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Effectiveness of a large-scale distribution programme of free nicotine patches: a prospective evaluation

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Summary

Background After an increase in cigarette taxes and implementation of smoke-free workplace legislation, the New York City Department of Health and Mental Hygiene, the New York State Department of Health, and the Roswell Park Cancer Institute undertook large-scale distribution of free nicotine replacement therapy (NRT). We did a 6-month follow-up survey to assess the success of this programme in improving smoking cessation on a population basis.

Methods 34 090 eligible smokers who phoned a toll-free quitline were sent a 6-week course of nicotine patches (2 weeks each of 21 mg, 14 mg, and 7 mg per day). Brief follow-up counselling calls were attempted. At 6 months after treatment, we assessed smoking status of 1305 randomly sampled NRT recipients and a non-randomly selected comparison group of eligible smokers who, because of mailing errors, did not receive the treatment. NRT recipients were compared with local survey-derived data for heavy smokers in New York City.

Findings An estimated 5% of all adults in New York City who smoked ten cigarettes or more daily received NRT; most (64%) recipients were non-white, foreign-born, or resided in a low-income neighbourhood. Of individuals contacted at 6 months, more NRT recipients than comparison group members successfully quit smoking (33% vs 6%, $p < 0.0001$), and this difference remained significant after adjustment for demographic factors and amount smoked (odds ratio 8.8, 95% CI 4.4–17.8). Highest quit rates were associated with those who were foreign born (87 [39%]), older than 65 years (40 [47%]), and smoked less than 20 cigarettes per day (116 [35%]). Those who received a counselling call were more likely to stop smoking than those who did not (246 [38%] vs 189 [27%], $p = 0.001$). With the conservative assumption that every 6-month follow-up survey non-respondent continued to smoke, the stop rate among NRT recipients was 20%. At least 6038 successful quits were attributable to NRT receipt, and cost was US\$464 per quit.

Interpretation Easy access to cessation medication for diverse populations could help many more smokers to stop.

Introduction

The use of tobacco kills about 5 million people worldwide every year.¹ If present patterns continue, it will cause 10 million deaths yearly by 2025.¹ Although prevention of smoking initiation is important, increased cessation will provide rapid health benefits. The benefits of giving up smoking are well documented,² and more than 70% of smokers in the USA are interested in stopping, with roughly half trying to quit each year.³ Of these, most attempt to stop smoking without counselling or medication.⁴ As a result, only 7% successfully stop smoking for a year or more.⁵ Universal access to effective treatment of tobacco dependence could prevent millions of premature deaths.^{6,7}

Smokers who use nicotine replacement therapy (NRT) are 1.5 to 2 times more likely to quit than those who do not use such treatment.^{5,8} Improved management of tobacco dependence in clinical settings^{5,7} is a strategy used to improve use of NRT and other effective treatments. Insurance coverage of NRT can increase both use of this treatment and stopping rates among smokers.⁹ However, since many smokers will not be reached by cessation treatment offered in clinical settings, provision of free NRT outside the health-care system is a complementary and potentially effective strategy.^{10–13}

In 2003, the New York City Department of Health and Mental Hygiene (NYC DOHMH), in collaboration with the New York State Department of Health and the Roswell Park Cancer Institute, undertook a large-scale distribution programme of free NRT. The programme was done in the context of rises in city and state cigarette taxes, implementation of smoke-free workplace regulations that covered virtually all establishments (including restaurants and bars), public anti-smoking messages focused on the health risks of second-hand smoke, and promotion of tobacco cessation in clinical practice through education of physicians citywide. Our aim was to help people to stop smoking and to assess the effectiveness of the programme.

Methods

Intervention

On April 2, 2003, the NYC DOHMH announced the availability of free 6-week courses of NRT patches to the first 35 000 eligible smokers to call the New York State Smokers' Quitline. All major metropolitan newspapers and television and radio stations reported the programme launch. Neighbourhood-specific media and promotional efforts were used to reach populations with the highest prevalence of heavy smokers. Call volume

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overwhelmed available response lines in the first days of the programme. From April 2, to May 14, 2003, more than 38 000 callers were screened for eligibility to receive free NRT patches. To qualify for free treatment, smokers had to be at least 18 years of age, a resident of New York City, have no medical contraindications to NRT patch use, not be using other NRT or bupropion, agree to attempt to quit in the week after the screening call, have smoked ten or more cigarettes per day for at least a year, and agree to be contacted for follow-up.

NRT patches were sent to 34 090 individuals. Kits contained a 2-week supply each of generic 21 mg, 14 mg, and 7 mg patches; instruction sheets in English and Spanish; patient information from the manufacturer; a self-help stop-smoking guide; and a list of local services for smoking cessation. Counselling calls, averaging 3 min, were attempted to all NRT recipients at 3 weeks and again at about 14 weeks after the intake call. Counselling included advice on patch usage, management of adverse reactions, and encouragement to start or continue a quit attempt. Telemarketing staff, trained by NYC DOHMH, made the calls using a computer-assisted script. Of the NRT recipients, 15 212 (45%) received at least one counselling call, and 5128 (15%) received two calls.

6-month follow-up survey

Of the 34 090 individuals to whom patches were sent, we attempted to recruit a random sample of 2150 NRT recipients after excluding: individuals randomly sampled for a separate cohort study (1597; 5%); those needing translation services for the NRT eligibility interview (358; 1%); those for whom conflicting information was obtained on receipt of patches (42; <1%); and those whose NRT patches were returned undelivered because of address errors (506; 1%). Those with address errors constituted a non-randomly selected comparison population for assessing quit rates (figure). We did the follow-up survey about 6 months after most NRT recipients would have started treatment. Before the survey, potential participants were sent a recruitment letter. Individuals in the study sample were telephoned between Oct 31, and Nov 19, 2003. Those not reached after 13 attempts were mailed a self-administered questionnaire; responses postmarked by Dec 30, 2003, were included in the study. Public transit cards were mailed as incentives to encourage response.

The 6-month follow-up survey included questions on baseline and current smoking status, attempts to quit, and more detailed demographics than were obtained at enrolment. A successful quit was defined as a “no” response to the question: “Have you smoked a cigarette, even a puff, in the last 7 days?”¹⁴ A quit attempt was defined by a “yes” response to the question: “Since you called for the free patches, have you stopped smoking for a day or longer because you were trying to quit smoking?”¹⁵ To determine programme penetration and

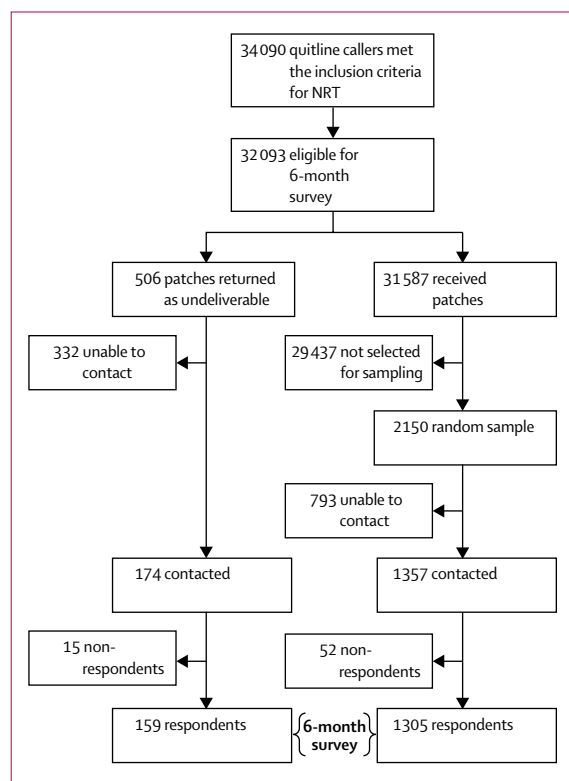


Figure: Survey sample selection

patterns of cessation, respondents were asked to state their ethnic origin. Zip code of residence at the time of enrolment was used to assign NRT recipients to specific neighbourhoods,¹⁶ which were grouped into three categories (<30%, 30–44%, ≥45%) on the basis of the percentage of people living in households with an income less than 200% of the federal poverty level.

To assess the population penetration of the NRT distribution, we compared the characteristics of NRT recipients with those of New York City residents who smoked ten or more cigarettes per day (NYC heavy smokers) on the basis of data from the Community Health Survey, a New York City neighbourhood-level telephone survey similar to the CDC Behavioural Risk Factor Surveillance System. For characteristics not assessed in all NRT recipients, 6-month survey respondents were compared with NYC heavy smokers. Because Community Health Survey estimates are from a cluster survey design, a simple χ^2 test could not be used to assess differences in proportions between NRT recipients and NYC heavy smokers from that survey. Instead, significant differences between proportions of smokers were assessed by dividing each by its standard error, estimated as the square root of estimated joint variance (the sum of the variance estimates of the compared proportions), and comparing the result to the critical value ($\alpha=0.05$, two-tailed) of a standard normal deviate.¹⁷ To assess possible response bias in NRT

recipients, characteristics of the 6-month survey respondents and other recipients were compared using χ^2 tests.

We compared the proportions of reported quit attempts and successful quits in NRT recipients with those to whom NRT was sent but returned undelivered. We also compared quit rates among NRT recipients for those who were and were not reached for counselling calls. Logistic regression analyses were used to identify respondent characteristics associated with successful quits and to adjust, for these characteristics, the relative odds of stopping in NRT recipients compared with non-recipients. We used logistic models to assess the effect of counselling calls to NRT recipients and potential interactions between receipt of counselling calls and NRT recipient characteristics to identify groups more likely to have benefited from counselling. Goodness of fit for all logistic models was assessed with the Hosmer-Lemeshow test.¹⁸ We reported only unweighted estimates since weighting for differential response rates yielded similar estimates. Telephone and mail responders reported similar quit rates; their data are combined in the results. To estimate the minimum total number of quits attributable to the NRT distribution, we assumed all survey non-respondents were still smoking. All analyses were done with SAS (version 8.01). Statistical significance was set at a two-sided 0.05 alpha level.

Our estimate of the added cost of this programme included costs of NRT purchase and shipping, additional Quitline staff for the increase in call volume, and staff to make counselling calls. The cost estimate did not include existing staff or infrastructure of the NYC DOHMH tobacco control programme and Quitline that supported the NRT distribution. The NYC DOHMH institutional review board approved the study.

Role of the funding source

Staff of the NYC DOHMH, which sponsored the study and the NRT distribution, designed the study and participated in data collection, data analysis, data interpretation, and writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Of the people in the random sample, about 60% of NRT recipients participated in the 6-month follow-up survey (figure); of these, 966 (74%) were interviewed 24–33 weeks (median 29 weeks) after their intake call, and 339 (26%) returned completed questionnaires 28–39 weeks (median 33 weeks) after their intake call. Of non-respondents, 793 (94%) could not be reached, 34 (4%) were ineligible to participate in the programme or submitted incomplete surveys, and 18 (2%) refused to participate. Of the 506 people in the comparison group

who were mailed but never received patches, 159 (31%) responded to the 6-month follow-up survey and constituted a non-randomly selected comparison for quit rate (figure). Of non-recipients who did not participate in the follow-up survey, 332 (96%) could not be reached, ten (3%) were ineligible to participate in the programme or submitted incomplete surveys, and five (1%) refused to participate.

An estimated 5% of all NYC heavy smokers (ten cigarettes per day or more) and 15% of those smoking more than one pack of 20 cigarettes per day received free NRT throughout this programme (table 1). More NRT recipients than NYC heavy smokers were women ($p < 0.0001$) and aged 25–44 ($p = 0.001$), and fewer were aged 18–24 years or 65 years and older ($p = 0.035$). Similar proportions of NYC heavy smokers and NRT

	NYC heavy smokers*†	NRT recipients†	Proportion of NYC heavy smokers participating in programme‡	6-month survey respondents†
Total	679 307	33 542	5%	1305
Sex				
Men	362 643 (53%)	13 944 (42%)§	4%	511 (39%)¶
Women	316 664 (47%)	19 544 (58%)§	6%	792 (61%)¶
Age, years				
18–24	65 753 (10%)	2 419 (7%)§	4%	67 (5%)
25–44	299 216 (45%)	16 793 (50%)§	6%	595 (46%)
45–64	247 422 (37%)	12 561 (37%)	5%	558 (43%) ¶
≥65	54 826 (8%)	1 796 (5%)§	3%	85 (7%)
Borough of residence				
Bronx	109 546 (16%)	6 346 (19%)§	6%	239 (18%)
Brooklyn	179 885 (26%)	8 537 (25%)	5%	324 (25%)
Manhattan	127 080 (19%)	4 976 (15%)§	4%	180 (14%)¶
Queens	207 130 (30%)	7 469 (22%)§	4%	319 (24%)¶
Staten Island	55 666 (8%)	6 213 (19%)§	11%	243 (19%)¶
Neighbourhood income**				
>45–90%	169 033 (31%)	9 863 (29%)	5%	371 (28%)
30–44%	141 574 (37%)	12 861 (38%)	5%	500 (38%)
<30%	100 042 (31%)	10 775 (32%)	5%	433 (33%)
Ethnic origin				
Non-Hispanic white	341 761 (50%)	NA	NA	618 (47%)
Non-Hispanic black	123 253 (18%)	NA	NA	314 (24%)¶
Hispanic	139 892 (21%)	NA	NA	210 (16%)¶
Asian Pacific Islander	45 653 (7%)	NA	NA	49 (4%)
Other	28 748 (4%)	NA	NA	114 (9%)
USA-born				
Yes	499 009 (74%)	NA	NA	1108 (86%)¶
No	179 952 (27%)	NA	NA	178 (14%)¶
Packs per day at time of enrolment				
<1 pack	349 441 (51%)	7 340 (22%)§	2%	293 (22%)¶
1 pack (20 cigarettes per day)	246 489 (36%)	13 828 (41%)§	6%	547 (42%)¶
>1 pack	83 377 (12%)	12 373 (37%)§	15%	465 (36%)¶
Counselling call				
None	NA	18 330 (55%)	NA	649 (50%)
>1	NA	15 212 (45%)	NA	656 (50%)

NA=No data available. *Estimated from the NYC Community Health Survey 2002. Heavy smokers defined as those smoking ten or more cigarettes per day. †Percentages may not add up to 100 because of rounding. ‡Number of NRT recipients divided by the survey-derived estimate of NYC heavy smokers. §Significant difference in proportion between heavy smokers in NYC and NRT recipients, $p < 0.05$. ¶Significant difference in proportion between the 6-month survey respondents and heavy smokers in NYC, $p < 0.05$. ||Significant difference in proportions between the 6-month survey respondents compared with the proportion of NRT recipients, $p < 0.05$. **Based on Zip code of residence at the time of enrolment, % of people living in households with incomes less than 200% of the poverty level.

Table 1: Characteristics of heavy smokers in New York City

recipients resided in low-income neighbourhoods. Although ethnic origin and place of birth were not available for all NRT recipients, survey respondents were more likely to be black ($p=0.036$) and less likely to be foreign-born ($p<0.0001$) than were NYC heavy smokers. When compared with NRT recipients overall, those who responded to the survey were more likely to be age 45–64 years ($p=0.044$) and to have received telephone counselling as part of this programme ($p=0.0005$) (table 1).

Of respondents who provided demographic data, those in the comparison group (eligible callers who did not receive NRT) were more likely than those in the NRT recipient group to be men (78 [49%] vs 511 [39%], $p=0.01$), of younger age (101 [64%] vs 595 [46%] were 25–44 years, $p<0.0001$), and residing in low-income neighbourhoods (67 [42%] vs 371 [28%], $p<0.0001$), and less likely to be white (36 [23%] vs 618 [47%], $p<0.0001$). Comparison group respondents were also less likely to be born in the USA (107 [70%] vs 1108 [86%], $p<0.0001$). The proportion of individuals smoking more than one pack per day did not differ between groups (56 [35%] vs 465 [36%], $p=0.92$).

Overall, 1135 (87%; 95% CI 86–89) of NRT recipients who provided data on quit attempts reported that they had attempted to stop since requesting NRT, compared with 84 (54%) of comparison group respondents (odds ratio 6.0; 95% CI 4.2–8.6). 435 (33%) NRT recipients and ten (6%) comparison group respondents reported successful quits ($p<0.0001$) (table 2). Successful quitters were more likely to report using all the patches received than those still smoking at 6 months (205 [51%] vs 192 [24%], $p<0.0001$). NRT recipients who did not quit reported a decrease in cigarette consumption. At the intake call, 652 (79%) of those still smoking at the 6-month follow-up reported smoking one pack per day or more (median 20 cigarettes), whereas at the 6-month follow-up 227 (28%) of those still smoking reported smoking one pack per day or more (median ten cigarettes, $p<0.0001$).

Cessation rates were significantly higher in survey respondents who were 65 years and older, foreign-born, Asian, and smoking less than one pack per day at baseline (table 2). Neighbourhood income level and educational attainment were not associated with quit success. In a multivariate logistic model, NRT receipt was associated with successful quit after adjustment for demographics and smoking status (table 2).

NRT recipients who received counselling calls were more likely to stop (246 [38%] vs 189 [29%], adjusted odds ratio 1.5; 95% CI, 1.1–1.9) than those who did not. Consistent with this finding, 25% (62/246) of those who received calls and ultimately quit smoking reported at the time of the call they were still smoking, and thus stopped after being called. There was a significant ($p=0.02$) interaction between receipt of a counselling call and level of smoking at baseline. In those who smoked less than one pack per day at enrolment, quit

rates were higher in those who received a counselling call (73 [50%] vs 40 [27%], $p<0.0001$) than in those who did not. By contrast, quit rates in those smoking more than one pack per day at baseline were similar to rates in those who did and did not receive a counselling call (72 [29%] and 59 [27%], respectively). On the conservative assumption that all follow-up survey non-respondents continued to smoke, the minimum proportion of all NRT recipients who quit was 20% (435), compared with 2% (ten) of comparison group participants, which is an attributable quit rate of 18%, or 6038 people. Incremental programme cost estimates included NRT purchases (US\$2.5 million), additional Quitline staff and shipping costs (\$200 000), and cost of staff making counselling calls (\$100 000). Thus the rough additional cost of the free patch distribution programme was \$2.8 million, with the cost per successful quit attributable to the programme estimated at \$464 (\$266 if the 33% quit rate among survey respondents is used).

	Quit rate n (%)	Odds ratio (95%CI)	Adjusted odds ratio (95%CI)*
Received free patches			
Comparison group	10 (6%)	Reference†	Reference†
NRT recipients	435 (33%)	7.4 (3.9–14.3)	8.8 (4.4–17.8)
Sex			
Female	272 (31%)	Reference	Reference
Male	171 (29%)	0.9 (0.7–1.1)	0.9 (0.7–1.2)
Age-group, years			
18–24	29 (37%)	1.4 (0.9–2.3)	1.4 (0.9–2.4)
25–44	203 (29%)	Reference†	Reference‡
45–64	173 (29%)	1.0 (0.8–1.2)	1.0 (0.7–1.2)
≥65	40 (47%)	2.2 (1.4–3.4)	2.0 (1.2–3.2)
Educational attainment§			
<High School	56 (28%)	Reference	Reference
High School graduate	161 (33%)	1.2 (0.9–1.8)	1.3 (0.9–2.0)
College or higher	227 (30%)	1.1 (0.8–1.5)	1.1 (0.8–1.6)
Neighborhood Income – % <2× poverty level¶			
>45–90%	118 (27%)	Reference	Reference
30–44%	176 (31%)	1.2 (0.9–1.6)	1.2 (0.9–1.6)
<30%	150 (33%)	1.3 (1.0–1.8)	1.2 (0.8–1.6)
Race			
Non-Hispanic White	212 (32%)	Reference‡	Reference
Non-Hispanic Black	101 (27%)	0.8 (0.6–1.0)	0.9 (0.6–1.2)
Hispanic	65 (26%)	0.7 (0.5–1.0)	0.9 (0.6–1.2)
Asian Pacific Islander	29 (45%)	1.7 (1.0–2.9)	1.8 (1.0–3.3)
Other	38 (29%)	0.9 (0.6–1.3)	1.1 (0.7–1.7)
US-born			
Yes	351 (29%)	Reference†	Reference†
No	87 (39%)	1.6 (1.2–2.1)	1.7 (1.2–2.4)
Packs per day at time of enrolment			
<1 pack	116 (35%)	1.5 (1.1–2.1)	1.6 (1.2–2.3)
1 pack (20 cigarettes per day)	194 (32%)	1.4 (1.0–1.8)	1.4 (1.1–1.9)
>1 pack	134 (26%)	Reference‡	Reference†

*Odds ratios are adjusted for all other variables in the table. The adjusted model has 1434 observations due to missing data on one or more characteristics. † $p<0.01$ (Wald χ^2 test). ‡ $p\leq 0.05$ (Wald χ^2 test). §Educational level describes total educational level attained and does not refer to age-groups. ¶Based on zip code of residence at the time of enrolment, % of persons living in households with incomes less than 200% of the poverty level.

Table 2: Odds ratios and 95% CIs for quit rate according to treatment and sociodemographic characteristics (n=1464)

Discussion

Our findings show the feasibility and effectiveness of a large-scale programme that used existing telephone helplines to screen smokers for NRT eligibility and to post a full course of free NRT patches directly to those who were eligible, reaching an estimated 5% of all heavy smokers in New York City in a 6-week period. On the conservative assumption that all the non-respondents to our follow-up survey sample continued to smoke, one in five NRT recipients, more than 6000 New Yorkers (about 1% of the city's smokers), stopped smoking as a result of this programme. If non-respondents stopped in similar proportions to survey respondents (33%), the programme accounted for more than 10 500 quits. Although New York City implemented this programme at a time when new smoke-free workplace legislation and increased taxation on cigarettes focused public attention on cessation, these findings suggest the potential for similar interventions to encourage large numbers of smokers to attempt to quit smoking.¹⁹

The programme's penetration among a diverse group of smokers could indicate a large unmet demand for cessation assistance that keeps both cost and logistical barriers to NRT receipt to a minimum. Penetration was similar in poor and affluent neighbourhoods, and based on 6-month survey respondents more than half of recipients were non-white. A reduction in the cost of NRT has increased use and cessation in some studies,^{10-13,19} but not others.^{20,21} This conflicting evidence suggests that other factors, such as convenience, should also be addressed. Some free NRT distribution efforts could still pose logistical barriers if smokers are asked to redeem vouchers,¹¹ travel to a pick-up location,¹² purchase additional medication, or receive counselling to complete a course of treatment. By contrast, the New York City programme mailed a free, full 6-week course of treatment directly to eligible callers and attempted to provide 3-min counselling calls to all recipients.

The New York City programme reached some groups more successfully than others. Women were more likely to participate, whereas adults 65 years and older and foreign-born smokers were under-represented in NRT recipients, a finding reported elsewhere.^{4,10,22-24} In our programme, stop rates were higher in these under-represented groups than in others. The promotion might not have reached these groups, or individuals could have been more readily discouraged by busy telephone signals at the start of the programme, or were less willing to provide a mailing address. At the same time, having overcome barriers to participation, these participants might have represented an especially motivated group of smokers.

The estimated quit rate of 33% in survey respondents who received NRT and 20% based on the conservative assumption of a 0% quit rate in survey non-responders, is high compared with most other mass NRT distribution programmes¹² and with clinical trials of

NRT patches.⁵ However, a recent effort that combined telephone counselling with free NRT yielded a similar quit rate in those followed up at 6 months (31%), although the intention-to-treat calculation resulted in a reduced rate (13%).²⁵ The estimated quit rate in our analysis is based on participants' self-reports 6 months after the start of the programme, which lack biochemical validation, and on complete abstinence from smoking in the past week. This method probably overestimates the proportion of NRT recipients who will remain abstinent over time.²⁶ However, most other estimates have used similar methods and definitions.^{8,12} Contextual factors related to overall New York City tobacco control efforts might also have played a part.^{6,27-30}

Some participants would have succeeded in quitting without receiving NRT. Without a randomised trial, the added benefit of NRT is impossible to quantify. A group that was eligible for, but did not receive NRT because of mailing address errors, provided an estimate of the quit rate in the absence of free NRT. Although this group was not a randomly assigned control group, that the quit rate in this comparison group (6%) was similar to the quit rate in reports of those who attempted to quit without the assistance of medication or counselling (7%) is noteworthy.⁵ With the assumption that all non-respondents continued to smoke, the quit rate in the comparison group was about 2%. By either estimate, NRT receipt substantially increased the probability of quitting.

The benefit of a brief telephone counselling call is consistent with other evidence;³¹ of note, this call was only effective in those who smoked less than 20 cigarettes per day in our programme. The quit rate for those who received at least one counselling call in this group of smokers (ten to 19 cigarettes per day) was 50%, and was higher than for those who did not receive a counselling call. However, counsellors reached only about half of NRT recipients. Those not receiving counselling calls could have had lower quit rates because of other factors associated with being difficult to contact.

At a modest added cost, we were able to reach a large number of smokers with medication and brief counselling, which improved the success of quit attempts. Individuals who called were probably more motivated to quit than those who did not call, and the quit rates estimated from this short-term initiative might not be achieved by making free NRT more widely available on a continuing basis. However, most smokers wish to quit, and this programme shows that making patches free and convenient can induce large numbers of smokers to make a quit attempt. Furthermore, nearly all NRT recipients made an attempt to stop. For some who did not succeed, this attempt may presage future successful quits. Although NRT recipients who were initially heavy smokers were less likely to quit, consistent with findings in other studies,³² most had reduced their cigarette consumption substantially at follow-up. These lighter smokers might be more likely to quit in the future.^{33,34}

Although our study sample was not completely representative and quitting was not biochemically validated, and although those who quit at 6 months might resume smoking, the health effect of this intervention is likely to be substantial. Even if only half of NRT recipients who successfully quit remain permanently abstinent and one in three would have died prematurely due to smoking had they continued to smoke,² more than 1000 premature deaths were averted as a result of this initiative.

Public-health agencies seek ways of implementing tobacco cessation programmes on a population basis. A quitline-driven free NRT distribution programme with brief counselling can reach thousands of smokers with an affordable, safe intervention that will help save lives.

Contributors

N Miller, T R Frieden, F Mostashari, and C Chang participated in all stages of the design, implementation, analysis, and preparation of the report; S Y Liu, K M Cummings, M T Bassett, and U Bauer contributed to programme design and implementation; T D Matte, S Y Liu, D R Deitcher, and M T Bassett assisted with analysis, interpretation, and report writing; all authors critically reviewed drafts of the article and approved the final report.

Conflict of interest statement

We declare that we have no conflict of interest.

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