Does physical exercise in addition to a multicomponent smoking cessation program increase abstinence rate and suppress weight gain? An intervention study

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Does physical exercise in addition to a multicomponent smoking cessation program increase abstinence rate and suppress weight gain? An intervention study

Tobacco use is considered the single most preventable cause of premature morbidity and mortality. Smoking cessation programs aim at two interrelated purposes, to help people to give up smoking and to prevent relapse. A multicomponent intervention consisting of nicotine replacement therapy, health education, behaviour modification therapy and counselling is widely recommended in the health care literature. Smoking cessation studies from a nursing perspective are few. The purpose of this quasi-experimental study was to compare outcomes of two nurse-managed 1-year group smoking cessation interventions. Intervention 1 (n = 34) was provided at a health care centre and consisted of nicotine replacement therapy, health education, behavioural modification and individual and group counselling. In intervention 2 (n = 33), provided in a health club, physical exercise was added to the intervention provided in 1. Participants were self-referred with equal numbers in both interventions. A nonsignificant difference in lapse free abstinence time (LFAT) at 1 year was demonstrated between intervention 1 (20.6%, n = 7) and intervention 2 (39.4%, n = 13) (p = 0.16, odds ratio = 2.5). The difference in weight gain between intervention groups was also nonsignificant. Within intervention comparison between abstinent participants and smokers showed that abstinent participants had gained significantly more weight than smokers in intervention 2 (p = 0.001), but in intervention 1 the difference was nonsignificant (p = 0.2). The small sample size in the study detracts from the significance of the findings. However, a trend is observed showing that physical exercise increases the abstinence rate of participants. The conclusion is drawn that a multicomponent smoking cessation program that includes physical exercise might be an effective intervention, but further studies with a larger sample size are needed.

Keywords: smoking cessation program, intervention, abstinence from smoking, weight gain, quasi-experiment.

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Introduction

Tobacco use is considered the single most preventable cause of premature morbidity and mortality. Smoking, the main source of tobacco use, is viewed as a multifactoral phenomenon, having psychological, social, biological and economic components. The main motive for smoking is nicotine addiction. Smoking is also conditioned to the cues surrounding it. Nicotine addiction and conditioning potentate each other. There is also a linkage to stress and people smoke in order to manage diverse emotions. Social influences on smoking and cessation have repeatedly been reported. Smoking habits of family and friends have been shown to be among the best predictors of smoking and smoking cessation (1).

Smoking cessation programs aim at two interrelated purposes. The first is to help people to give up smoking. The second is a long process to prevent a relapse (1). Available smoking cessation programs are of different characters. A multicomponent intervention is recommended, as a significant predictor of abstinence is attributed to the number of different intervention modalities provided (2). Frequently recommended components are nicotine replacement therapy, health education, behaviour modification therapy and counselling (1, 3, 4). Adjusting intervention to individual needs, the number of contacts the therapist keeps with participants, the length of time of
Intervention programs and the use of both individual and group contacts have also been shown to be strong predictors of abstinence (1).

Nicotine replacement therapy has been widely regarded as an effective aid in helping people to quit smoking (5). The effectiveness of this therapy alone has been questioned, and it has been demonstrated that it should be accompanied by formal smoking cessation interventions (6). Nicotine replacement therapy is based on the premise that it reduces withdrawal symptoms following cessation. This helps people overcome behavioural and psychological components of nicotine addiction and makes them thereafter ready to cope with the nicotine withdrawal itself (7). Nicotine replacement therapy also counteracts weight gain and thus enhances abstinence (1, 8). The nicotine medication needs to be used regularly in a sufficient amount and for a sufficiently long time. The recommended length of time is between 6 and 18 months (9). Different forms of the nicotine medication need also be considered because of different patterns of smoking urge and different degrees of nicotine dependency. Transdermal nicotine patches release nicotine steadily and slowly throughout the day, but the user has no control over its dosing. Dosing with nicotine chewing gum, nasal spray, buccal inhalator, lozenges and tablets is better controlled by the user and they release nicotine more rapidly and with a potential higher concentration (5, 7, 10). Studies that have combined two or more forms of the nicotine medication indicate a higher efficacy in prevention of relapse. Therefore, two or more forms of the nicotine medication are highly recommended for successful outcome (11).

Concerns regarding weight gain are common in relation to smoking cessation. It is observed that smokers have about 10% higher metabolic rate and that they weigh less than nonsmokers (12). Weight-concerned participants in a smoking cessation program provided without nicotine replacement therapy were shown to be less probable to remain abstinent compared to nonweight-concerned participants (13). Meyers et al. (13) demonstrated that weight-concerned smokers were significantly lighter and were less probable to gain weight immediately after cessation than those who did not share this concern. The authors concluded that actual weight gain might be a poor indicator of weight concerns and therefore also a poor predictor of smoking cessation and relapse. In a thorough literature review, Fromm et al. (14) showed that quitters gain on average 5–6 kg in weight postcessation. Kleesges et al. (15) compared weight gain in continuously abstinent smokers (CA), point prevalence abstinent smokers (PP) and continuous smokers (CS) participating in a cognitive-behavioural smoking cessation program without nicotine replacement therapy. Results showed that there were statistical differences in weight gain between all three groups, in CA 5.9 kg, in PP 3.04 kg and in CS 1.09 kg in 1 year. However, the weight gain was uneven. In the CA group the increase was 5.4 kg between 0 and 6 months and 0.46 kg between 6 and 12 months post cessation. Doherty et al. (8) demonstrated that both percentage of abstinent participants and weight gain was significantly related to nicotine dose in point prevalence abstinent participants at 90 days postcession. A significantly smaller proportion of users that used placebo gum (13%) remained abstinent compared with 2 mg (29%) and 4 mg (31.8%) nicotine gum users. Postcessation placebo gum users gained 3.7 kg, 2 mg users gained 2.1 kg and 4 mg users gained 1.7 kg (a significant difference between placebo and 4 mg users). Results are inconclusive as if and when weight returns to baseline following smoking cessation. Despite this, Fromm et al. (14) concluded that the risk of weight gain is highest during the first year and declines thereafter.

Some studies have reported intervention modalities other than nicotine replacement therapy to counteract weight gain, but results so far have not been promising (15). Fromm et al. (14) showed that physical exercise attenuates the degree of weight gain following smoking cessation (in four out of five studies reviewed). Nishi et al. (16), however, in a meta-analysis (n = 5) of the effect of group exercise on smoking cessation in general maintained that the effect remains inconclusive because of the small number of studies and the small sample size for each study, although a consistent positive trend was observed.

Reports of smoking cessation interventions developed by nurses have been increasing in the past years. As Table 1 shows, the majority of the studies are on hospitalized patients, different from the studies described above (studies on women during and after childbirth are excluded from this analysis) and they vary in terms of the seriousness of participants’ illnesses and the studies’ methodological rigour. In these studies point prevalence abstinence rates ranges from 5 to 75% in the experimental groups. Only a few of them reached a statistical significance, although all except one (18) demonstrated a positive trend in support of the experiment. It is important to notice also that in these studies participants were not provided with structured nicotine replacement therapy. In the latest study reported, however, authors referred to public guidelines for smoking cessation and pointed out that this should be the case (22).

Several studies have been published in nonnursing journals on the effectiveness of smoking cessation interventions delivered by nurses without the nurses necessarily designing the interventions. In a meta-analysis on nurse-delivered interventions in clinical trials Rice (23) showed modest but significantly positive effects of these interventions, emphasizing the importance of the role of nurses in helping people to stay away from smoking.

In this study, outcomes of two 1-year group smoking cessation programs, intervention 1 and intervention 2, were compared. Intervention 1 consisted of nicotine replacement therapy, health education, behavioural

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<table>
<thead>
<tr>
<th>Reference</th>
<th>Research methods</th>
<th>Intervention</th>
<th>Follow-up time</th>
<th>Participants</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(17)</td>
<td>Case study</td>
<td>Minimal intervention approach: Advice, health education, follow-ups, nicotine med. available</td>
<td>1 year</td>
<td>Mixed</td>
<td>17% abstinent participants</td>
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<td>Age: 16-60</td>
<td>12% reduced smoking</td>
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<td></td>
<td></td>
<td>Significance not reported</td>
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<td>(18)</td>
<td>Factoral quasi-experim. design</td>
<td>Multicomponent treatment, diff. according to treatment groups</td>
<td>1 year</td>
<td>Cardiovascular health problems</td>
<td>Individual interv: 14% abstinent participants</td>
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<td></td>
<td>Age: ≥18</td>
<td>Group interv: 15% abstinent participants</td>
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<td></td>
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<td>n = 255</td>
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<td>Control group: 33% abstinent participants</td>
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<td></td>
<td>Significant at p = 0.01</td>
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<td>(19)</td>
<td>Randomized two group quasi-experim. design</td>
<td>Health education, individual counselling, relaxation</td>
<td>7 weeks</td>
<td>Surgical cancer patients</td>
<td>Exp. group: 75% abstinent participants</td>
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<td>Age: ≥19</td>
<td>Control group: 43% abstinent participants</td>
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<td>Biochemically confirmed</td>
<td>n = 26</td>
<td>Significant at p = 0.10</td>
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<td>5–6 weeks</td>
<td>Postoperative patients</td>
<td>Exp. group: 37.8% abstinent participants</td>
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<td>Age: ≥19</td>
<td>Control group: 25.6% abstinent participants</td>
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<td>Biochemically confirmed</td>
<td>n = 80</td>
<td>Nonsignificant relationship</td>
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<td>Prospective one group pretest/posttest design</td>
<td>Health education, individual counselling, relaxation</td>
<td>6 weeks</td>
<td>Lung cancer patients</td>
<td>40% abstinent participants</td>
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<td></td>
<td>Age: ≥19</td>
<td>93% ≥ one attempt to quit</td>
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<td>Biochemically confirmed</td>
<td>n = 15</td>
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<tr>
<td>(22)</td>
<td>Randomized two group quasi-experim. design</td>
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<td>6 weeks</td>
<td>Surgical cancer patients</td>
<td>Exp. group: 21% abstinent participants</td>
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<td></td>
<td>Age: ≥19</td>
<td>Control group: 14% abstinent participants</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Biochemically confirmed</td>
<td>n = 28</td>
<td>Nonsignificant relationship</td>
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modification and individual and group counselling. In intervention 2, a physical exercise program was added to the intervention provided in intervention 1. The research questions were:

1 Is there a statistical significant difference between abstinence rates at 1-year follow-up in intervention 1 and intervention 2?
2 Is there a statistical significant difference between weight gain at 1-year follow-up in intervention 1 and intervention 2?

**Methods**

This quasi-experimental study compares outcomes of two-group intervention programs provided at a health care centre and in a health club, respectively. The smoking cessation programs were advertised. Participants came voluntarily and paid for the intervention. Intervention 2 was more expensive than intervention 1. Each intervention program, which lasted for 1 year, was provided to groups. A total of 10 groups received intervention, i.e. five groups according to intervention 1 and five according to intervention 2. Several groups were run simultaneously but no group started at the same point in time. The total time of the study was 17 months. The Data Protection Commission of the Government of Iceland and the Ethical Committee of the Health Care Center in Reykjavik approved this study. No pharmaceutical company funded the study.

**Participants**

A convenience sample consisted of 34 men and 33 women. Participants were self-referred. Equal numbers were in both groups, 34 in intervention 1 and 33 in intervention 2. Demographic characteristics of participants were similar except for gender, where women are higher in number in intervention 1 and the reverse is true for intervention 2. The participants’ dependence on nicotine was also similar (see Table 2).

**Data collection**

Data were collected at every encounter with the participants, using a data information format described previously (9, 11) with the most extensive data collection before the program started and after its ending. The main components of the assessment were: the physical condition, motivation to quit smoking, nicotine dependency (Fagerstrom Test of Nicotine Dependence), smoking habits, cooperation with the therapist and the group, weight measurement, carbon monoxide (CO) measurement and the use of alcohol. For participants in intervention 2, assessment by an exercise specialist, including exercise test and skin fold measure were added (not used in this study). Smoking status was assessed in every encounter with the participants.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Intervention 1 (n = 34)</th>
<th>Intervention 2 (n = 33)</th>
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<tbody>
<tr>
<td>Gender (%)a</td>
<td></td>
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<tr>
<td>Men</td>
<td>38.2 (n = 13)</td>
<td>63.6 (n = 21)</td>
</tr>
<tr>
<td>Women</td>
<td>61.8 (n = 21)</td>
<td>36.4 (n = 12)</td>
</tr>
<tr>
<td>Mean age (years)a</td>
<td>43.5 (SD = 11.9)</td>
<td>39.3 (SD = 9.0)</td>
</tr>
<tr>
<td>Men</td>
<td>44.7 (SD = 11.2)</td>
<td>39.5 (SD = 9.8)</td>
</tr>
<tr>
<td>Women</td>
<td>42.8 (SD = 12.6)</td>
<td>38.7 (SD = 7.8)</td>
</tr>
<tr>
<td>Mean Fagerstrom test of nicotine dependence (0–10)a</td>
<td>5.9 (SD = 1.8)</td>
<td>5.8 (SD = 1.5)</td>
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</tbody>
</table>

*a Statistically nonsignificant.

**Outcome measures**

There were two main outcome measures in this study: (a) A continuous self-reported abstinence rate referring to abstinence since the cessation attempt or ‘lapse free abstinence time’ (LFAT) for 1 year. Participants were considered smokers if they had used some form of nicotine medications once or more often after cessation. (b) Body weight was measured by the nurse (DJ) a week before the first group meeting and by the participants themselves in their homes by the end of the intervention.

**Statistical analysis**

Frequency of demographic variables and descriptions of the main characteristics of interest were evaluated by chi-square tests. Comparison of abstinence rates and weight gain between and within intervention groups at the end of intervention was conducted by a two-tailed t-test on independent samples. The significant marker of $p = 0.05$ was considered acceptable. Odds ratio was calculated on the difference in LFAT between intervention groups.

**Intervention**

The procedure of this study is based in part on a smoking cessation program that has been developed before (9, 11) but incorporating emphasis on therapeutic relationships (24, 25) as well as personal support through group work (26) from a nursing perspective. The interventions were managed and carried out solely by one nurse (DJ) except for the physical exercise part in intervention 2, which was under the supervision of an exercise specialist.

**Intervention 1 – usual intervention**

The usual intervention consisted of nicotine replacement therapy, group counselling for 1 month with five sessions and individual counselling for 1 year. One week before
participants were to stop smoking, a comprehensive individual counselling and assessment was provided. Participants were contacted four times by telephone, 3 weeks after the last group session, 6 weeks, 3 months and 6 months later (the last contact 365 days after the first smoke-free day). Health education was provided along with the counselling throughout the intervention. During the intervention participants were invited to contact the nurse by phone as needed. The second day after the first group session was defined as the quitting day. Abstinence from alcohol use for 3 months after quitting smoking was requested.

**Intervention 2 – usual intervention and physical exercise**

Nicotine replacement therapy, individual and group counselling and assessment was the same as in intervention 1 but the group counselling lasted for 2 months with seven meetings (instead of five). The telephone contacts occurred four times as in intervention 1, but with a 3-months interval. They started 1 month after the last session and ended 365 days after the first smoke-free day. In addition to this, subjects participated in a physical exercise program in a group and under the guidance of an exercise specialist three times a week during the 2 months of the group counselling and the next 4 months after its ending without the exercise specialist and at their own time schedule.

The usual intervention consists of four components, nicotine replacement therapy, health education, behavioural modification and individual and group counselling, as follows:

**Nicotine replacement therapy.** The nicotine replacement was adjusted to each individual’s needs based on the score on the Fagerstrom Test of Nicotine Dependence Scale (0–10), the duration of smoking and the amount of smoking. For example, a nicotine replacement plan for a 45-year-old individual who has smoked for 20 years, 20 strong cigarettes/day, scores >7 on Fagerstrom and has CO >17 p.p.m. measured a.m. would be: A 15/20 mg transdermal nicotine patch for 4 months, 10/15 mg for 3 months, 5/7 mg for 2 months and 2.5/5 mg for 1 month (The pharmaceutical effects of the nicotine medication are the same in each category. Different doses reflect different products that have the same biological effects). As it has been shown to be beneficial to combine two or more forms of nicotine medication, nicotine gum and nasal spray were used along with the transdermal patch, as needed.

**Health education.** Health education was grounded in daily life experiences focusing on the smoking addiction, nicotine, nicotine drugs, withdrawal symptoms, relapses and smoking induced diseases. Relevant handouts were distributed each time.

**Behavioural modification, individual and group counselling.** Central in interacting with the participants was the emphasis on trust, respect, acceptance, empathy, a genuine concern for their well-being and the willingness to help them. In that way the counselling was aimed at changing behaviour, thoughts and emotions (23, 24, 27) focusing on the following (3, 26, 28): Give contemplation time, setting goals (e.g. specific quit date), view smoking cessation as a lifelong process, admit one’s addiction and need for help, explore stress-related circumstances/situations, plan interruption of conditioned responses that support smoking, identify and prepare plans to cope with temptations that might trigger falls, encourage self-management strategies in relation to peer pressure to resume smoking, foster self-worth/confidence, facilitate learning about oneself and new coping strategies in group discussions, teach means to seek support from family, friends and coworkers, say goodbye to the cigarettes as an old friend and confront relapse temptations.

Participants’ willingness to follow intervention guidelines strictly and active participation in group-work was requested in order to stay in intervention. Development of group cohesion was encouraged. Group support was viewed as an important element in relapse prevention. Formation of support groups that would continue to meet after cessation of the meetings was encouraged. Contact times during the follow-up period were made known beforehand and participants were invited to contact the nurse through the phone at any time during the intervention. Ongoing support and praising adherence to preset goals is viewed fundamental to successful relapse prevention.

**Physical exercise.** The physical exercise comprised of aerobic training (40%) consisting of treadmills and stationary biking, weight lifting (40%), and stretching exercises (20%). The time-length of the program started with 40 min and was gradually increased to 80 min three times a week.

**Results**

**Abstinence rates (LFAT)**

Results show that at 1 year the rate of LFAT was higher in intervention 2 (39.4%) than in intervention 1 (20.6%), although the difference did not achieve statistical significance (p = 0.16, odds ratio = 2.5), see Table 3.

**Weight gain**

The mean weight gain for participants (n = 40) irrespective of intervention form was 0.7 kg (SD = 5.7). The difference in weight gain between intervention forms was nonsignificant (see Table 3). When abstinent participants (no use of nicotine from the beginning of the intervention) and smokers were compared within intervention groups,
abstinent participants gained significantly more weight than smokers in intervention 2 did (p = 0.001, t = −3.7, n = 26), but the difference in intervention 1 was non-significant (p = 0.2, t = −1.3, n = 14).

Calculations on weight gain are limited by the fact that several measurements (n = 27) are missing. This happened because participants were not willing to be weighed. Some were not weighed at all (n = 4), some only in the end (n = 2) and several only in the beginning (n = 21). The majority of missing cases is from three subgroups within intervention 1. As there is nothing that indicates that subgroups within intervention groups were different, it is maintained that no systematic error in measurement has taken place.

Use of nicotine replacement medication

Only 15.8% (n = 8) of the participants used nicotine medication by the end of the intervention. No statistical difference between smokers and abstinent participants was found on the use of nicotine replacement medication ($\chi^2 = 0.9$, d.f. = 1).

Smoking habits and the amount of smoking

Participants in intervention 2 had made significantly more attempts to quit smoking than participants in intervention 1 did ($\chi^2 = 0.02$, d.f. = 5). Participants had smoked from 1 to more than 40 years and the difference between intervention groups was nonsignificant. The majority of both groups, or 74.6% (n = 50), had smoked between 11 and 30 years, 7.5% (n = 5) 1–10 years and 18.0% (n = 12) had smoked more than 30 years.

The difference in the number of smoked cigarettes/day between the intervention groups was nonsignificant. Of both groups 6.1% (n = 4) had smoked 1–10 cigarettes/day, 39.4% (n = 26) 11–20 cigarettes/day, 42.4% (n = 28) 21–30 cigarettes/day and 12.1% (n = 8) had smoked 31–40 cigarettes/day.

Discussion

Results show that intervention 2, with physical exercise added to the usual intervention given in intervention 1, did not prove to be significantly different from the usual intervention in terms of ensuring total abstinence from smoking. Despite this, the results are encouraging as people participating in intervention 2 are almost twice as probable to stay totally abstinent than participants in the usual intervention. It needs, however, to be emphasized that there was a difference in the provision of the two interventions as regards variation in the frequency and timing of contacts with the participants. Also, participants in intervention 2 paid more for their intervention and they had more often attempted to quit smoking, which may indicate that they were more motivated to quit than the participants in intervention 1 were.

Weight gain has been shown to precipitate relapse (13). In this study, the difference in weight gain between intervention groups was nonsignificant. However, when abstinent participants and smokers are compared within intervention groups, abstinent participants had gained significantly more weight than smokers in intervention 2, but in intervention 1 the difference was non-significant. In intervention 2 those who exercised and still smoked lost an average of 3.1 kg but abstinent participants gained 5.0 kg on average. Abstinent participants in intervention 2 are close to the average weight gain postcessation, which is 5–6 kg (14). Increased body mass may, in part, contribute to the weight gain in the abstinent participants who were into physical exercise. This was, however, not measured in this study and is only a speculation.

Measurement of body weight is a weakness of this study. Body weight was measured on the same scale at the beginning of the intervention but at the end of the study the participants themselves in their homes measured it. Also, about 40% of the participants were not willing to report their weight by the end of the intervention. Both reduce the reliability of the measurements. However, attending to body weight should be an essential aspect of smoking cessation programs as increased weight is a potential hindrance for serious attempts to quit and may precipitate relapse as well.

Success in smoking cessation programs varies and is on the average not high. In an overview of outcomes of smoking cessation interventions for people with chronic diseases, Wewers & Abijevych (21) showed that point prevalence abstinence rate (abstinent at the time of the measurement) at 1 year ranged from 10 to 70% (n = 13) with the mean of 28% in experimental groups.
nursing studies described in Table 1, the outcomes ranged from 5 to 75% (n = 6) also with the mean of 28% measured by point prevalence abstinence rate at different points in time postcessation. The majority of these participants were patients and the interventions were initiated in hospitals or outpatient clinics. Comparing those results with outcomes of this study is promising. In the present study, the outcome measure is by definition more conservative than point prevalence measurements. Still the results are 20.6% in intervention 1 and 39.4% in intervention 2. Participants in the present study were not patients and they participated in the program without direct referrals from health care professionals. The conclusion drawn here is that the effectiveness of intervention 1 is good and that adding physical exercise to it may make it considerably more effective.

The nurse providing the intervention in this study approached participants with a strong notion of establishing a therapeutic relationship with them as well as establishing effective group work among participants. The insistence on grounding one’s work in nursing beliefs is very important for the development of nursing practice at the same time that work of other health care professionals is built upon and acknowledged. The extent to which this approach influenced the outcome of this study is only speculative but needs to be studied in the future.

The major limitation of this study is the small sample size. Intervention 2 has now been discontinued, which makes further data unattainable. As it seems beneficial to add physical exercise to the usual intervention, the protocol for intervention 1 has now been modified in order to encourage any further participants to incorporate physical exercise actively into their cessation program. Still, further research into the effectiveness of physical exercise is necessary. In addition to exploring its effects on counter-acting weight gain; its effects on attenuating withdrawal symptoms and stress, which frequently accompanies attempts to quit smoking, are important focuses of future research.

**Implications for practice**

To quit smoking is a lengthy, complex and demanding process. Smoking is an addiction for which smokers need sympathy and effective help. The literature on smoking cessation is rich in information that is helpful for health care professionals on which to base their actions towards helping people to quit. A multicomponent therapy in line with the one described in this study is one of them. Other means may also be useful and nurses, as well as other health care professionals, are obligated to develop and implement relevant strategies according to their client’s needs and the circumstances of their work place to help people conquer this most serious threat to peoples’ health.

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