HEALTH EDUCATION RESEARCH Vol.28 no.1 2013
Pages 141–152
Advance Access published 20 June 2012

Implementation of a community-based secondhand smoke reduction intervention for caregivers of urban children with asthma: process evaluation, successes and challenges

Susan Blaakman[1,2,#], Paul J. Tremblay[1,*#], Jill S. Halterman[1], Maria Fagnano[1] and Belinda Borrelli[3]

[1]Department of Pediatrics, University of Rochester School of Medicine and Dentistry and Golisano Children's Hospital at Strong, Box 777, 601 Elmwood Avenue, Rochester, NY 14642, USA, [2]University of Rochester School of Nursing, Box SON, Helen Wood Hall, Rochester, NY 14642, USA and [3]Center for Behavioral and Preventive Medicine, The Miriam Hospital and Brown University School of Medicine, Coro Building, Suite 500, One Hoppin Street, Providence, RI 02903 USA

*Correspondence to: P. J. Tremblay. E-mail: paul_tremblay@urmc.rochester.edu
[#]These authors contributed equally to this work as first authors.

Received on October 26, 2011; accepted on April 27, 2012

Abstract

Many children, including those with asthma, remain exposed to secondhand smoke. This manuscript evaluates the process of implementing a secondhand smoke reduction counseling intervention using motivational interviewing (MI) for caregivers of urban children with asthma, including reach, dose delivered, dose received and fidelity. Challenges, strategies and successes in applying MI are highlighted. Data for 140 children (3–10 years) enrolled in the School Based Asthma Therapy trial, randomized to the treatment condition and living with one or more smoker, were analyzed. Summary statistics describe the sample, process measures related to intervention implementation, and primary caregiver (PCG) satisfaction with the intervention. The full intervention was completed by 79% of PCGs, but only 17% of other smoking caregivers. Nearly all (98%) PCGs were satisfied with the care study nurses provided and felt the program might be helpful to others. Despite challenges, this intervention was feasible and well received reaching caregivers who were not actively seeking treatment for smoking cessation or secondhand smoke reduction. Anticipating the strategies required to implement such an intervention may help promote participant engagement and retention to enhance the program's ultimate success.

Introduction

To fully understand the potential impact of complex, multi-component public health interventions, it is essential to not only evaluate program outcomes but also the processes that assure optimal intervention delivery [1–3]. This manuscript provides a process evaluation of the motivational interviewing (MI) intervention component of the School Based Asthma Therapy (SBAT) trial [4, 5] following the guidelines presented by Linnan and Steckler [6]. Using this model, we will describe the context, reach, dose delivered, dose received and fidelity aspects of the MI component of the larger trial.

Context

Asthma is a common chronic illness in children contributing to significant and often preventable

doi:10.1093/her/cys070

disability [7–11]. Children with persistent asthma experience more frequent emergency room and acute care visits and higher hospitalization rates compared with other children [11, 12]. Inadequately controlled asthma is associated with functional impairment, including physical activity limitations and school absenteeism [11, 13]. Parents report diminished quality of life [14] and miss work when children are ill [13].

Children, including those with asthma, are exposed to secondhand smoke (SHS) at an alarming rate [15–17]. Exposure to SHS is associated with increased asthma severity and greater difficulty with asthma control [18–21]. For children, the greatest source of SHS exposure is in the home [15, 22, 23], and caregiver decisions regarding smoking behaviors strongly influence SHS exposure levels [24]. In the United States, impoverished children and children from minority ethnic and racial backgrounds are more likely to be exposed to SHS [25–27] and suffer the greatest burden of asthma [9, 11, 28, 29]. Reducing SHS exposure among these vulnerable children is a priority.

The comprehensive SBAT trial was designed for urban children with persistent asthma, to test the effect of daily administration of preventive asthma medications given as directly observed therapy (DOT) through school and a home-based SHS reduction counseling intervention for smoke-exposed children. The SHS reduction counseling intervention (MI intervention) utilized MI to promote smoking cessation among family members and reduce children's overall SHS exposure.

MI was developed within the field of addictions treatment as a directive, client-centered counseling approach for enhancing intrinsic motivation to change by exploring and resolving ambivalence [30, 31]. MI techniques include expressing empathy, reflective listening, recognizing resistance, enhancing efficacy and developing discrepancies to encourage assessment and adjustment of personal goals and behaviors [30, 31]. MI has become common in many medical and behavioral health therapies, including treatment adherence, smoking cessation and diet and exercise regimens [32–34]. MI interventions with caregivers are increasingly used to promote pediatric health and several have targeted SHS reduction [35–38]. However, little discussion exists in the literature about the processes involved in delivering these interventions successfully [39]. This is particularly true for community-based interventions with impoverished, underserved populations and frames the context for this process evaluation.

The intervention

SBAT trial

As one component of the SBAT trial, SHS reduction counseling was paired with a school-based DOT program. Children 3–10 years of age ($N = 530$) with physician-confirmed persistent asthma at the time of screening (per expert criteria at SBAT initiation [40]) attending preschool or elementary school in Rochester, NY were enrolled over 3 years (2006–09). Details of the larger randomized controlled trial (RCT), including eligibility and exclusion criteria [4, 5] and primary outcomes [5], have been reported. Only data pertaining to primary caregivers (PCGs) of smoke-exposed children ('How many people in this child's home smoke?'; smoke-exposed defined as ≥ 1) randomized to receive the MI component of the SBAT trial ($n = 140$) were analyzed for this article. PCGs were smokers or non-smokers and were not required to be seeking assistance with SHS reduction and/or smoking cessation.

Baseline assessment and randomization, prior to MI intervention

Baseline evaluations for the SBAT trial were conducted during an initial home visit and included assessments of asthma severity, family demographics, health history, child SHS exposure and environmental asthma triggers [5]. As an objective measure of SHS exposure, saliva samples to measure cotinine, a nicotine metabolite and marker of SHS exposure, were collected from each child [41]. Samples were analyzed with a standard assay method (Salimetrics, LLC, State College, Pennsylvania). Each child was stratified according to the reported presence or absence of SHS exposure in the home at the baseline

visit and then randomized into either the usual care (control) group or the school-based care (treatment) group. For the SHS-exposed treatment group, families were offered the MI intervention in addition to the child receiving preventive asthma medication (via DOT) at school.

MI intervention for SHS reduction

This intervention was delivered by one of two registered nurses using a protocol that incorporated MI principles to (i) support caregivers in reducing their children's SHS exposure if they were ready and able, (ii) build motivation and confidence toward reducing SHS exposure if caregivers were ambivalent or uncertain about change and (iii) provide brief smoking cessation counseling tailored to a smoker's readiness to quit, if applicable [42]. The counseling protocol was adapted from the Parents of Asthmatics Quit Smoking (PAQS) project [43, 44], and the nurse interventionists were trained by the developer using two full days of didactic and role plays with intermittent multi-media reinforcement over the course of the study. The MI intervention accommodated three possible conditions for counseling recipients: PCG smoker, PCG nonsmoker, and one 'other smoker' caregiver who spent a significant amount of time with the child. The intervention included one in-person counseling visit and two follow-up telephone calls.

By design, compensation was not provided for any component of the MI intervention and the use of extrinsic motivators for participation was avoided. For the larger trial, PCGs received token compensation for the time required to complete surveys. Grocery store gift cards were provided after completion of the baseline assessment ($20) and follow-up surveys ($10/survey).

The MI intervention home visit occurred within 2–3 weeks after the baseline assessment. This timeframe allowed for a measure of the child's baseline SHS exposure, based on salivary cotinine levels, to be determined prior to the first counseling session. The purpose of the visit was explained in detail, and caregivers were told explicitly that they did not need to want to quit or change SHS-related behaviors in order to participate. Appointments were made at the PCGs' convenience and another study team member accompanied the nurses. The MI intervention home visit was designed to last 30–45 min and to be delivered individually to the PCG. If the 'other smoker' in the home chose to receive the MI intervention, a separate session using the same counseling protocol was offered.

Consistent with MI principles, capacity for change was explored with a genuine interest in caregiver experiences and perspectives. The nurse guided conversations to highlight caregiver self-motivational statements and behavior change talk. The interaction remained person-centered and supportive of caregiver autonomy by affirming that caregiver views, feelings, decisions and actions were valued. Any decision about behavior change was made by the caregiver.

Nurses asked about the enrolled child's sources of SHS exposure and elicited the caregiver's readiness to reduce the child's exposure. The counseling approach was tailored to the caregiver's readiness to change. The nurse engaged the caregiver to explore ambivalence regarding making changes and identified barriers and facilitators of change. With the caregiver's permission, the nurse discussed the child's cotinine level, how smoking affects asthma, and potential benefits gained by reducing SHS exposure. If the caregiver was ready to change SHS control practices, MI-based negotiation skills for the caregiver to use with other smokers in the household were discussed, along with SHS avoidance strategies, self-reinforcement and the importance of support for change efforts.

If the caregiver smoked and was interested in quitting, the session was extended by 15 min to discuss smoking cessation. The nurse provided advice to quit but supported the smoker's choice to change behavior or not. Again, the nurse assessed readiness to change and tailored the counseling accordingly. Caregiver smoking and quit attempt histories were discussed in a person-centered style, as were pharmacological options for smoking cessation treatment (although pharmacological agents were not provided). The smoker was offered an American Lung Association *Freedom From*

Smoking® [45] manual and referral information for community smoking cessation resources.

Two MI intervention follow-up telephone calls (15 min each) were provided to the PCG and the other identified smoker (if applicable), 1 month and 3 months after the MI home visit. Follow-up telephone calls focused on continuing support for SHS reduction practices, discussing barriers to caregiver efforts, and identifying benefits, if any, of SHS control. The second telephone call incorporated SHS exposure feedback using cotinine analysis of a second saliva sample taken from the child 2 months after baseline. For smokers, the follow-up calls additionally assessed smoking status and motivation to quit, reviewed coping strategies, prepared the caregiver for possible relapses, and enhanced confidence, as indicated.

Methods

Per the Centers for Disease Control, 'process evaluation involves the collection of information to describe what a program includes and how it functions over time' ([3], p. 4). Using this definition, the literature [1, 2, 6, 46], and collaborations within and outside of our team, we developed and evaluated four key process components ([6], p. 15) of the MI intervention, as follows.

Reach: Demographic and intervention participation data for each PCG randomized to receive MI counseling were entered into a secured database using a numerical identifier. Data for the child enrolled in the study and the 'other smoker' in the home, if applicable, were also entered.

Dose delivered: The nurses delivering the MI intervention tracked if caregivers completed the home session and the follow-up phone sessions using paper and electronic documentation. Delivery effort was recorded as the number of contact attempts made before each session was completed, the time and day of each attempt, and the length in minutes of each intervention component. Audiotapes were used to verify data.

Dose received: Intervention engagement was determined by PCG responses to a 16-item, 5-point survey completed by phone at the end of the study. The survey was conducted by team members uninvolved with MI intervention delivery and elicited PCGs' satisfaction with how the intervention was delivered. Throughout the study, engagement was monitored by nurses' field notes and review of audiotapes.

Fidelity: The MI expert performed fidelity assessments [47–49] through weekly telephone supervision with the nurses, targeting 20% of the recorded intervention sessions. Nurses used intervention checklists to be sure all intervention components were completed and reviewed these during supervision. Notes taken during supervision sessions guided the content of subsequent counseling. Each nurse received at least one quantitative Motivation Interviewing Treatment Integrity (MITI) [50] rating as a fidelity benchmark. The MITI consists of two Likert-type scales that range from 1 (low) to 7 (high) and provide global ratings of the *empathy/understanding* (efforts to grasp the participants' perspectives) expressed by the nurse and adherence to the 'spirit' of MI based on *evocation* (drawing out the participants' ideas), *collaboration* (negotiating without taking an authoritarian stance) and *autonomy* (supporting participants' choices to change or not). Using the MITI, the expert coder also tallies interventionist behaviors that include being MI adherent (e.g. asking permission before giving information or advice), using open-ended questions that encourage dialog, and using complex reflections that respond and add meaning to the participants' statements. From behavioral counts, the ratios of MI adherence to non-adherence, open to closed-ended questions, complex to simple reflections, and total reflections to questions were calculated to further measure counselor competency.

Statistical analysis

Statistical analysis was performed using SPSS 18.0 (Chicago, IL, USA). Bivariate analyses (depending on continuous or categorical data) included independent Student's *t*-tests, one-way analysis of variance, chi-square and Pearson's correlation at the statistical level of significance of $P < .05$.

Results

Reach: description of intervention recipients

Demographics

The intended recipients of the MI counseling were caregivers of urban, smoke-exposed children with persistent asthma. The overall response rate for the SBAT trial was 74%. Based on SBAT trial design, 140 PCGs were randomized to the MI intervention and included in analyses. Four PCGs withdrew their child from the study entirely before the MI intervention was initiated, and four did not participate (two declined; two were repeatedly not available) but remained in the SBAT trial. Baseline PCG and child characteristics are provided in Table I. Consistent with the demographics in the Rochester (NY) City School District, PCGs were mostly African American, single mothers who were at least 30 years old. Slightly more than half of PCGs completed high school and many exhibited low health literacy [Rapid Estimate of Adult Literacy in Medicine (REALM) score < 61; eighth grade equivalent or less] [51]. Nearly half (48%) of the PCGs reported some depressive symptoms based on the validated Kessler Psychological Distress Scale [52, 53].

SHS exposure and smoking characteristics at baseline

Based on the study design, all PCGs in this group described their children as being smoke-exposed. Most PCGs were smokers (71%) and more than half identified other caregivers in the home as smokers. At baseline, less than one-third reported a home smoking ban defined by no smoking in the home and no exceptions to the rule. Of the 93 PCGs who had cars in which to enforce a smoking rule, only 30% reported having a car smoking ban. PCGs who reported a home smoking ban and no car SHS exposure (including those who had no car) were considered to have a total smoking ban. Smokers reported significantly fewer home ($\chi^2 = 8.67$, $df = 1$, $P = 0.003$) and car ($\chi^2 = 4.32$, $df = 1$, $P = 0.038$) bans but did not differ on total bans compared to non-smoking PCGs. Smokers were on average older ($\chi^2 = 4.31$, $df = 1$, $P = 0.038$) than non-smokers (Table I).

Dose delivered

Most (79%) PCGs completed all components of the MI intervention, 6% received no intervention, and the remaining 15% completed a partial intervention consisting of the initial home visit with no follow-up phone call ($n = 2$), or the MI home visit plus one follow-up phone call ($n = 19$). Of the other smokers in the home eligible for MI counseling ($n = 79$), 17% completed the intervention whereas 38% received a partial intervention. Eight other smokers relocated out of the study child's home after the initial MI home visit and were no longer accessible for one or both follow-up phone calls (Table II).

Non-smoking PCGs were more likely to complete the entire MI intervention ($\chi^2 = 6.34$, $df = 1$, $P = 0.012$) as compared with PCGs who were smokers. PCG smokers who completed the entire intervention reported consuming on average fewer cigarettes per day ($t = 2.50$, $df = 137$, $P = 0.014$, 95% CI [0.71, 6.03]) as compared to partial-completers. Partial MI intervention completers were also more likely to have school aged versus preschool aged children ($\chi^2 = 3.87$, $df = 1$, $P = 0.049$). No other significant differences were found between PCGs who fully versus partially completed the MI intervention (Table III), and there was no difference in baseline motivation or confidence to quit.

MI counseling home visits were completed with 94% of families ($n = 132$), lasting on average 46 min (range 17–96). Most home visits (79%) were completed Monday through Friday between 8.00 a.m. and 5.00 p.m. Most (64%) were scheduled and completed with less than six telephone calls, although multiple calls (>12) from the study team were needed for PCGs who were difficult to reach (mean = 5.9, range 1–35, SD = 6.2). Thirty-five percent of appointments were rescheduled by phone at least once, and 39% of home visits required more than one trip to the home due to no answer at the door or appointment cancellation upon arrival.

Table I. *Baseline characteristics of PCGs and children randomized to MI group*

PCG characteristics	All PCGs $N = 140$ *n* (%)	Smoker $N = 99$ *n* (%)	Non-smokers $N = 41$ *n* (%)	*P*-value
Age in years				
19–29	50 (35.7)	30 (30.3)	20 (48.8)	0.038*
>30	90 (64.3)	69 (69.7)	21 (51.2)	
PCG is the mother of child?	133 (95.0)	93 (93.9)	40 (97.6)	0.371
Education (completed high school or above)	73 (52.1)	49 (49.5)	24 (58.5)	0.330
Marital status (married or domestic partner)	37 (26.4)	24 (24.2)	13 (31.7)	0.362
Race (PCG)				
White	21 (15.0)	17 (17.2)	4 (9.8)	
Black	81 (57.9)	60 (60.6)	21 (51.2)	
Other	38 (27.1)	22 (22.2)	16 (39.0)	0.104
Other household member smokes?				
Yes	82 (58.6)	41 (41.4)	41 (100.0)	0.001*
No	58 (41.4)	58 (58.6)	0 (0.0)	
Home smoking ban	43 (30.9)	23 (23.5)	20 (48.8)	0.003*
Car smoking ban (/ number of families with cars)	28/93 (30.1)	14/61 (23.0)	14/32 (43.8)	0.038*
Total smoking ban [home ban + (car ban or no car)]	29 (20.9)	17 (17.2)	12 (29.3)	0.115
Where does PCG smoking occur?				
Outside only		32 (32.3)		
Outside and inside		51 (51.5)		
Inside mostly		12 (12.1)		
Low literacy (REALM < 61)	44 (32.4)	30 (31.6)	14 (34.1)	0.769
Child characteristics				
Child age				
Mean ± SD	6.88 ± 1.998	6.90 ± 2.03	6.83 ± 1.94	0.852
Child gender				
Male	89 (63.6)	63 (63.6)	26 (63.4)	0.980
Female	51 (36.4)	36 (36.4)	15 (36.6)	
Child saliva cotinine (ng/ml)				
Mean ± SD	1.90 ± 1.93	2.10 ± 1.92	1.42 ± 1.87	0.057
Insurance (child)				
Medicaid	109 (77.9)	80 (80.8)	29 (70.7)	0.191
Asthma severity				
Mild	41 (29.3)	30 (30.3)	11 (26.8)	0.682
Mild persistent	2 (1.4)	2 (2.0)	0 (0.0)	
Moderate persistent	77 (55.0)	52 (52.5)	25 (61.0)	
Severe persistent	20 (14.3)	15 (15.2)	5 (12.2)	

*$P < 0.05$.

During the 5-month MI intervention timeframe, 49% of families changed phone numbers and 22% relocated at least once. On average, MI counseling follow-up phone calls required 5.3 attempts to complete and lasted 17.4 min (range 4–44, SD = 16). Despite a wide range (1–57) of attempts to complete follow-up phone calls, few PCGs (11%) required >12 calls to finish this part of the MI intervention.

Dose received

Inherently, MI counseling cannot be implemented effectively unless it is well received by the participants. At the end of the school year, PCGs rated their satisfaction with the counseling intervention (Table IV). With an 80% response rate, nearly all PCGs reported satisfaction with the MI counseling provided by the nurse and felt that a similar SHS

Table II. *SHS reduction intervention completion rates per component*

Recipient of counseling	Initial MI home visit	Partially completed MI home visit + one call	Fully completed MI home visit + two calls
PCG[a]	94.3%	92.8%	79.3%
	132/140	130/140	111/140
	(39/41)	*(39/41)*	*(38/41)*
Other smoker	38%	35.2%	16.9%
	30/79	25/71	12/71

[a]Non-smokers, SHS counseling reduction only; number in parentheses.

Table III. *Baseline characteristics of PCGs by completion status of SHS reduction intervention*

PCG characteristics	Completed intervention ($n = 111$)	Partially completed ($n = 29$)
Age in years		
19–29	41 (36.9)	9 (31.0)
>29	70 (63.1)	20 (69.0)
Education (completed high school or above)	58 (52.3)	15 (51.7)
Race (PCG)		
White	17 (15.3)	4 (13.8)
Black	64 (57.7)	17 (58.6)
Other	30 (27.0)	8 (27.6)
Depression (well if K10 <20)	53 (47.7)	14 (48.3)
Smoking variables (at baseline)		
PCG is a smoker	73 (65.8)	26 (89.7)*
Motivation to quit, 1–10 scale (Mean ± SD)	7.12 ± 2.79	6.42 ± 2.52
Confidence in quitting, 1–10 scale (Mean ± SD)	6.26 ± 2.97	6.23 ± 3.04
How long smoking (years) (Mean ± SD)	16.37 ± 9.66	13.80 ± 6.73
Number of previous quit attempts (Mean ± SD)	3.90 ± 11.38	5.57 ± 7.22
Number of average daily cigarettes (Mean ± SD)	5.77 ± 6.10	9.13 ± 7.6*
More than one smokers in home	39 (35.1)	11 (37.9)
Home smoking ban	34 (30.9)	9 (31.0)
Car smoking ban (/number of families with cars)	25/78 (32.1)	3/15 (20.0)
Total ban [home ban + (car ban or no car)]	21 (18.9)	8 (27.6)
Child characteristics		
Child age		
3–5 years ($n = 34$)	31 (27.9)	3 (10.3)
6–10 years ($n = 106$)	80 (72.1)	26 (89.7)*
Insurance (child)		
Medicaid	85 (76.6)	24 (82.8)
Asthma severity		
Mild	35 (31.5)	6 (20.7)
Mild persistent	2 (1.8)	0 (0.0)
Moderate persistent	62 (55.9)	15 (51.7)
Severe persistent	12 (10.8)	8 (27.6)

*$P < 0$ .05.

Table IV. *SHS reduction program PCG satisfaction*[a]

Question asked	Strongly agree or agree (%) $N = 112$
The visits with the nurse made me think about the effects of smoking on my family.	89.3
I felt as if the nurse understood where I was coming from.	93.8
The nurse made it comfortable for me to talk about my smoking (or my child's exposure to SHS).	93.8
I felt as if the nurse respected me and my opinions.	96.4
I felt like it was up to me to decide whether or not to make changes about my smoking habits (or my child's exposure to SHS).	93.8
The home visits helped me cut back or quit smoking (or reduce/eliminate my child's exposure to SHS).	79.6
In general, it was very helpful to have the nurse talk to me about smoking and exposure to SHS.	93.8
Question asked	**Very or somewhat helpful (%) $N = 112$**
How helpful do you think this type of smoking program might be to other parents of children with asthma?	98.2
How satisfied were you with the care the nurse provided?	98.2

[a]Satisfaction survey response rate: 80%.

reduction program might be helpful to other caregivers of children with asthma. Overall, 80% stated the MI intervention helped them change smoking or SHS control behaviors, but responses to this question had the widest variation depending if the PCG was a smoker (75% agreed) or non-smoker (93% agreed). Consistent with the person-centered approach of MI, 94% of respondents felt like it was their decision whether or not to make changes related to their smoking or SHS control behaviors.

Fidelity

As targeted, 20% of tapes were reviewed for fidelity supervision. Nurses met by telephone with the MI expert both individually and together. Nurses completed intervention checklists for 100% of MI sessions, which ensured adherence to the MI protocol except for deviations due to caregiver preference or unavailability. Supervision also focused on adherence to MI technique and reinforced training and skills. Benchmark MITI scores indicated the nurses rated above average in empathy and understanding (mean = 5.67) and on MI 'spirit' (mean = 5.33), and had 100% MI adherence when providing information. Nurses also demonstrated competence in their ratio of open to closed-ended questions (mean = 73.3%), but did not meet consistent proficiency in the percentage of complex reflections offered or the ratio of reflections to questions in the coded sessions.

Discussion

Getting the intervention to the target: addressing challenges for reach and dose delivered

The MI intervention was moderate in scope, aiming to reach an intended 140 families. It built upon the research team's previous work with this population and knowledge of the asthma burden disproportionately carried by young, urban children. We were able to reach participants partly due to years of building relationships with community partners (e.g. school personnel, primary care practitioners), which facilitated our recruitment and communication efforts. The participation rate for the overall trial was high, very few PCGs randomized to the MI condition withdrew their children from the RCT, and an equally small number declined the MI intervention (either actively or passively) while remaining in the larger trial. Almost all PCGs randomized to the MI intervention received at least a partial intervention dose, whereas more than three-fourth completed the counseling in its entirety.

One of the greatest challenges to MI intervention implementation was engaging caregivers to complete counseling contacts. Many factors (e.g. children, visitors, pets, electronics, traffic) created distractions and considerably lengthened (or unexpectedly shortened) the time taken to deliver the intervention. Additionally, most PCGs were reached with fewer than six calls, but certain caregivers required many more calls to complete each MI intervention component. Some PCGs rescheduled appointments repeatedly or were not accessible when an appointment was due. Some caregivers were not reachable because of fluctuating work schedules, competing commitments, phone number changes, or relocating. PCGs reported frustration when MI calls occurred proximally to monthly follow-up phone surveys that were part of the larger SBAT trial.

To optimize delivery, scheduling and counseling phone calls were made all days of the week any time between 7:30 a.m. and 9:30 p.m. as amenable to the caregiver. The phone services that families relied on dictated when calls were placed as many plans were pay-per-minute and offered free off-peak minutes in the later evenings and on weekends. Phone service plans and phone numbers changed often and unpredictably. This challenge, common to similar types of community-based interventions, was only mitigated by having multiple contact options and by the persistence of the research team.

Scheduling appointments with other smokers was especially difficult, as PCGs often acted as gatekeepers and strongly influenced whether or not the other smokers participated. Some PCGs were observably reluctant to involve their child's caregiver or family member who smoked. PCGs spoke of their dependence on these other smokers, who in many instances provided childcare and/or income to the household. The SBAT focused on asthmatic children and their PCGs, leaving few alternatives for accessing other smokers, which may be a consideration for future intervention design.

We also discovered that the MI intervention completion rates were higher if the PCG was not a smoker. This may be related to several factors. Non-smoking PCGs often seemed more aligned with the goals of the SHS reduction intervention and eager for help that is not consistently offered elsewhere [54]. These PCGs also reported less ambivalence about change and/or less guilt if felt they weren't the direct source of SHS exposure. PCGs who smoked fewer daily cigarettes on average were also more likely to complete the intervention, possibly for similar reasons. Despite evidence to the contrary [24], these PCGs frequently voiced feeling as if they did not contribute significantly to their children's smoke exposure, possibly making the intervention more palatable. It is not entirely clear why PCGs of pre-school children were also more likely to complete all intervention components. This may be related to worries about asthma severity and vulnerability to SHS risks for these youngsters [55]. PCGs of school-aged children often reported feeling more experienced with asthma care and less anxious as their child grew older. Several PCGs anticipated that their child would soon 'outgrow' asthma, which would have diminished the MI intervention's saliency.

Delivering the intervention well: addressing challenges to dose received and fidelity

Despite fidelity safeguards, flexibility to the protocol was needed. Being person-centered conflicted with strict adherence to the manual-based protocol, but may have enhanced the PCGs satisfaction with counseling. Nurses tried to adhere to the spirit of MI when PCGs wanted to discuss topics in the order of their choice and opted to skip or combine topics. Time constraints and competing demands for attention routinely distracted caregivers, which was especially difficult to address over the telephone.

Caregiver frustration may have also impacted intervention quality. MI is intended to be non-judgmental, yet caregivers receive messages from multiple sources that SHS is dangerous (e.g. from media, health care providers). Caregivers often referred to graphic anti-tobacco public service announcements during counseling sessions [56]. Guilt about not changing behavior may have resulted in caregivers avoiding contacts. Some caregivers may have felt pressured by the persistent calls from the

nurses even when given the option to decline the intervention. In traditional MI counseling, participants reinforce their choice to engage when they schedule and attend appointments at their counselor's office. For this community-based intervention, MI counselors initiated scheduling and sometimes made unannounced home visits when caregivers could not be reached by phone. This may have undermined the caregivers' sense of choice and inadvertently compromised the intended MI spirit. Although substantial time was spent in training efforts, weekly supervision and team dialog to support intervention fidelity, the collection of more extensive objective measurements of MI adherence was not feasible. Routine expert MITI coding is labor-intensive and costly, but may be beneficial to assure optimal intervention delivery.

Practice implications

Children randomized to receive treatment in the SBAT trial had significantly improved symptoms [5]. Understanding possible MI influences first requires knowing the context of intervention delivery. Caregiver decisions determine children's health, and thus, interventions tailored to caregiver concerns and needs are essential. For young urban children with significant asthma, we found that many caregivers engaged in person-centered counseling, even if not actively seeking treatment for smoking cessation or SHS control. Community-based MI counseling can be used to reach caregivers beyond the clinic to explore health behavior change on behalf of children with asthma. This may be important for non-smokers who are less likely to receive SHS control support through routine health care contacts.

Conclusion

Overall, our intervention effectively reached and was well received by the majority of participants. Community partnerships, detailed tracking, persistence, flexibility and acceptance facilitated intervention delivery. Recognizing caregivers' desire to care well for their children assisted in navigating the challenges encountered. Nurses maintained a non-judgmental demeanor to allow caregivers to feel safe to share perspectives and contemplate behavior change as evidenced by high participation rates and satisfaction scores. Even caregivers who were initially difficult to reach for counseling expressed satisfaction once contact occurred. Additional objective measures would have been helpful to further assess intervention fidelity. With appropriate resources an MI intervention of this type can be implemented feasibly. Understanding the processes involved with intervention delivery will be invaluable to enhance the potential for success for this and similar programs.

Acknowledgements

We thank the SBAT study team for their tireless efforts, the participating children or families who graciously shared aspects of their lives with us, and the Rochester (NY) City School District and School Health Services program.

Funding

National Heart, Lung and Blood Institute at the National Institutes of Health (grant number RO1HL079954); and through a grant from the Halcyon Hill Foundation.

Conflict of interest statement

None declared.

References

1. Nakkash RT, Alaouie H, Haddad P *et al*. Process evaluation of a community-based mental health promotion intervention for refugee children. *Health Educ Res* 2011, doi:10.1093/her/cyr062.
2. Campbell M, Fitzpatrick R, Haines A *et al*. Framework for design and evaluation of complex interventions to improve health. *Br Med J* 2000; **321**: 694–6.
3. Centers for Disease Control and Prevention. *Introduction to Process Evaluation in Tobacco Use Prevention and Control*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health

Promotion, Office on Smoking and Health, 2008, Available at: http://www.cdc.gov/tobacco/publications/index.htm. Accessed: 1 February 2012.
4. Halterman JS, Borrelli B, Fisher S *et al*. Improving care for urban children with asthma: design and methods of the School-Based Asthma Therapy (SBAT) trial. *J Asthma* 2008; **45**: 279–86.
5. Halterman JS, Szilagyi PG, Fisher SG *et al*. Randomized controlled trial to improve care for urban children with asthma: results of the School-Based Asthma Therapy trial. *Arch Pediatr Adolesc Med* 2011; **165**: 262–8.
6. Linnan L, Steckler A. Process evaluation for public health interventions and research: an overview. In: Steckler A, Linnan L (eds). *Process Evaluation for Public Health Interventions and Research*. San Francisco, CA: Jossey-Bass, 2002, 1–23.
7. U.S. Department of Health and Human Services: Office of Disease Prevention and Health Promotion–Healthy People 2010. *Nasnewsletter* 2000; **15**: 3.
8. National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. *Expert Panel Report 3. Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD: National Institutes of Health, 2007.
9. Akinbami LJ, Schoendorf KC. Trends in childhood asthma: prevalence, health care utilization, and mortality. *Pediatrics* 2002; **110**: 315–22.
10. Akinbami LJ. Advance Data from Vital and Health Statistics: No 381. *The State of Childhood Asthma, United States, 1980–2005*, Revised December 29, 2006. Hyattsville, MD: National Center for Health Statistics, 2006.
11. Newacheck PW, Halfon N. Prevalence, impact, and trends in childhood disability due to asthma. *Arch Pediatr Adolesc Med* 2000; **154**: 287–93.
12. Institute of Medicine. *Clearing the Air: Asthma and Indoor Air Exposures*. Washington, DC: National Academy Press, 2000.
13. Diette GB, Markson L, Skinner EA *et al*. Nocturnal asthma in children affects school attendance, school performance, and parents' work attendance. *Arch Pediatr Adolesc Med* 2000; **154**: 923–8.
14. Halterman JS, Yoos HL, Conn KM *et al*. The impact of childhood asthma on parental quality of life. *J Asthma* 2004; **41**: 645–53.
15. Pirkle JL, Bernert JT, Caudill SP *et al*. Trends in the exposure of nonsmokers in the U.S. population to secondhand smoke: 1988-2002. *Environ Health Perspect* 2006; **114**: 853–8.
16. Crain EF, Walter M, O'Connor GT *et al*. Home and allergic characteristics of children with asthma in seven U.S. urban communities and design of an environmental intervention: the Inner-City Asthma Study. *Environ Health Perspect* 2002; **110**: 939–45.
17. Halterman JS, Fagnano M, Conn KM *et al*. Do parents of urban children with persistent asthma ban smoking in their homes and cars? *Ambul Pediatr* 2006; **6**: 115–9.
18. Strachan DP, Cook DG. Health effects of passive smoking. 6. Parental smoking and childhood asthma: longitudinal and case-control studies. *Thorax* 1998; **53**: 204–12.
19. Chilmonczyk BA, Salmun LM, Megathlin KN *et al*. Association between exposure to environmental tobacco smoke and exacerbations of asthma in children. *N Engl J Med* 1993; **328**: 1665–9.
20. Mannino DM, Homa DM, Redd SC. Involuntary smoking and asthma severity in children: data from the Third National Health and Nutrition Examination Survey. *Chest* 2002; **122**: 409–15.
21. Halterman JS, Szilagyi PG, Yoos HL *et al*. Benefits of a school-based asthma treatment program in the absence of secondhand smoke exposure: results of a randomized clinical trial. *Arch Pediatr Adolesc Med* 2004; **158**: 460–7.
22. Johansson A, Hermansson G, Ludvigsson J. How should parents protect their children from environmental tobacco-smoke exposure in the home? *Pediatrics* 2004; **113**: e291–5.
23. Scherer G, Meger-Kossien I, Riedel K *et al*. Assessment of the exposure of children to environmental tobacco smoke (ETS) by different methods. *Hum Exp Toxicol* 1999; **18**: 297–301.
24. U.S. Environmental Protection Agency. *The National Survey on Environmental Management of Asthma and Children's Exposure to Environmental Tobacco Smoke, (NSEMA/CEE)*.
25. Hopper JA, Craig KA. Environmental tobacco smoke exposure among urban children. *Pediatrics* 2000; **106**: e47.
26. Morkjaroenpong V, Rand CS, Butz AM *et al*. Environmental tobacco smoke exposure and nocturnal symptoms among inner-city children with asthma. *J Allergy Clin Immunol* 2002; **110**: 147–53.
27. Weaver VM, Davoli CT, Murphy SE *et al*. Environmental tobacco smoke exposure in inner-city children. *Cancer Epidemiol Biomarkers Prev* 1996; **5**: 135–7.
28. Akinbami LJ, LaFleur BJ, Schoendorf KC. Racial and income disparities in childhood asthma in the United States. *Ambul Pediatr* 2002; **2**: 382–7.
29. Agency for Healthcare Research and Quality. *National Healthcare Disparities Report*. 2005. Available at: http://www.ahrq.gov/qual/nhdr05/fullreport/Index.htm Accessed: 1 February 2012.
30. Miller WR. Motivational interviewing with problem drinkers. *Behav Psychother* 1983; **11**: 147–72.
31. Miller WR, Rollnick S.. *Motivational Interviewing: Preparing People for Change*. New York: Guilford Press, 2002.
32. Resnicow K, DiIorio C, Soet JE *et al*. Motivational interviewing in health promotion: it sounds like something is changing. *Health Psychol* 2002; **21**: 444–51.
33. Emmons KM, Rollnick S. Motivational interviewing in health care settings: opportunities and limitations. *Am J Prev Med* 2001; **20**: 68–74.
34. Halterman JS, Riekert K, Bayer A *et al*. A pilot study to enhance preventive asthma care among urban adolescents with asthma. *J Asthma* 2011; **48**: 523–30.
35. Hovell MF, Meltzer SB, Zakarian JM *et al*. Reduction of environmental tobacco smoke exposure among asthmatic children: a controlled trial. *Chest* 1994; **106**: 440–6.
36. Hovell MF, Zakarian JM, Wahlgren DR *et al*. Reducing children's exposure to environmental tobacco smoke: the empirical evidence and directions for future research. *Tob Control* 2000; **9**(Suppl. 2): II40–7.
37. Hovell MF, Zakarian JM, Matt GE *et al*. Effect of counselling mothers on their children's exposure to environmental

tobacco smoke: randomised controlled trial. *BMJ* 2000; **321**: 337–42.
38. Tyc VL, Hovell MF, Winickoff J. Reducing secondhand smoke exposure among children and adolescents: emerging issues for intervening with medically at-risk youth. *J Pediatr Psychol* 2008; **33**: 145–55.
39. Ruger JP, Emmons KM, Kearney MH *et al*. Measuring the costs of outreach motivational interviewing for smoking cessation and relapse prevention among low-income pregnant women. *BMC Pregnancy Childbirth* 2009; **9**: 46.
40. National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. *Expert Panel Report 2. Guidelines for the Diagnosis and Management of Asthma - Update on Select Topics 2002*. Bethesda, MD: National Institutes of Health, 2003.
41. Benowitz NL. Cotinine as a biomarker of environmental tobacco smoke exposure. *Epidemiol Rev* 1996; **18**: 188–204.
42. McQuaid EL, Walders N, Borrelli B. Environmental tobacco smoke exposure in pediatric asthma: overview and recommendations for practice. *Clin Pediatr (Phila)* 2003; **42**: 775–87.
43. Borrelli B, McQuaid EL, Becker B *et al*. Motivating parents of kids with asthma to quit smoking: the PAQS project. *Health Educ Res* 2002; **17**: 659–69.
44. Borrelli B, McQuaid EL, Novak SP *et al*. Motivating Latino caregivers of children with asthma to quit smoking: a randomized trial. *J Consult Clin Psychol* 2010; **78**: 34–43.
45. Davis A, Faust R, Ordentlich M. Self-help smoking cessation and maintenance programs: a comparative study with 12-month follow-up by the American Lung Association. *Am J Public Health* 1984; **74**: 1212–17.
46. Resnicow K, Jackson A, Wang T *et al*. A motivational interviewing intervention to increase fruit and vegetable intake through black churches: results of the Eat for Life trial. *Am J Public Health* 2001; **91**: 1686–93.
47. Borrelli B. The assessment, monitoring, and enhancement of treatment fidelity in public health clinical trials. *J Public Health Dent* 2011; **71**(Suppl. 1): S52–63.
48. Bellg AJ, Borrelli B, Resnick B *et al*. Treatment Fidelity Workgroup of the NIH Behavior Change Consortium. Enhancing treatment fidelity in health behavior change studies: best practices and recommendations from the NIH Behavior Change Consortium. *Health Psychol* 2004; **23**: 443–51.
49. Borrelli B, Sepinwall D, Ernst D *et al*. A new tool to assess treatment fidelity and evaluation of treatment fidelity across 10 years of health behavior research. *J Consult Clin Psychol* 2005; **73**: 852–60.
50. Moyers T. B., Martin T., Manuel J. K., Miller W. R.. The motivational interviewing treatment integrity (MITI) code. Version 2.02003, Available: http://casaa.unm.edu/download/miti.pdf. Accessed: 1 February 2012.
51. Davis TC, Long SW, Jackson RH *et al*. Rapid estimate of adult literacy in medicine: a shortened screening instrument. *Fam Med* 1993; **25**: 391–5.
52. Kessler RC, Barker PR, Colpe LJ *et al*. Screening for serious mental illness in the general population. *Arch Gen Psychiatry* 2003; **60**: 184–9.
53. Andrews G, Slade T. Interpreting scores on the Kessler Psychological Distress Scale (K10). *Aust N Z J Public Health* 2001; **25**: 494–7.
54. Winickoff JP, Park ER, Hipple BJ *et al*. Clinical effort against secondhand smoke exposure: development of framework and intervention. *Pediatrics* 2008; **122**: e363–75.
55. Wagener TL, Gregor KL, Busch AM *et al*. Risk perception in smokers with children with asthma. *J Consult Clin Psychol* 2010; **78**: 980–5.
56. Davis KC, Nonnemaker JM, Farrelly MC *et al*. Exploring differences in smokers' perceptions of the effectiveness of cessation media messages. *Tob Control* 2011; **20**: 26–33.