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Evaluating a childhood obesity program with the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework

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ABSTRACT

Primary care providers can use behavioral lifestyle interventions to effectively treat children with overweight and obesity, but implementing these interventions is challenging. Most childhood obesity intervention evaluation studies focus on effectiveness. Few studies describe implementation. Our goal was to evaluate critical components of a childhood obesity intervention in primary care. We conducted a pilot implementation study of an existing structured lifestyle intervention in the Canton of Bern, Switzerland from 2013 to 2015. The intervention consisted of 10 sessions, led by a primary care physician. It included children aged 6–8 years old, with BMI over the 90th age-adjusted percentile. We used the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) evaluation framework to describe the pilot implementation study. We stratified description of RE-AIM components at the patient- and physician-level. For Reach: 864 children were screened; 65 were overweight; 394 physicians were invited to participate in the study. For Effectiveness: BMI z-score significantly decreased (-5.6%, $p = 0.01$). For Adoption: 14 participating physicians treated 26 patients. Implementation: the mean number of consultations was 8. For Maintenance: 9 (35%) children discontinued the intervention; 7 (50%) of physicians continued to apply at least one component of the intervention. The summarized components of the program within the RE-AIM framework suggest the program was successful. Stakeholders can use our results if they intend to disseminate and evaluate similar interventions in different settings.

1. Introduction

Primary care-based treatment programs can be effective for children with overweight and obesity (Sargent et al., 2011). The US Preventive Services Task Force (2017) therefore recommends that physicians screen children aged 6 or older for obesity and either offer behavioral obesity intervention themselves or refer the children to such an intervention. Treatment options for childhood obesity include lifestyle interventions in the primary care setting, treatment in highly specialized obesity clinics, or bariatric surgery (l'Allemand and Laimbacher, 2013). Primary care-based treatment should be the first step, and other interventions should be considered if primary care-based treatment does not ameliorate the problem (l'Allemand and Laimbacher, 2013). Unfortunately, treatment is often not initiated as indicated. One barrier to treatment is that physicians do not have the time or skills to treat children with overweight (l'Allemand and Laimbacher, 2013). Physicians often do not offer specific treatment to parents and children and, when they do, parents and children might resist treatment, particularly when physicians lack communication skills to explain the problems associated with childhood obesity or to address the topic of overweight without making parents resistant or angry (Gerards et al., 2012).

These barriers can make it difficult to implement overweight and obesity treatment programs. Studies that test lifestyle interventions to address childhood obesity in primary care usually focus on the effectiveness of an intervention, and do not provide important details for future implementation in other settings such as the number of invited children who participated, or the amount of payment or training physicians received for providing the intervention (Klesges et al., 2012).

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We found few studies that specifically described and reported on the implementation process. Beyond the implementation, we found no study who reported on the maintenance of the intervention after the end of the study phase, a critical component for stakeholders to decide if their investment in a program will have long lasting effects on health professionals and patients (Burke et al., 2015; Klesges et al., 2012). Without such studies, it is difficult for stakeholders and clinicians to implement and prioritize interventions in other settings.

We conducted a pilot implementation study of a low-threshold combined lifestyle intervention program for overweight children in primary care in the Canton of Bern, Switzerland. We used the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework to break implementation down into manageable components, so the process can be more easily replicated and compared.

2. Methods

We conducted a pilot implementation study of an existing structured lifestyle intervention in the Canton of Bern, Switzerland. The intervention was tested in 2012, in a pilot study in the Canton of Fribourg, Switzerland (S. Orellano, unpublished data). This pilot study showed that the simplicity of the intervention made it easy to implement and that primary care providers, children, and their parents were very satisfied with it. This may make it a promising new approach for treating overweight and obese children. The core components of the intervention that focused on diet, exercise, and everyday life were then implemented and tested in the Canton of Bern, Switzerland, from 2013 to 2015. The goal of the intervention was to teach children to live a healthier lifestyle and to stabilize their BMI. We did not set weight loss goals because we thought these might be unrealistic for growing children.

2.1. Recruitment of physicians and children (Fig. 1)

We recruited physicians by mail, sending letters to all General practitioners (GPs) and pediatricians in the Canton of Bern who were conducting routine school medical exams and to all pediatricians, regardless of their involvement in routine school medical exams. Physicians could choose to participate only in the screening process, or in both the screening process and the intervention study. Physicians who elected to participate in the intervention study attended a 2-hour training session where they received information about the program and about motivational coaching of parents with overweight children. Participating physicians screened children for BMI during routine school medical examinations and, if children were overweight, handed them an information letter to give to their parents. Participating physicians could also include children directly through their clinic. Interested parents were encouraged to make an appointment for a first consultation. Parents signed the informed consent at this first meeting. The Ethics Committee did not require children to provide written consent. Since we thought that the program could only work if children were motivated to participate, physicians assessed their motivation for the program in the first consultation. We included children 6–8 years old, whose BMI was over the 90th percentile (the European definitions of overweight and obesity in childhood set overweight at > 90th percentile for BMI in gender-adjusted growth charts, and obesity at > 97th percentile) (l'Allemand et al., 2006). We used the growth charts recommended by the Swiss Society of Paediatrics as our reference (Braeggera, 2011). We excluded only children whose parents did not speak German well enough to communicate with physicians.

2.2. Intervention

Participating children were enrolled in the intervention, which consisted of a block of 10 consultations with a specially trained physician. In these consultations, physicians measured parameters like height, weight and BMI at predetermined intervals. There were, ideally, 2–3 weeks between the first three consultations and 2–6 weeks after the third consultation. Each consultation focused on a topic like hobbies, food shopping habits, or eating rules. These topics were addressed multilaterally via questionnaires, short homework assignments like writing a food diary or physical exercise, and brief counselling on that topic by the primary care provider, which focused on diet, exercise, and other everyday life habits (Fig. 2). The questionnaires asked all parties about progress and satisfaction with the program, Parents and children were asked about nutritional and exercise habits, everyday life, motivation, and quality of life. Children visualized their progress by writing

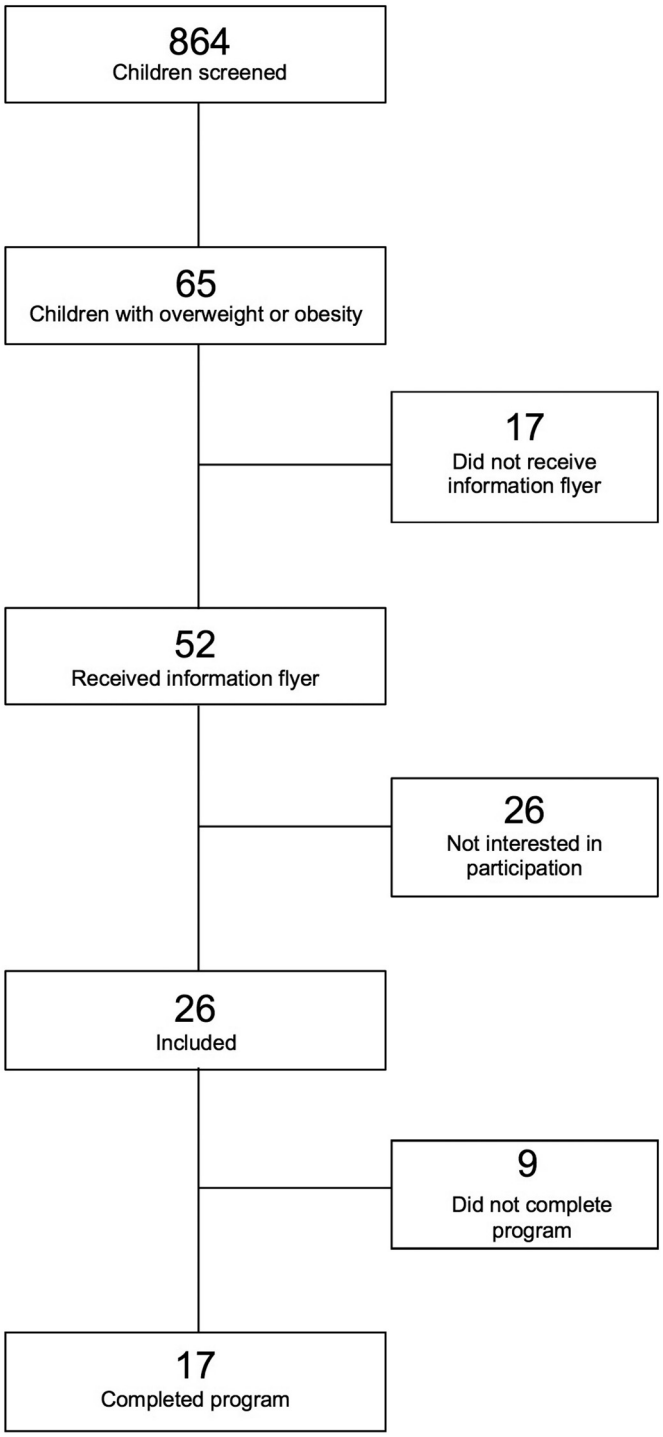

Fig. 1. Flow chart (Bern, 2013).

Fig. 2. Components of the intervention (Bern, 2013).

it down on a chart. The intervention was intended to stabilize BMI rather than ensure the child lost weight. It was also intended to improve parenting skills like implementing rules for family meals, and children's nutritional and exercise habits. Physicians made folders for each participant, into which they placed the measurements they recorded and all questionnaires about the participant.

We obtained ethical approval for this study from the ethics committee in Bern and all parents of participants provided us with written informed consent.

2.3. Description of the implementation process within the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) evaluation framework

We used the RE-AIM framework to evaluate implementation of the intervention two years after study end (Glasgow, 2006). We analyzed RE-AIM dimensions at the physician and patient level (Table 1).

For *Reach*, we counted the number of children screened (patient level). We surveyed physicians who participated in the screening program and counted the number of children screened, the number of overweight children, the number of children given an information flyer about the program, and the number of children included in the intervention study. We counted the number of physicians invited to participate in the study (physician level) and the number of participating physicians. For *Effectiveness*, we measured changes in BMI z-score, waist-to-height ratio, nutritional habits, exercise habits, media consumption (which included TV/DVD, internet and computer use) and quality of life (patient level). The quality of life questionnaire consisted of 15 questions, some about general quality of life and some about weight-specific quality of life. Physicians recorded weight, height, and BMI at consultations 2, 4, 6, 8 and 10. We later calculated BMI z-score (adjusted for sex, age and skewness of distribution) using the AnthroPlus Software of the WHO (WHO). Waist circumference was recorded at consultations 2 and 10. Nutritional and exercise habits, media consumption (including TV/DVD, internet and computer use) and quality of life (general, weight specific and health specific) were recorded in questionnaires at consultations 1, 6 and 10. For *Adoption*, we described characteristics of participating children and physicians. For *Implementation*, we counted the consultations that were held (patient and physician level). We noted whether BMI was measured as frequently as intended. We determined who covered the costs of the intervention. For *Maintenance*, we counted children who had dropped out of the study and determined why they dropped out (patient level). We determined the percentage of parents who would recommend the program to other parents (patient level). We determined the percentage of physicians who would recommend the program to colleagues and we followed up physicians by phone, two years after the study ended, to see if they continued to use components of the intervention or had modified it (physician level).

2.4. Statistical analysis

We calculated mean values of BMI z-score, waist-height ratio, amounts of snacks and sweets consumed per day, intake of sugary beverages per day, hours of physical activity per week, hours of TV or computer use per week, and scores in parent's questionnaire about children's quality of life at first and last visit. We determined the mean number of consultations per child and the frequency of BMI-

Table 1
RE-AIM dimensions (Glasgow, 2006) (Bern, 2016).

RE-AIM dimension	
Reach	**Patient level**
	Number of school children screened
	Proportion of overweight children screened who participated
	Proportion of overweight children who received an information flyer about the program
	Physician level
	Number of physicians contacted for participation in study
	Proportion of physicians who participated
Effectiveness	**Patient level**
	Change over course of study in:
	- BMI z-score (main outcome)
	- Waist-to-height ratio
	- Nutritional habits
	o Amount of sweets and snacks consumed daily
	o Amount of sugary beverages consumed in a day
	- Exercise habits
	o Hours of physical activity during one week
	- Everyday life
	o Quality of life
	o Media consumption
Adoption	**Patient level**
	Number and characteristics of children included in the study
	Physician level
	Number and characteristics of physicians who participated in the study
Implementation	**Patient and physician level**
	Mean number of consultations held
	Percentage of patients whose BMI measurements were done at intended frequency
	Direct payment of physicians for their participation
Maintenance	**Patient level**
	Number of dropouts
	Reasons for dropout
	Percentage of parents recommending the program to other parents
	Physician level
	Percentage of physicians recommending the program to other physicians
	Number of physicians that continued intervention components after the study
	Modifications to the original program

measurement. We evaluated the follow-up survey to determine the number of physicians who still used components of the intervention two years later, and how they modified the original program. We analyzed data using the STATA® Software 14.1 (StataCorp LP, College Station, TX).

3. Results

3.1. Reach

During screening, 864 6-to-8-year-old children had their height, weight, and BMI measured; 65 children (7.5%) had overweight and obesity. Of children with overweight, 52 (80%) were handed an information flyer and contact information for physicians who offered the intervention program; 13 (20%) received no information flyer, usually because they were disinterested or there was a language barrier. We included 26 children in our study: 40% of the children that had been identified as overweight during the screening process, and 50% of the children who had received an information flyer about the program.

In total, 320 GPs and 74 pediatricians were contacted to participate in the study. Of the physicians we contacted, 38 were willing to participate: 22 GPs (6.8% of those contacted to participate in the initial screening program), and 16 pediatricians (21.6% of those contacted for the initial screening program); 14 could include children in the study.

3.2. Effectiveness

BMI z-score decreased significantly (5.4%), as did waist-height ratio (2.8%) from baseline to conclusion (Table 2). BMI and weight significantly increased. Children ate significantly fewer sweets and snacks, consumed less media, and exercised more. Their weight-specific quality of life also improved slightly but significantly. Their intake of sugary beverages did not significantly decrease and other categories of quality of life did not improve.

3.3. Adoption

We included 26 children in our study: 12 boys and 14 girls. Of these children, 1 was between the 90th and 97th BMI percentile, 7 were between the 97th and 99th percentile and 18 were > 99th percentile.

Of the 14 participating physicians, 9 were pediatricians and 5 were GPs (Table 3).

3.4. Implementation

Though the intervention comprised 10 consultations, the mean

Table 2
Effectiveness (Bern, 2013–2015).

	N[e]	Before	After	Absolute change	% change	p-Value
BMI z-score, mean (SD)[a]	22	3.3 (1.4)	3.1 (1.4)	−0.2	−5.6%	0.01
BMI, mean (SD), kg/m^2	22	23.5 (3.7)	23.9 (3.8)	0.4	+1.9%	0.03
Weight, mean (SD), kg	22	39.7 (7.8)	43.5 (8.4)	3.8	+9.8%	< 0.001
Waist-to-height ratio, mean (SD)[b]	16	0.59 (0.06)	0.57 (0.08)	−0.02	−3.0%	0.04
Physical activity[c]						
Hours of physical activity per week, mean (SD), h	16	4.5 (2.1)	5.7 (2.2)	1.3		0.09
Nutrition[c]						
Amount of sweets and snacks consumed daily, mean (SD)	17	1.2 (1.2)	0.5 (0.6)	−0.7		0.04
Sugary beverages consumed in a day, mean (SD), dl	13	2.5 (0.2)	2.4 (0.2)	−0.1		0.9
Quality of life and media consumption						
Quality of life[d]						
General, mean (SD)	15	43.1 (4.0)	43.3 (3.2)	0.2		0.7
Weight specific, mean (SD)	17	12 (2.7)	13.6 (1.7)	1.6		0.03
Health specific, mean (SD)	17	3.7 (0.8)	3.9 (0.7)	0.2		0.6
Media consumption[c], mean (SD)	15	9.6 (6.9)	6.2 (2.7)	3.4		0.05

[a] First and last measurement.
[b] Of children that completed all 10 consultations, measurements from visit 2 and 10.
[c] First and last measurement of children, that completed at least 6 consultations, measured at visit 1, 6 and 10.
[d] First and last score in parent's questionnaire 'Well-being of child' of children that completed at least 6 consultations, measured at visit 1, 6 and 10.
[e] N with available data.

Table 3
Characteristics of study participants (Bern, 2013–2015).

Physicians: Total, N[a] (%)		14 (100%)
Sex		
Male, N[a] (%)		7 (50%)
Age group, N[a] (%)		
30–39		2 (17%)
40–49		8 (67%)
50–59		2 (17%) (missing data for 2 physicians)
Specialty, N[a] (%)		
General medicine		5 (36%)
Pediatrics		9 (64%)
Patients: Total		26
Sex		
Male, N[a] (%)		12 (42%)
Age, mean (SD)		6.7
BMI percentile (first measure)[b], N[a] (%)		
> 90–97		1 (4%)
> 97–99		7 (27%)
> 99		18 (69%)
Parents of children: Total, N[a] (%)		26 (100%)
Living apart, N[a] (%)		6 (24%)
	Mothers (missing data for 2 mothers)	Fathers (missing data for 5 fathers)
Country of birth, N[a] (%)		
Born in Switzerland	18 (72%)	16 (69%)
Highest education, N[a] (%)		
Elementary school	7 (28%)	1 (5%)
Apprenticeship	16 (64%)	17 (85%)
University/college	2 (8%)	2 (10%)
BMI, N[a] (%)		
< 25	10 (41.7%)	4 (20%)
25– < 30	5 (20.8%)	10 (50%)
> 30	9 (37.5%)	6 (30%)

[a] Number of observations.
[b] First measure during intervention was at consultation 2.

number of consultations was 8. BMI was measured regularly at every other consultation, in 92% of patients. Health insurance covered the cost of the intervention which was 1000 CHF on average for the whole program (about 90 CHF per consultation and a laboratory fee of 100 CHF at the beginning of the intervention). Physicians received an additional 300 CHF from the study organization when they returned study documentation.

3.5. Maintenance

Of the 26 patients, 9 (35%) discontinued the program before reaching 10 consultations. 6 provided no reason for dropping out and could not be contacted. One child's family moved to a different canton, but felt that the program had helped the child and was enjoyable. Another family said that the program was too much work and that they had trouble following the recommendations. One family felt the program did not help them.

At the end of the program (consultation 10), 92% of parents who had filled in the questionnaire (12 out of 13 parents) said they would recommend the program to other parents of overweight children. At consultation 6, this percentage had been 85%, including one family that dropped out of the program later.

We reached 12 of 14 study physicians for our follow-up survey. Of these, 10 (83%) said they would recommend this program to colleagues (71% of all participating physicians). This is similar to the percentage that would have recommended it immediately after the study (86%). Half the participating physicians (7/14) reported they still used components of the intervention program. Some had modified the original program. Three physicians held less frequent consultations, one physician held longer consultations, and one used the structure and ideas of the program but did not hand out the documents that had been provided for the study.

4. Discussion

We successfully used the RE-AIM framework to report on an intervention intended to reduce obesity in children aged 6–8: Reach, Effectiveness, Adoption, Implementation, and Maintenance. Our program reached 864 children, and we contacted 394 physicians to deliver the intervention. Of children identified with overweight, 40% were treated with the intervention, but few GPs (7%) and pediatricians (22%) offered the intervention. The results suggest that the program significantly reduced BMI z-score and waist-to-height ratio in participating children. Physicians usually followed the program. They held consultations and took measurements on schedule. Health insurance covered the cost of the intervention which was around 1000CHF for the whole program, and physicians received an additional 300CHF when they returned study documentation. The dropout rate among our patients was 35%. We found that only 50% of physicians continued to use any components of the intervention after the study concluded.

Our program reached 864 children by screening children in routine school medical examinations and by encouraging primary care physicians to recruit them from their practices. Of the 65 children identified with overweight, 40% entered our program. This percentage is lower than the 72% reported in an evaluation of a community-based childhood obesity program conducted in Canada that also used RE-AIM framework (Burke et al., 2015), but this percentage stands for interested participants included in the study who directly contacted the investigators after reading posted advertisements or referred by their physicians. In a German study in a similar setting (Wiegand et al., 2005), as well as in a Swiss national study on group therapy (L'Allemand et al., 2014), allocation to therapy and dropout rates were similar, indicating that only about 30 to 40% of overweight children and their families start a therapy. We did not collect any data on why families chose not to participate, but some may have thought that overweight was not a problem in small children; other may have felt the

intervention would be too time-consuming.

Concerning the implementation of our program, health insurance covered the cost of the consultations and we rewarded physicians an additional 300CHF for participation. Maintenance at patient level was similar to other studies with a dropout rate of 35% (Gunnarsdottir et al., 2011; Hughes et al., 2008). Maintenance by physicians was 50%. We have no basis for comparison, because we found no other published study that reported on whether physicians maintained the program after the study phase (Klesges et al., 2012; van der Heijden et al., 2014), Only about 50% of the few physicians who participated continued using the intervention, even though 83% said they would recommend it to their colleagues. Other studies reported on physician-side barriers to implementation, including physician reluctance to raise the subject of overweight, cost of the program, lack of time, or negative experiences with other lifestyle interventions (Schalkwijk et al., 2016). When parents have unrealistic expectations of weight loss, children may develop body image dissatisfaction and eating disorders (Schreiber et al., 2014). We reduced this risk by training primary care providers not to focus on weight loss, and instead to promote a healthier lifestyle. In our study, physicians were asked to participate in the program, were trained, and given structured material to support the intervention. They were also paid for participation. This structure may have made the program attractive to participating physicians. It is possible that when the structure vanished, it discouraged them from continuing. If similar structured programs were more broadly available, easy to access and use, more physicians might take advantage of them over the long term. Based on our experience in the implementation of the program described in this report, we created "*Fit in 7 steps*", a slightly shorter version of the intervention we describe. *Fit in 7 steps* was developed after the end of the study and provides guidelines and materials for GPs and pediatricians who treat overweight children aged 6–12. The *Fit in 7 steps* PDF is free to members of the Swiss Association for Obesity in Childhood and Adolescence (AKJ). We intend to study the Fit in 7 Steps program applying the RE-AIM framework in a future study.

Our study had several limitations. First, we did not have a control group. Only a randomized controlled trial (RCT) could conclusively show that the intervention caused BMI z-scores to drop significantly. However, several well-designed and well-conducted RCTs showed that similar interventions were effective (Seburg et al., 2015), and we thought that withholding proven effective interventions might be unethical. Future researches may want to explore the question in a delayed intervention RCT. Since we focused on implementation rather than effectiveness, our findings about effectiveness should be carefully interpreted. Second, weight, height and waist circumference measurements were not standardized. This made it easier for physicians to implement the program, but makes it more difficult to interpret the results. We did not include waist measurement in our screening program, which means we might have missed some overweight children since BMI fails to identify over a quarter of children with excess body fat (Javed et al., 2015). The waist-height ratio naturally declines as children age, so reductions in waist-to-hip ratio measurements should be carefully interpreted (Kesztyus et al., 2016). Third, the questions about media consumption did not include use of mobile phones which might have caused us to underestimate the time of media consumption which could lead to bias. Fourth, we did not have many participants. Fifth, the inclusion of families with migration background was relatively low, since parents without good knowledge in German language were excluded.

This program appeared to reduce BMI z-score in children who opted to participate, but our chief concern was implementation, rather than effectiveness. We successfully used RE-AIM to retroactively analyze implementation, and we encourage future researchers to use it in the planning stage for childhood obesity interventions. If successful and effective programs report on the whole implementation process, it will be easier for other stakeholders to adopt and maintain them.

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