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Impact of a multi-level intervention to prevent secondhand smoke exposure schoolchildren: A randomized cluster community trial

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ABSTRACT

Objective. To assess the effectiveness of a multi-level (individual, family, and school) school-based intervention to prevent the exposure to secondhand smoke (SHS) in a population of schoolchildren (12–14 years old).

Method. This was a community trial with cluster randomization of schools to an intervention and comparison group (ClinicalTrials.Gov identifier NCT01881607). The intervention targeted schoolchildren in Terrassa (Catalonia, Spain). We assessed SHS exposure in different settings and tobacco consumption by means of a questionnaire before and one year after the intervention.

Results. We analyzed data from 1734 students with both baseline and follow-up data. The crude analysis showed that SHS exposure among students in the intervention group significantly decreased at school (−14.0%), at home (−19.9%), and on transportation (−21.8%). In the comparison group, SHS exposure significantly decreased only at home (−16.9%). After adjustment for potential confounders, the good accomplishment of the activities showed a possible trend towards a non-significant reduction in exposure at home, transportation, and leisure time.

Conclusion. While this school-based multi-level intervention had no overall effect in SHS exposure, the improvement of the activities focused on preventing SHS would be needed in order to achieve a significant decrease in the proportion of children exposed to SHS.

Introduction

Secondhand smoke (SHS) is a complex mixture of pollutants that include toxic and irritant compounds as well as carcinogenic substances (IARC, 2004). SHS has been classified by the International Agency for Research on Cancer as a type I carcinogen to humans (IARC, 2004). Moreover, children are inevitably more vulnerable to the effects of SHS exposure because they are still physically developing (Bearer, 1995); preventing exposure of this age group to SHS is thus an important issue for public health.

Exposure to SHS and tobacco smoking is an avoidable risk factor for childhood respiratory diseases (Bloch et al., 2008; Hawthorne et al., 2008). Respiratory symptoms related to asthma are among the most frequent diseases during childhood (Sears, 1997), and more severe symptoms can be present in children exposed to SHS (Gergen, 2001). A study in the US of children aged 4–16 years concluded that SHS

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exposure increased the frequency of respiratory symptoms and school absenteeism, and suggested that SHS exposure may provoke restricted pulmonary function (Mannino et al., 2002).

Smoking initiation occurs during adolescence, as does the first contact with alcohol and other illegal drugs (Sutherland and Willner, 1998). Every day, nearly 3900 children less than 18 years of age in the US alone try their first cigarette, and more than 950 children will become new, regular, daily smokers (American Lung Association, 2011). In European countries, tobacco smoking among adolescents has decreased in the last decade. In Spain, the prevalence of smokers among pupils aged 14–16 was 14.7% in 2006 (Villalbi et al., 2012). It is necessary to develop and implement public health interventions to prevent both smoking initiation and SHS exposure in children (Sussman et al., 2006).

There have been multiple educative interventions to prevent tobacco consumption, but few interventions use a comprehensive approach to focus on preventing SHS exposure among children and adolescents (Gehrman and Hovell, 2003). Most studies have addressed parental smoking cessation exclusively, with the obvious implication that if the parent will quit smoking, the child's exposure would be reduced or eliminated. A Cochrane review focused on interventions among parents attending clinical pediatric or child health services has provided no evidence of a positive effect of such interventions, although it is possible that the reviewed studies had little power to detect small effects (Roseby et al., 2008). Hence, interventions to prevent SHS exposure in children and adolescents should incorporate a stepped approach from the school setting to the household, based on social cognitive theory, behavior-modification principles, and self-efficacy and outcome expectations (Gehrman and Hovell, 2003). The objective of this study was to assess the impact of a multi-level (individual, family, and school) intervention to reduce SHS exposure and smoking initiation among a population of schoolchildren 12–14 years old.

Methods

Study design

This community trial (ClinicalTrials.Gov with identifier NCT01881607) randomized schools to intervention and comparison groups to assess the effectiveness of the intervention (cluster randomization). The intervention was designed to target schoolchildren aged 12–14 years in the first and second years of Compulsory Secondary Education (*Enseñanza Secundaria Obligatoria* in the Spanish educational system) in Terrassa, a city in the Metropolitan Area of Barcelona with more than 200,000 inhabitants. These children were attending the secondary school for an entire cycle of 4 years. Participation in the study was offered in May 2006 to the 25 secondary schools of the city; all of them agreed to participate, beginning in September 2006 (2006–2007 academic year).

Ethics

The study protocol was approved by the Research Ethics Committee of the "Hospital Universitari de Bellvitge". Parents and school staff provided written informed consent for the children to participate in the study and for all measurements to be performed. The deans and responsible health education personnel were informed about the main study objective and the planned intervention.

Participants and field-work development

Schools were allocated at random to the comparison group (13 schools) or the intervention group (12 schools). All pupils in the first year of Compulsory Secondary Education in these schools were included in the study. During October–November 2006, a field-work team visited all schools for baseline (pre-intervention) data collection (questionnaire on SHS exposure and smoking); these data included 1779 pupils of the 1888 pupils enrolled in the schools (94.2% participation). One year later, during October–November 2007, the field-work team revisited the schools to obtain post-intervention data from the same pupils (now in the second year of Compulsory Secondary Education). The post-intervention participation rate was 92.4% (1818 of 1968 pupils enrolled). As expected, some of the 1779 pupils included in 2006 were lost to follow-up because they had changed to a school outside Terrassa (n =24) or because they were not present at school or refused to participate in the follow-up survey (n = 21). Moreover, in 2007 we surveyed children who did not participate in the 2006 baseline data collection. These pupils were already in the second year of Compulsory Secondary Education in 2006 or had arrived at the schools from outside Terrassa in 2007 (typical of migrants, who arrive once the academic course has started). Thus, after linkage via a unique confidential code, our study included a total of 1734 pupils (977 in the comparison group and 757 in the experimental group) with baseline and follow-up data (follow-up rate of 97.5%).

Information collected

We administered a questionnaire at baseline and one year later to gather sociodemographic data and data on self-perceived SHS exposure and smoking behavior. The questionnaire was prepared from previously validated questionnaires on SHS and smoking (Ariza et al., 2008; Ariza et al., 2009; Tomas et al., 2002).

Exposure to SHS was investigated at home, at school, on transportation (private or public), and during leisure time. SHS exposure at home was assessed by asking "How many people living with you at home usually smoke at home (not including balcony, terrace, or gallery)?" Those who answered "nobody" were considered to be non-exposed. SHS exposure at school was assessed in the classroom, corridor, main door entrance, teachers' room, playground, and restroom. Respondents who answered "nowhere at school" were considered to be non-exposed. SHS exposure on transportation was differentiated between public and private transportation; participants who were rated as "exposed" answered that somebody smoked near him/her. SHS exposure during leisure time was assessed with the question, "Have you been in indoor places – neither at home nor at school – where somebody smokes (so close to you that you can smell the smoke)?" This question had four possible answers (often exposed, sometimes, seldom, never), and weekdays and weekends were considered separately. Exposed subjects answered "often exposed" or "sometimes."

To gain information about the participants' behaviors related to tobacco smoking, we asked, in accordance with previous research (De Vries et al., 2003), "Which one of these situations better describes your behavior?" We considered "regular smokers," who declared that they smoke every day or at least once per week; "experimental smokers," who reported that they smoke once per month, at least once per month, or were self-declared ex-smokers; and "non-smokers," who said that they had never smoked or had smoked just once.

We determined socioeconomic status by means of the Family Affluence Scale (von Rueden et al., 2006), a socioeconomic indicator designed to be answered by children and adolescents. The scale includes information about family car ownership, bedroom occupancy, family holidays in the past 12 months, and computer ownership. A composite score was calculated for each subject based on the sum of the responses for the preceding four items, producing an ordinal scale from 0 to 7 that was coded into three categories: low (0–3), intermediate (4–5), and high affluence (6–7). The scale has been translated and adapted to Spanish for previous research in Spain (Martin-Pujol et al., 2013).

Intervention

Based on a previously evaluated intervention to prevent smoking initiation (PASE/ESFA Program) (Ariza et al., 2008) we designed a new intervention (the RESPIR·NET Program) including two new activities to prevent passive smoking to be applied at three levels: in the classroom (pupils), at the school (pupils, teachers, and parents), and in the family (pupils and parents). The intervention at the classroom consisted of six sessions with the pupils of 1 h each that were conducted by the teacher/tutor. The specific objectives, contents, and activities of these sessions are summarized in Table 1. We provided the teachers with a training session and a teachers' guide, and we gave each pupil a workbook with the activities, including space to record personal notes. Each pupil received a pen and a sticker with the logo of the program. At the school level, the intervention consisted of four types of posters with specific messages directed to students, teachers, and parents, and the fourth poster type advertised the new smoking laws. Moreover, we gave teachers and school managers the guide "Towards a Smoke-Free School" (Ariza and Lopez, 2006) to facilitate the prevention and control of smoking (active and passive) in the school environment. The intervention at the family level included several activities. Parents were required to complete the "My risk thermometer" activity at home with