

## BRIEF REPORT

# Intervention to reduce environmental tobacco smoke exposure in Latino children: null effects on hair biomarkers and parent reports

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**Objective:** To evaluate the effectiveness of a lay delivered intervention to reduce Latino children's exposure to environmental tobacco smoke (ETS). The a priori hypothesis was that children living in households that were in the intervention group would have lower exposure over time than measurement only controls.

**Design:** A two group, randomised control trial was conducted.

**Setting:** Areas of San Diego county with a large Latino population.

**Participants:** 143 Latino parent–child pairs.

**Intervention:** Trained bicultural and bilingual Latina lay community health advisors, or *promotoras*, conducted problem solving aimed at lowering the target child's exposure to ETS in the household. Six home and telephone sessions were delivered by the *promotoras* over a four month period.

**Main outcome measures:** Outcome measures were collected at baseline, immediately post-intervention, three months post-intervention, and 12 months post-intervention. Four outcomes were considered: (1) parent's paper-and-pencil reports of the child's past month exposure; (2) hair samples from the child analysed for past month nicotine; (3) hair samples from the child analysed for past month cotinine; and (4) per cent confirmed reducers.

**Results:** There were no significant condition-by-time interactions, the term indicative of a differential intervention effect. Significant or near significant time main effects were seen for children's hair cotinine, per cent confirmed reducers, and, in particular, parent reports of exposure.

**Conclusions:** Applying a lay *promotora* model to deliver the behavioural problem solving intervention unfortunately was not effective. A likely explanation relates to the difficulty of delivering a relatively complex intervention by lay women untrained in behaviour change theory and research methods.

particularly high risk for asthma, a condition exacerbated by cigarette smoke.<sup>5</sup> Latinos have lower rates of insurance coverage and are less likely to have access to preventive health care and public health programmes and interventions. Furthermore, randomised studies of culturally appropriate tobacco related interventions, particularly ETS reduction interventions, are rare. Although certain generic approaches may be effective, many agree an intervention approach that takes into consideration the cultural attitudes, norms, expectations, and values of the targeted cultural group is likely to increase acceptance of a programme and may enhance effectiveness.<sup>3,6</sup> The goal of this two group randomised trial was to evaluate a culturally tailored behavioural problem solving intervention, based on operant and social learning theory, to reduce ETS exposure among young Latino children.

## METHODS

Efforts were directed toward an adult member (for example, the mother) of the household in which the child lived. After recruitment from community organisations and venues (for example, Head Start Programs and cultural fairs), eligible participants were randomly assigned either to the intervention group or to the measurement only control group (that is, they participated only in surveys, but received no intervention). To be eligible, an adult had to be Latino, have a child between the ages of 1–9 years, and report exposing their child to at least six cigarettes a week.

Intervention participants were guided by trained bicultural and bilingual Latina lay community health advisors, or *promotoras*, to do problem solving aimed at lowering the target child's exposure to ETS in the household. Six home and telephone sessions were delivered by the *promotoras* over a four month period. Intervention methods included contracting, shaping, positive reinforcement, problem solving, and social support to assist families in achieving their ETS reduction goals. The ETS reduction goals were identified by individual participants and, therefore, differed across households. Examples of typical ETS reduction goals were having the adult smoker quit smoking completely or not allowing smoking in certain rooms in the house. Participants were also asked to identify potential barriers to achieving their goal of reducing ETS exposure. The participant and the *promotora* worked together to devise the steps needed to overcome the barriers towards achieving the goals set.

All participants received home visits by different bilingual measurement technicians to collect outcome measures at four times: baseline, immediately post-intervention (that is, four months after baseline), three months post-intervention,

**Abbreviations:** ETS, environmental tobacco smoke; GEE, generalised estimating equation

Environmental tobacco smoke (ETS) is designated by the US Environmental Protection Agency as a group A carcinogen—that is, there is sufficient evidence to support a causal association between ETS exposure and cancer.<sup>1</sup> Non-cancer health effects of ETS are also well established, and some of these are particularly prevalent in children.<sup>1,2</sup> Latinos have significantly lower smoking rates than the national average (18.6% v 23.3%),<sup>3</sup> and are likely to have smoke-free homes.<sup>4</sup> However, the issue of ETS exposure among Latino children remains a concern for several reasons. Latinos are the fastest growing ethnic minority in the USA, and acculturation may increase the incidence of cigarette smoking among some Latino groups.<sup>1</sup> Latino children are at

and 12 months post-intervention. At each assessment, two types of data were collected: (1) parent's paper-and-pencil reports of the child's past month exposure; and (2) hair samples from the child analysed by radioimmunoassay for past month nicotine and cotinine concentrations, valid biomarkers of ETS exposure.<sup>7</sup> Briefly, parents estimated the number of cigarettes or cigars their child was exposed to in the past 30 days, in both car and home, from each of eight sources: (1) one's own smoking, (2) spouse or boyfriend/girlfriend, (3) sibling, (4) babysitter in the house, (5) someone else living in the house, (6) visiting relative, (7) visiting friend, and (8) any other person. A measure of total adult reported past month ETS exposure was computed by summing the number of cigarettes/cigars across all eight sources. Using a standard protocol, hair samples were obtained by cutting a small amount of the child's hair (approximately 30 strands) from the posterior vertex and close to the scalp. The sample was then trimmed to 1–1.5 cm from the root end, corresponding to a past month exposure timeframe based on typical hair growth rates. Hair samples were analysed for nicotine and cotinine by radioimmunoassay. The sensitivity of the assay was 0.05 ng/mg for hair nicotine and 0.01 ng/mg for hair cotinine. Details of the measures and laboratory techniques used are described elsewhere.<sup>7, 8</sup> The a priori hypothesis was that children living in households that were in the intervention group would have lower exposure over time than measurement only controls.

## RESULTS

Participants were 143 Spanish speaking Latino adults and their children (one child per adult). The random assignment procedure resulted in 71 participants in the intervention group and 72 in the control group. Almost all adult participants were mothers of the children, and averaged 33 years of age. The average household income was \$700 to \$1099 per month, low by US standards. About 85% were born in Mexico. Mean acculturation level was relatively low (2.0 on a five point scale ranging from low to high acculturation). The majority (71%) obtained their education in Mexico, and the median level of education was 9–11 years. The average age of the children was 4 years; 55% were female. Attrition was acceptably low (81% provided data at all assessments), and analyses showed attrition introduced no significant biases. A power calculation showed that the sample size had sufficient power (0.80) to detect a 40% difference in hair nicotine between the groups at the final assessment using a one tailed test, with a level of significance of  $p = 0.05$ .

Generalised estimating equation (GEE) methods were used to assess the differential effects of the behavioural problem solving intervention over time. Four outcome measures were examined: (1) hair nicotine level measured in approximately one month's growth of the child's hair; (2) hair cotinine level measured in approximately one month's growth of the child's hair; and (3) parent reports of the child's past month exposure from all sources in the household over the last 30 days as measured by number of cigarettes. The fourth outcome variable, "confirmed" reduction, was a dichotomous variable based on both parent reports and children's hair biomarkers. Parents reporting any reduction from baseline and who also showed any reduction on either the child's hair nicotine or cotinine variable were considered a biologically confirmed reducer.

As shown in table 1, there were no significant condition-by-time interactions, the term indicative of a differential intervention effect. Significant or near significant time main effects were seen for children's hair cotinine, per cent confirmed reducers, and, in particular, parent reports of exposure. Both groups showed improvement on these three outcomes. A number of intermediate psychosocial outcomes (that is, knowledge and attitudinal constructs) were hypothesised to change over the course of the study and to potentially mediate intervention effects.<sup>9</sup> Additional analyses showed no differential group change on any psychosocial construct. In addition, none of the psychosocial constructs or sociodemographic characteristics (for example, acculturation level, income) were associated with change in exposure across condition.

## DISCUSSION

Analyses comparing baseline and post-intervention data indicated that, on average, Latino families exposed their children to less ETS over time. Yet approximately the same changes were seen across both intervention and control families. Some reduction in exposure to tobacco smoke may have been prompted simply by participating in the measurement portion of this study, which clearly focused on tobacco use and exposure of one's child to tobacco smoke in the home. However, it was surprising that the *promotora* delivered intervention did not produce additional reduction in ETS exposure to the children living in intervention homes. We had expected that a family oriented intervention to reduce ETS had a particularly good chance of being effective with Latino families, given the cultural value of *familismo* and importance placed on children's health and wellbeing.<sup>10</sup> Also, previous research has shown that lay community health

**Table 1** Analysis of intervention effects on environmental tobacco smoke (ETS) exposure measures using generalised estimating equations (GEE) methods

Exposure measure	Mean or %				GEE estimate		
	Baseline (n = 143)	Post-intervention (n = 133)	3 month follow up (n = 132)	12 month follow up (n = 127)	Time	Group	Interaction
Hair nicotine (log ng/mg)							
Intervention	0.25	0.17	0.28	0.23			
Control	0.23	0.19	0.32	0.23	0.002	-0.002	-0.001
Hair cotinine (log ng/mg)							
Intervention	0.05	0.03	0.04	0.02			
Control	0.05	0.03	0.04	0.04	-0.001*	0.003	-0.001
Parent reports (log number of cigs in past month)							
Intervention	1.75	1.42	1.27	1.06			
Control	1.85	1.62	1.44	1.27	-0.048**	-0.118	0.008
% confirmed reducers							
Intervention	NA	46	52	61			
Control	NA	45	46	56	0.015†	0.027	0.001

\* $p \leq 0.05$ ; \*\* $p \leq 0.001$ ; † $0.005 < p < 0.10$   
NA, "confirmed reducers" not applicable at baseline.

### What this paper adds

To our knowledge, no rigorous study has tested culturally tailored approaches to reducing environmental tobacco smoke (ETS) in the homes of Latinos. A culturally tailored intervention was delivered by lay community health advisors, or *promotoras*, in the home of Latino parents who admitted exposing their young children to ETS. The intervention group fared no better than a measurement only control group, as measured by parents' reports of ETS and children's hair biomarkers. We believe the lack of intervention effectiveness was likely related to the difficulty of delivering a relatively complex intervention by lay women untrained in behaviour change theory and research methods.

advisors (that is, *promotoras*) can be effective in creating awareness of health issues and providing support for behaviour change within their community.

When designing this study's approach, we had believed that the *promotora* model would provide an effective and low cost approach, given that many *promotoras* are unpaid volunteers. Yet even an intervention using community health advisors can entail a fair amount of costs. In the present study, intervention costs included producing *promotora* training materials (translating and printing), incentives and mileage reimbursements, incentives provided to intervention families, and costs to recruit intervention participants (for example, flyers, posters, newspaper and radio ads). Intervention costs in this study were estimated at just over \$29 000; spread across 71 intervention families, this averaged just over \$400 per intervention household. Adding more intervention families would bring the average costs down; however, this approach cannot really be considered low cost considering the efforts required to reach and intervene in households with children and smokers. In fact, broader public health approaches (for example, media campaigns) might bring about meaningful change at relatively lower cost, considering their wider reach throughout the community.

In addition to evaluating the intervention, we were interested in how the *promotoras* themselves might have been influenced by working on this project. *Promotoras* were very positively received by the intervention families they visited. Also, a positive impact of participating in the *promotora* training was documented. *Promotoras'* scores on several psychosocial constructs, general self esteem, and general self efficacy measures typically showed changes in the desired direction from pre- to post-training for the role of *promotora*.<sup>11</sup> Also, exit surveys measuring *promotoras'* opinions about the project indicated very positive experiences, including reports that their work made them feel good about themselves. *Promotoras* uniformly rated their overall satisfaction with the project at the top of the scale, with 100% indicating they would participate in a similar programme in the future.

The study also addressed the feasibility of collecting hair samples to provide biological markers of ETS exposure in Latino children. Experiences in this study suggested that the hair sampling approach was both acceptable and feasible in Latino children from low acculturated, primarily non-English speaking households. The feasibility of hair collection in Latino participants' homes, and the modest correlations of ETS specific constituents (particularly nicotine) in children's hair with adult reports of children's exposure suggest hair

sampling may be a potentially useful, non-invasive technique in ETS studies.<sup>8</sup> However, it should be considered only an additional tool to add to multiple convergent measures of ETS exposure.<sup>8</sup>

In summary, applying a *promotora* model to deliver the behavioural problem solving intervention used in this study was generally a positive experience both for the *promotoras* and for the Latino families with whom they worked. The unfortunate lack of intervention effectiveness was likely related to the difficulty of delivering a relatively complex behavioural intervention by lay women untrained in behaviour change theory and research methods. A four week, 20 hour course was probably inadequate training for effective delivery of this intervention. Lastly, the challenges posed by having *promotoras* deliver the intervention within the context of an experimental trial may have compromised the model's effectiveness, as the research protocol may have constrained *promotoras'* interactions with participants to a greater extent than is typical in other *promotora* interventions.

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