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Implementing a hospital-based smoking cessation programme: Evidence for a learning effect

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Abstract

Objective: This study assessed a newly set-up, hospital-based smoking cessation clinic with regard to continuous abstinence rates and the effectiveness of concomittant nicotine replacement therapy.
Methods: Smoking status of 369 participants of this 8-week cognitive-behavioural smoking cessation group programme was obtained using exhaled carbon monoxide at the end of the course as well as self-report 6 months after the course. In addition to demographic data, FTND score, SDS score, and usage of nicotine replacement products were recorded.
Results: Overall, 29.8% of all participants reported to have been continuously abstinent for 6 months after the course. Success rates increased significantly during the first year after initiation of the programme (from 15 to 35%, $p < 0.001$), indicating a learning process of the staff running the course. Nicotine replacement therapy was used by 51.3% of participants, but 58% of these discontinued its use within 5 weeks. Nicotine substitution for more than 5 weeks was associated with a 50% success rate after 6 months.
Conclusions: Our data indicate a learning effect of smoking cessation course staff and a possible minimum duration required for nicotine replacement to be effective.
Practice implications: The observed learning effect in smoking cessation programmes should be considered when evaluating newly established interventions of this kind. Patients tend to stop nicotine replacement therapy too early, thereby decreasing their chances of middle-term abstinence.

Keywords: Learning effect; Smoking cessation; Nicotine replacement therapy; Group programme

1. Introduction

Smoking is the leading cause of preventable death in the developed world [1,2], and smoking cessation is highly effective in reducing morbidity and mortality [3]. However, population cessation rates are generally low at around 2.5% per year [4] due to the highly addictive nature of nicotine [5]. Still, at any given time, one-third of smokers is actually willing to quit smoking [6]. The most effective intervention for this group of smokers is an intensive behavioural cessation programme that includes the use of pharmacological aid [7].

Previous studies evaluating such programmes have mainly focused on interventions that were part of clinical trials under controlled conditions. However, success rates and their time-course in a ''real-life'' clinical setting have not been studied in great depth. Questions to be addressed are whether success rates of cessation programmes improve over time and to which extent participants are willing to take nicotine replacement medications when they are not supplied in the context of a clinical trial.

In most smoking cessation guidelines, a maximum NRT treatment course of 8 weeks is recommended [8], but there is little information as to whether there is a minimum duration needed for NRT to be effective. Indeed, it has been stated that one of the most important mistakes in the application of nicotine substitution is for the treatment course to be ''too short'' [9].

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The aim of the present study was to assess a newly set-up, hospital-based smoking cessation programme in terms of changes in its medium-term success rates over a period of 2 years and to determine predictors of continuous abstinence following the course.

2. Methods

2.1. Description of the course

In March 2003 an intensive behavioural support smoking cessation programme was established at Goettingen University Hospital [10]. Courses were conducted based on a concept published by Unland [11] and consisted of eight weekly sessions lasting 90–120 min each, with a maximum of 14 participants per group. The Unland concept was designed to address smokers willing to quit and was based on published recommendations for smoking cessation interventions as of 1995. Up until now, peer-reviewed reports of success rates of the course concept used have not been available. Key features of the cognitive-behavioural approach included the exploration of participants' attitudes towards smoking as well as expectations towards the course, enhancement of motivation and the development of strategies for relapse prevention. The course manual contained instructions for the staff running the course including short presentations on the mechanisms of nicotine addiction and material to be completed by participants (e.g. working out replacement behaviours for smoking). During the first sessions, medical and psychological issues were discussed, and participants were asked to observe their own smoking behaviour. An individual quit date between the fourth and fifth session was chosen by each participant. During the remainder of the course, coping skills and relapse prevention were addressed. As an adjunct, sessions of relaxation training were embedded in the course concept. Participants were charged 120 euros per course of which up to 80% could be reimbursed by their health insurer. Although in the German health care setting, participants have to purchase nicotine replacement therapy products themselves, the use of NRT was greatly encouraged during course sessions. The manual offered information on the rationale and ideal use of NRT products. However, therapy duration as a factor influencing long-term success was not addressed. Questions regarding NRT use were discussed as they arose within the group, but not in a standardized manner. Participants were expected to follow manufacturer's recommendations when applying NRT. The psychologist running the courses attended several specialist workshops on smoking cessation in which general principles were discussed; there was no specific training regarding the Unland concept.

2.2. Recruitment of participants

The programme was offered to hospital staff as well as to the general population, including hospital outpatients. Information was disseminated in local newspaper articles, posters and flyers. Hospital staff enrolling in the programme were granted an extra day off by hospital administration. Before entering the course, each participant's smoking habits were assessed in a separate interview. Nicotine dependence was determined with the Fagerstrom Questionnaire (FTND) [12], and the degree of depressive symptoms was assessed using the self-rating depression scale (SDS) [13].

2.3. Assessment of smoking status and statistical analysis

Smoking status was assessed by means of carbon monoxide concentrations in expired air throughout the course as well as by self-report (telephone interview) at the 6-month follow-up. For each course, individual follow-up dates were calculated; thus, smoking status was captured exactly 6 months after each course. Participants with a CO value above 6 ppm or those lost to follow-up were considered to be smokers. All data were anonymized prior to statistical analysis in order to comply with ethical standards. Since this was an observational post hoc analysis, no separate approval of the local ethics committee was required.

Data were analysed using *t*-tests for continuous and Kruskal–Wallis or Mann–Whitney *U*-tests for categorical variables. Between-group differences on dichotomous variables were analysed with χ^2-tests, employing the Bonferroni adjustment for post hoc analyses of differences between several groups. Logistic regression was used to determine predictors of continuous abstinence. Distributions were found to be non-normal in most cases, thus data are given as median (range) unless otherwise stated. Significance levels were set to 5%.

In order to examine the time-course of success rates after initiation of the programme, participants were subdivided into four consecutive groups of approximately 6 months each to ensure a sufficient sample size per cohort. For these four cohorts, courses were completed between May and December 2003, February and July 2004, July and December 2004, and February and July 2005, respectively. Cohort was used as an independent variable in a multivariate analysis with continuous abstinence at 6 months as outcome variable. In order to avoid confounding by group differences at baseline, all relevant smoking history data were included in the model.

3. Results

3.1. Participant characteristics

Between May 2003 and January 2006, a total of 494 participants joined the programme of which 369 had completed the 6-month evaluation by January 2006. Data for this subgroup of participants are presented in Table 1. Just over half of participants were female (58.8%) and the median age was 45; 19% belonged to our hospital staff. The median age at onset of smoking was 16 years, and participants had been smoking for a median of 29 years. Daily tobacco consumption was 20 cigarettes so that participants had smoked an equivalent of 27.5 pack years when entering the course. The median FTND value was 5, but 13.1% of participants were highly dependent scoring more than 7 points. The median SDS score was 35 and a small

Table 1
Subject characteristics

	Median (range)	*n*
Age (years)	45 (13–73)	369
Onset of smoking (years)	16 (9–32)	369
Cigarettes smoked per day	20 (4–80)	369
Pack years	27.5 (0.9–140)	369
Years smoked	29 (2–56)	369
FTND score	5 (0–10)	357
SDS score	35 (21–58)	353
Number of previous quit attempts	1 (0–12)	362

FTND, Fagerstrom test of nicotine dependence; SDS, self-rating depression scale.

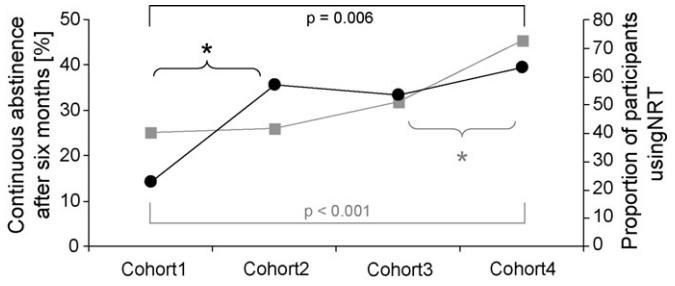

Fig. 1. Time-course of continuous abstinence after 6 months (●) and use of nicotine replacement therapy (■) over the four cohorts. *p*-Values refer to comparisons between all four cohorts. Asterisks indicate a *p*-Value < 0.001 for the comparison of two cohorts.

proportion of participants (5.1%) received scores indicative of significant depression. Only 21% had never tried to give up smoking before. However, 11% of participants had already tried to give up at least five times. Of all participants, about half (43.3%) had completed at least high school.

Participant characteristics across the four cohorts were similar (Table 2). However, the proportion of hospital staff taking part in the programme dropped from the first cohort (43.6%) through to the fourth cohort (8.8%; $\chi^2(3) = 48.772$, $p < 0.001$). An influence of this variable on success rates was evaluated by comparing continuous 6-month abstinence rates of staff members and other participants; no statistical significance was observed ($\chi^2(1) = 0.097$, $p = 0.76$).

3.2. Success rates

At the end of the 8-week course, 72.8% of participants claimed to have given up smoking; an expired air CO concentration of 0–6 ppm was found in 79.4%. Point prevalence at 6 months was 38.0% and continuous abstinence was 29.8%. This analysis includes 15 participants lost to follow-up who were counted as smokers. Participants who were still smoking at the end of the course ($n = 95$) had reduced their median daily cigarette consumption from 20 (6–80) to 8 (1–60) per day ($p < 0.001$). In those participants who either had not stopped smoking during the course or had re-started smoking in the following 6 months ($n = 235$), median cigarette consumption after 6 months was still significantly lower than before starting the course (14 (1–60) versus 20 (5–80) cigarettes per day; $p < 0.001$).

As can be seen in Fig. 1, there was a notable increase in continuous abstinence rates across cohorts ($\chi^2(3) = 12.453$, $p = 0.006$). Further analysis revealed that this was due to a significant rise in continuous abstinence rates at 6 months between the first and the second cohort ($\chi^2(1) = 10.621$, $p < 0.001$) indicating a significant improvement in programme outcome during the first year. Multivariate analysis including continuous abstinence after 6 months as the outcome variable and all other parameters reported in Table 2 as independent variables revealed that belonging to a later cohort was the only parameter significantly associated with higher success rates at 6 months (adjusted OR = 1.38; 95% CI: 1.09–1.76).

In total, 37.2% of participants did not use any pharmacological support; 51.3% used NRT, and 11.5% were prescribed bupropion or took a combination of bupropion and NRT. Due to the small number of participants using bupropion ($n = 40$), only participants using either NRT or no concomittant medication were included in the following set of analyses ($n = 314$).

Overall, NRT use compared to no medication nearly doubled the success rate after 6 months (odds ratio = 1.83; 95% CI: 1.10–3.03).

The proportion of participants using NRT rose significantly over time ($p < 0.001$) mainly due to a sharp increase of NRT use in the fourth cohort (see Fig. 1). In addition, the median duration for which participants took concomittant medication

Table 2
Comparison of subject characteristics in the four cohorts

	Cohort 1, 5/03–12/03 ($n = 79$)	Cohort 2, 2/04–7/04 ($n = 105$)	Cohort 3, 7/04–12/04 ($n = 94$)	Cohort 4, 2/05–7/05 ($n = 91$)	*p*-Value
Age in years [median (range)]	43 (22–67)	46 (15–68)	46 (13–66)	44 (17–73)	0.672
Male [percent (*n*)]	34.2% (27)	41.0% (43)	43.6% (41)	45.1% (41)	0.494
Hospital staff [percent (*n*)]	43.6% (34)	21.9% (23)	5.3% (5)	8.8% (8)	<0.001
Cigarettes smoked per day [median (range)]	20 (6–70)	20 (4–60)	20,5 (6–80)	20 (5–58)	0.605
Pack years [median (range)]	27.5 (3.5–140)	26.7 (1.1–138)	31.4 (1.3–76)	26.3 (0.9–102)	0.922
FTND score [median (range)]	5 (0–9)	5 (0–10)	5,5 (1–9)	5 (0–9)	0.586
SDS score [median (range)]	35 (25–57)	34 (21–58)	33 (21–57)	36 (22–58)	0.187
NRT use [percent (*n*)]	39.2% (31)	41.0% (43)	48.9% (46)	68.1% (62)	0.001
Onset of smoking in years [median (range)]	16 (11–28)	16 (9–30)	16 (11–30)	16 (11–32)	0.98
Number of previous quit attempts [median (range)]	2 (0–10)	1 (0–12)	1 (0–8)	1 (0–10)	0.051

FTND, Fagerstrom test of nicotine dependence; SDS, self-rating depression scale; NRT, nicotine replacement therapy. *p*-Values refer to the Kruskal–Wallis test for continuous variables and to the chi-square test for categorical variables.

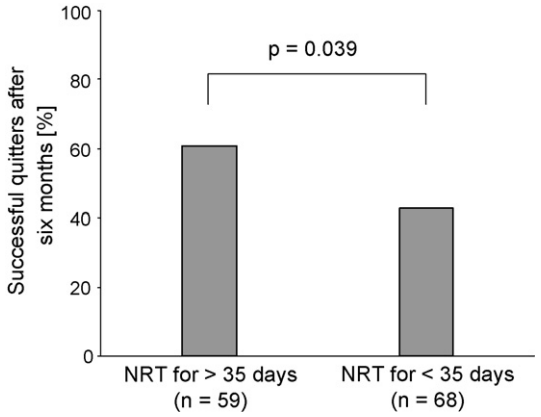

Fig. 2. Influence of duration of nicotine replacement therapy (NRT) on continuous abstinence after 6 months. Only participants who did not relapse before stopping NRT were included.

increased from 21 (5–120) days in the first cohort to 42 (1–270) days in the fourth cohort ($p = 0.046$). The increase in success rates over time reported above was also found in the subgroup of people not using NRT ($\chi^2(3) = 8.029$, $p = 0.045$) but did not reach statistical significance in those using NRT ($\chi^2(3) = 6.496$, $p = 0.09$).

In total, 58.1% of NRT users discontinued their medication within the first 35 days of treatment. Participants who reported to have been continuously abstinent at the 6-month evaluation had used NRT for longer periods of time compared to those who had relapsed (28 (1–180) versus 42 (2–270) days; $p = 0.027$). The minimum duration for NRT that was found to have a statistically significant impact on quit success rates was 5 weeks. In order to avoid confounding, the analysis was repeated after excluding all participants who had relapsed before stopping NRT; the findings remained significant (see Fig. 2).

3.3. Predictors of continuous abstinence

Univariate analysis revealed that those who were continuously abstinent at the 6-month follow-up had a significantly lower SDS score, were more likely to have used NRT and to have been in a later cohort than relapsers; they also had a lower FTND score though this difference was not significant (see Table 3).

When analysis was restricted to participants using NRT ($n = 182$), only FTND score ($p = 0.014$) and duration of nicotine substitution in weeks ($p = 0.026$) were significantly different between the two groups. In order to determine predictors of continuous abstinence, logistic regression analysis was performed including FTND score, SDS score and concomittant medication according to the results of the univariate analysis. Course cohort was not included due to a correlation between cohorts and NRT use.

Statistical significance was observed for the FTND score ($p = 0.041$), the use of NRT ($p = 0.027$) and the SDS score ($p = 0.037$). Within the subgroup of participants using NRT, statistically significant predictive value could still be ascribed to the FTND score (adjusted OR = 0.769; 95% CI: 0.645–0.918), but not the SDS score (adjusted OR = 0.980; 95% CI: 0.939–1.023). However, the duration of NRT use (as measured in weeks) was now found to be a predictor of continuous abstinence (adjusted OR = 1.104; 95% CI: 1.028–1.185) and, confirming bivariate analysis, those using NRT for more than 35 days were nearly three times as likely to stay quit than participants using NRT for less than 35 days (95% CI: 1.482–5.556). The proportion of participants using NRT in combination was higher among those who administered NRT for more than 35 days (20%) compared with those using it for a shorter period (5.7%; $\chi^2(1) = 8.522$; $p = 0.004$); however, this was not the case when comparing successful quitters (12.1%) with relapsers (11.2%) after 6 months. Indeed, NRT use in combination did not predict successful quitting when added to the above multivariate model underlining that combining NRT had no impact on results.

4. Discussion and conclusion

4.1. Discussion

To our knowledge, this is the first study to report the increase of success rates of a smoking cessation programme over time. Although the clinical performance of a therapist who gains more experience would be expected to improve, this can by no means be assumed—and it has important implications for training and supervision of therapists. The 6 months continuous abstinence rate of 30% observed in our clinic, although at the

Table 3
Univariate analysis of subject characteristics regarding continuous abstinence after 6 months ($n = 314$)

Parameter	Quitters ($n = 97$)	Relapsers ($n = 217$)	p-Value
Age in years [median (range)]	46 (23–73)	44 (13–67)	0.266
FTND score [median (range)]	5 (0–9)	5 (0–10)	0.053
SDS score [median (range)]	32 (22–57)	35 (21–58)	0.009
Pack years [median (range)]	25.5 (5.25–90)	27 (0.9–102)	0.901
Cohort [median (range)]	3 (1–4)	2 (1–4)	0.008
Number of previous quit attempts [median (range)]	1 (0–10)	1 (0–12)	0.865
High-school or higher education [percent (n)]	45.4% (44)	41.9% (91)	0.616
NRT use [percent (n)]	68.0% (66)	53.5% (116)	0.019
Male [percent (n)]	47.4% (46)	38.2% (83)	0.138
Hospital staff [percent (n)]	19.6% (19)	18.4% (40)	0.876

FTND, Fagerstrom test of nicotine dependence; SDS, self-rating depression scale; NRT, nicotine replacement therapy. p-Values were derived from Mann–Whitney U-tests for continuous variables and from Fisher's exact test for dichotomous variables.

higher end, was comparable to those reported in clinical trials [14–18]. However, when nicotine replacement therapy was used and administered in a correct manner (including a minimum duration of 5 weeks), even higher continuous abstinence rates of up to 50% after 6 months can be achieved.

Since all courses were conducted by the same psychologist, the increase of success rates after the initiation of the programme suggests a significant learning effect of the staff running the course. Although there was a concurrent increase of NRT use, the increase in cessation rates over time in participants not using NRT implies the existence of a true time effect independent of concomittant medication. While cohorts also differed significantly in the proportion of hospital staff among participants, this cannot explain the significant rise in success rates since being a hospital member was not associated with a lower quit rate. The four cohorts were homogeneous with regard to all other relevant variables. Success rates refer to continuous abstinence 6 months after participation in the course. In addition, as there was no attrition at the 6-month follow-up, differential success rates cannot be attributed to differences in follow-up rates.

Since no formative evaluation of staff performance was carried out, the cause of success rate improvement can only be discussed in hypothetical terms. With increased experience, the psychologist running the courses gained more confidence in directing group discussions and uncovering barriers to smoking cessation in individual participants. Over time, course components that seemed most effective were emphasised more strongly. Thus, external social support was particularly stressed as participants entering into no-smoking contracts with relatives or friends showed favourable outcomes. In addition, the psychologist learned to identify group-dynamic processes impeding effective discussion and how to resolve them.

Our findings indicate that both the success of behavioural interventions as well as the effective recommendation of NRT may be subject to a learning curve. This novel finding corresponds to other fields of medical care for which learning effects have been reported (e.g. cardiac catheterization). The lack of a significant learning effect in the subgroup of people using NRT may be ascribed to the small sample size. On the other hand, the effect observed in the subgroup not using NRT points out that the experience of programme staff may be especially important for participants who do not take any concomittant medication.

Recently, it has been suggested that the results obtained in the Lung Health Study might not be reproducible in a clinical setting due to its resource-intensive nature [19]. However, although the long-term outcome of the programme described here cannot be assessed yet, we suggest that the implementation of effective smoking cessation interventions is also feasible outside large clinical trials, even under the conditions of the German health care system in which funding of smoking cessation interventions is generally low.

Consistent with previous research, multivariate analysis showed that lower nicotine dependence, the absence of depressive symptoms and the use of NRT were all predictive of successful continuous abstinence [20,21]. However, while the general role of nicotine replacement therapy in smoking cessation is widely accepted [7], data on the ideal duration of treatment are scarce. Our findings indicate that the length of a nicotine substitution course significantly impacts on middle-term success rates. In one study, a 3-week course of nicotine replacement versus placebo was not effective in helping hospitalized patients to quit smoking [22]. In fact, most relapses occur more than 2 weeks after the last cigarette was smoked [23] with a medium relapse-free period of 28–42 days [24]. This alone would require the duration of NRT to be at least 5 weeks if not longer.

If our findings reflect a true influence of NRT duration on continuous abstinence, this aspect needs further clarification, considering that only a small proportion of patients are willing to take nicotine substitution for a longer period of time when being recommended to use NRT products by their general practitioner [25].

This study had a number of limitations. Our data were not derived from a randomized-controlled trial, and participants in our programme were not assigned to any specific length of treatment. Instead, the decision to take any concomittant medication as well as how long to use it was incumbent on the participants themselves. It can be hypothesised that highly motivated participants were ready to pay for NRT products while less motivated participants could not be encouraged to use nicotine substitution. This might also explain the effect of treatment duration on the success rates found in this study. Since NRT has to be paid for privately in Germany, there may also be a socio-economic differential between participants using NRT and those not using NRT, which could have influenced quit success [26,27]. Although socio-economic status was not assessed directly in our study, the lack of a significant difference between successful and unsuccessful quitters in terms of educational attainment (a marker of socio-economic status) would suggest that this is unlikely.

Another limitation of this study is a possible over-estimation of abstinence rates because smoking status at 6 months was not validated biochemically. Since participants were recruited from a large area it would have been difficult to obtain CO or cotinine measurements from a satisfactory number of participants although this would have been desirable [28]. However, self-report has been shown to reliably capture smoking status [29] and in our study self-report and CO in expired air yielded comparable results at the end of the treatment course, suggesting reasonable validity of self-reported smoking status in this sample.

4.2. Conclusion

In conclusion, our study indicates that a learning effect is associated with smoking cessation programmes. The data presented show that there is an important duration effect of NRT use on smoking cessation. Our results suggest that NRT should be used for a minimum of 5 weeks to maximise its effectiveness. These findings require further evaluation.

4.3. Practice implications

The increase in success rates over time observed in our study should be taken into account when evaluating newly set-up cessation clinics. Despite the proven effectiveness of pharmacological support, patients tend not to use nicotine replacement therapy at all or to terminate its use too early. This might be attributable to the lack of reimbursement for pharmacological support to smoking cessation in Germany. Still, patients should be encouraged to administer a sufficient course of medication.

Conflict of interest

T. Raupach and S. Andreas have been reimbursed for attendance at several Pfizer® symposia on smoking cessation throughout the year 2006. All other authors have no competing interests to declare.

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