4: SAS Institute, Cary, NC, U.S.A.) using 2-sided statistical testing at the 0.05 significance level.

RESULTS

Table I details patient enrolment data. From January 2017 to June 2018, 8095 cancer patients were screened for cigarette use, of whom 1135 (14.0%) self-identified as current or recent smokers. All were offered referral to the smoking cessation program, and 313 (27.6%) attended a referral appointment. Of those 313 patients, 117 (37.4%) accepted a prescription for NRT. Complete follow-up data were available for 71 patients (60.7%). Reasons for loss to follow-up included not providing consent at follow-up (15.2%), not being reachable (41.3%), and having died (43.5%).

Table II presents the baseline characteristics of enrolled patients. Median age in the cohort was 60.7 years. Median number of cigarettes smoked per day was 15, and median years of smoking was 40. Most patients underwent curative-intent treatment (81.7%), with 73.9% being treated by a radiation oncologist. Median follow-up was 9.0 months [25%–75% interquartile range (IQR): 5.7–11.6 months]. The numbers of male and female patients were roughly equal. The most common primary disease sites were breast (14.1%), lung (32.4%), and head and neck (16.9%). Most patients were consistent in giving a high ranking to the importance of quitting (IQR: 5–5), but showed more variation in ranking their confidence in quitting (IQR: 2.5–4).

TABLE I Patient enrolment data

Variable	Value [*n* (%)]
Patients screened	8095
Current or recent smokers	1135
Patients offered referral	1135
Patients who attended a referral appointment	313
Patients who accepted a prescription for NRT	117
Patients with complete follow-up	71
Reasons for incomplete follow-up	
Did not provide consent	7 (15.2)
Not reachable	19 (41.3)
Deceased	20 (43.5)

NRT = nicotine replacement therapy.

Table III details smoking cessation outcomes. Of 57 patients (80.3%) who reported decreased cigarette smoking, 25 (35.2%) reported complete smoking cessation. The median decline in the number of cigarettes used was 58.3% (IQR: 16.7%–100%). On univariable analysis (Table IV), no factors were significantly predictive of smoking cessation, but reporting more than 10 initial cigarettes (compared with 10 or fewer) was significantly predictive of smoking reduction [odds ratio: 5.04; 95% confidence interval (CI): 1.46 to 17.45; $p = 0.011$].

Compared with the previous iteration of our smoking cessation program in 2015–2016, which required patients to pay for NRT, the 2017–2018 iteration found that rates of patient referral and patients attending a referral appointment were significantly higher (100% vs. 80.3%, $p < 0.001$, and 27.6% vs. 11.3%, $p < 0.001$, respectively).

DISCUSSION

Continued smoking has been associated with worse oncologic outcomes and treatment-related adverse events. A 2019 meta-analysis examined the effects of smoking on patients with head-and-neck cancer undergoing radiotherapy[3]. The analysis spanned twenty-four studies comprising 6332 patients and found that continued smoking was associated with a higher risk of mortality (relative risk: 1.85; 95% CI: 1.55 to 2.21; $p < 0.001$) and of locoregional failure (relative risk: 2.24; 95% CI: 1.42 to 3.52; $p < 0.001$). Although the authors were unable to perform a quantitative analysis of toxicity data, a qualitative synthesis suggested that smoking was also associated with worse late treatment-related adverse events. Similar conclusions were reached in non-small-cell lung cancer, with a 2010 meta-analysis of

TABLE II Baseline characteristics of enrolled patients

Characteristic	Value
Age (years)	
Median	60.7
IQR	54.3–67.4
Sex [*n* (%)]	
Women	36 (50.7)
Men	35 (49.3)
Follow-up (months)	
Median	9
IQR	5.7–11.6
NRT dose [*n* (%)]	
7 mg	14 (19.7)
14 mg	27 (38.0)
21 mg	23 (32.4)
Multiple	7 (9.9)
Initial cigarettes smoked	
Median	15
IQR	10–20
Years smoked	
Median	40
IQR	30–50
Primary disease site [*n* (%)]	
Breast	10 (14.1)
Colorectal	7 (9.9)
Gynecologic	6 (8.5)
Head and neck	12 (16.9)
Lung	23 (32.4)
Other	13 (18.3)
Treatment intent [*n* (%)]	
Curative	58 (81.7)
Palliative	13 (18.3)
Specialty of primary oncologist [*n* (%)]	
Radiation oncology	51 (73.9)
Medical oncology	8 (11.6)
Other	10 (14.5)
Wake-to-smoke interval (minutes)	
Median	20
IQR	10–30
Quit importance (1–5 Likert scale)	
Median	5
IQR	5–5
Patient quit confidence (1–5 Likert scale)	
Median	3
IQR	2.5–4

IQR = 25%–75% interquartile range; NRT = nicotine replacement therapy.

TABLE III Smoking cessation outcomes

Outcome	Value
Smoking status [*n* (%)]	
Cessation	25 (35.2)
Decrease	32 (45.1)
No change	7 (9.9)
Increase	7 (9.9)
Decrease in cigarettes (%)	
Median	58.3
IQR	16.7–100

IQR = 25%–75% interquartile range.

five studies (860 patients with non-small-cell lung cancer) reporting that continued smoking was associated with increased risks for mortality (hazard ratio: 2.94; 95% CI: 1.15 to 7.54) and recurrence (hazard ratio: 1.86; 95% CI: 1.01 to 3.41)[9].

We previously reported on enrolment data from our program in 2015–2016 at a time when we provided only counselling and follow-up results[8]. The present study suggests that, compared with a prior cohort of patients from our centre, the more recent cohort, who were provided with free NRT, showed higher rates of patient referral and smoking reduction. No identified factors were predictive for smoking cessation, and only a report of more than 10 initial cigarettes compared with 10 or fewer was significantly predictive of smoking reduction.

The cost of NRT varies depending on jurisdiction, formulation, and dose, with a 12-week course estimated to cost between $125 and $340 in Canada[10]. Cost-effectiveness analyses of NRT have been published, with one study reporting an incremental cost per life–year saved of $2,527 for a 45-year-old male smoker[11]. That incremental cost is relatively small compared with the drugs used in primary prevention of disease or in chemotherapy, which often carry an incremental cost per life–year saved well in excess of $10,000[12].

Literature about the effectiveness of various smoking cessation interventions for the general public is abundant[4–6]. A 2011 meta-analysis examined the effectiveness of interventions in cancer patients specifically[7]. The pooled analysis of eight randomized controlled trials comprising 1304 patients showed no significant difference in cessation rates. However, it showed a trend toward higher rates of cessation in trials combining pharmacologic and behavioural interventions. Similar reviews have been performed for specific cancer types, although the availability of evidence is more limited[9,13,14].

The results from a similar smoking cessation program at a cancer centre in Australia were published in 2016[15]. That prospective single-cohort study provided combined pharmacologic and behavioural interventions to actively smoking patients with cancer. The authors described an abstinence rate of 24% (95% CI: 14% to 36%) in enrolled patients—a rate similar to that observed in the present study. Interestingly, the Australian authors also identified

TABLE IV Univariable logistic regression models predictive of smoking cessation and reduction

Dependent variable	Comparator	Smoking cessation				Smoking reduction			
		OR	95% CI	*p* Value	*C*	OR	95% CI	*p* Value[a]	*C*
Age	Per 5 years	0.93	0.73 to 1.18	0.551	0.526	0.98	0.73 to 1.31	0.888	0.504
Women	Men	2.31	0.85 to 6.30	0.102	0.603	0.72	0.22 to 2.35	0.592	0.540
NRT dose				0.277	0.597			0.396	0.642
14 mg	7 mg	1.25	0.31 to 5.11	0.756		1.14	0.27 to 4.84	0.856	
21 mg	7 mg	1.09	0.25 to 4.71	0.904		4.20	0.66 to 26.89	0.130	
Multiple	7 mg	6.25	0.84 to 46.57	0.074		2.40	0.22 to 26.82	0.477	
Initial cigarettes	Per 10 units	1.04	0.62 to 1.73	0.892	0.525	1.52	0.75 to 3.07	0.245	0.652
>10	≤10	1.51	0.52 to 4.35	0.447	0.545	5.04	1.46 to 17.45	**0.011**	0.690
>20	≤20	0.80	0.24 to 2.62	0.707	0.520	1.95	0.39 to 9.81	0.416	0.551
Site of primary tumour				0.673	0.585			0.320	0.719
Breast	Lung	0.87	0.19 to 3.92	0.853			NR		
Head and neck	Lung	0.43	0.09 to 2.03	0.289		2.32	0.23 to 23.42	0.477	
Other	Lung	0.58	0.18 to 1.87	0.359		0.40	0.10 to 1.53	0.180	
Palliative	Curative	2.59	0.76 to 8.82	0.127	0.575	0.78	0.18 to 3.32	0.737	0.519
Specialty of primary oncologist				0.557	0.559			0.393	0.640
Medical	Radiation oncology	2.19	0.49 to 9.87	0.309			NR		
Other	Radiation oncology	1.46	0.36 to 5.89	0.597		0.37	0.09 to 1.55	0.172	
Years smoked	Per 10 years	0.93	0.59 to 1.44	0.731	0.523	0.87	0.50 to 1.51	0.620	0.575
Wake-to-smoke interval	Per 10 minutes	0.92	0.74 to 1.13	0.412	0.474	0.87	0.72 to 1.06	0.166	0.563
Quit importance	Per 1 unit	0.90	0.40 to 2.06	0.809	0.512	1.52	0.61 to 3.74	0.367	0.580
Patient quit confidence	Per 1 unit	1.28	0.84 to 1.96	0.245	0.609	1.20	0.73 to 2.00	0.472	0.583

[a] Sole significant value shown in boldface type.
OR = odds ratio; CI = confidence interval; *C* = concordance index; NRT = nicotine replacement therapy; NR = not reported.

2 factors associated with abstinence (readiness to quit and severe toxicity requiring hospitalization); in contrast, our study did not find any factors associated with cessation.

In our single-cohort study, no comparator was available to quantify the effectiveness of our smoking cessation interventions compared with standard clinical care. The generalizability of our conclusions is also limited, given that our work was conducted in a single institution. Because the median follow-up was 9 months, extrapolating conclusions about long-term cessation rates would be difficult. Further work could extend the follow-up time to examine long-term effects and could give consideration to other factors not captured in the present study.

CONCLUSIONS

This prospective single-cohort study of a smoking cessation program that piloted free NRT demonstrated rates of referral and acceptance of NRT that were improved compared with rates observed during the earlier program iteration. It also showed that most patients either decreased their cigarette use or quit entirely. Smoking cessation has been shown to be associated with benefits even after a diagnosis of cancer; it should be an important aspect of a patient's cancer journey.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood *Current Oncology*'s policy on disclosing conflicts of interest, and we declare the following interests: AVL has received honoraria from Varian Medical Systems Inc. and AstraZeneca. All other authors have no conflicts of interest to disclose.

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