



Short Communication

Factors affecting the dose of intervention received and the participant satisfaction in a school-based obesity prevention intervention

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ABSTRACT

This study assessed factors associated with the perceived dose of intervention received and with the participant satisfaction in a school-based obesity prevention intervention. It also explored the variance in the dose of intervention received that was at the school level. Process evaluation data from a school-based intervention study conducted in Oslo in 2007–2009 were used. A total of 542 11-year-olds from 12 intervention schools were included. A web-based questionnaire was used to collect data. Descriptive analyses and multilevel regression analyses were conducted. Females and those with medium (vs. low) parental education had higher odds of reporting a high vs. low dose of intervention received at mid-way (8 months after baseline). Perceived social capital and perceived social support for physical activity from friends at baseline were positively associated with the dose of intervention received at mid-way. Perceived social capital at mid-way was positively associated with the dose of intervention reported post-intervention (20 months after baseline). Around 20% of the variance in the perceived dose of intervention received was at the school level. Satisfaction with the intervention was high overall and higher for females for several intervention components at mid-way and at post-intervention. The factors identified in this study should be taken into consideration when planning future obesity prevention interventions among youth.

1. Background

The pandemic of overweight (OW) and obesity (OB) is a major global public health problem. In 2016, an estimated 50 million girls and 74 million boys worldwide were obese (NCD Risk Factor Collaboration (NCD-RisC), 2017). An increasing number of interventions aimed at combating OW/OB have been conducted in different settings among youth. Although promising results were documented, many interventions have fallen short of their intended effects (Thomas, 2006; Amini et al., 2015; Connelly et al., 2007). There are multiple factors explaining the limited effects of interventions targeting OW/OB, including poor implementation and reach of intervention components (Thomas, 2006; Amini et al., 2015). In this regard, process evaluation of interventions provides vital information by indicating which intervention components work and the groups for which they work (Amini

et al., 2015). Process evaluation can have different components including the dose of intervention received and the participant satisfaction with the intervention (Saunders et al., 2005). Other components include fidelity (degree to which intervention is delivered as intended), reach (participation rate) and context (aspects of the environment affecting program implementation) (Saunders et al., 2005). Assessing the dose of intervention received provides useful information about whether or not different intervention components are used by participants. Assessing participant satisfaction in interventions is also important, as finding an intervention interesting might mediate effects of interventions (Oenema et al., 2005). The literature reporting on process evaluation of interventions targeting lifestyle behaviors among youth has grown over the past decades (Amini et al., 2015; Yildirim et al., 2011). However, systematic reviews suggest that process evaluation results of many interventions are still not reported (Thomas, 2006; Yildirim et al.,

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2011). Subgroup differences have also received limited attention in the analyses of process evaluation data (Yildirim et al., 2011). This is surprising given that existing evidence suggests that some interventions might widen social inequality (McGill et al., 2015; White et al., 2009), as some intervention components might be more easily taken up by more advantaged groups due to higher support, coping skills, better resources etc. (White et al., 2009). Gender-related differences in the effects of school-based interventions have been reported in one review (Yildirim et al., 2011); while another reported mixed results (Amini et al., 2015). Exploring whether intervention components are received equally between participants of different gender and socioeconomic backgrounds is thus important. In addition, as postulated in the social ecological model and as documented in the literature, individual (self-efficacy and enjoyment) and interpersonal (social support, social capital) factors are positively associated with lifestyle behaviors (Sallis et al., 2008). What is less known is whether these factors can also positively influence the uptake of intervention components. Finally, in a school-based intervention, differences in the dose of intervention received could at least in part be due to differences in intervention implementation (the extent of which can be explored by calculating school-level variations). School-level factors affecting the implementation of school-based behavioral interventions include time constraints, resource availability/quality and the supportiveness of the school climate (Naylor et al., 2015).

The aim of this paper was to assess factors associated with the dose of intervention received and with the participant satisfaction with intervention components in a school-based obesity prevention intervention. School-level variance in the dose of intervention received was also assessed.

2. Methods

2.1. Study design and sample

Data from the school-based HHealth In Adolescence (HEIA) intervention study aimed at developing and evaluating a multi-component intervention to promote healthy weight development through diet and physical activity (PA), were used. A total of 177 schools were invited and 37 accepted the invitation. Twelve schools were randomly assigned by simple drawing to the intervention group and 25 to the control group. All 6th graders ($n = 2165$) were invited to participate in the baseline study. Parental consent was obtained for 1580 adolescents, of which 566 adolescents were in the intervention schools. The baseline, mid-way and post-intervention data collections took place in September 2007, May 2008 and May 2009 respectively. The classroom intervention components included dietary behavior lessons, computer tailored advice on energy balance-related behaviors, fruit/vegetable and PA breaks during class, and motivational posters. The environmental components included active transport/commuting campaigns and distribution of equipment to increase PA during recess, inspirational courses for physical education (PE) teachers and fact sheets on energy balance-related behaviors to parents. The intervention has been described further elsewhere (Lien et al., 2010).

Consent for participation was obtained from school administrators and from the parents of participating adolescents (who themselves provided assent). Ethical clearance was obtained from the Regional Committees for Medical Research and the Norwegian Social Science Data Service.

2.2. Measures

Ten questions were used to assess the dose of intervention received at mid-way and 11 questions were used at post-intervention assessment. Most of the questions had “yes” and “no” answer categories except for a few questions that were recoded as “yes” and “other” (Table 1).

Total scores for the dose of intervention received were computed by

summing answers to the different questions (yes = 0, no/other = 1). Thereafter, a dichotomous variable with categories reflecting high and low dose of intervention received was created. At mid-way, scores of 0 to 7 were designated as “low” and scores of 8 to 10 as “high”. At post-intervention, scores of 0 to 7 were designated as “low” and scores of 8 to 11 as “high”. These cut-offs for dichotomization were used because of the sample distribution of the variables, but also because high participation corresponds to a participation in at least 70%–80% of activities, which we considered reasonable.

Seven questions were used to assess the satisfaction with the intervention at both time points. The answer categories were: “very much”, “quite a lot”, “not so much”, and “not at all”. These were recoded into “very much and quite a lot” vs. “other” categories (Table 2).

Parental education was reported by parents. It was categorized into: low (12 years of education or less), medium (between 13 and 16 years of education) and high (> 16 years of education). Educational status of the parent with the longest education or else the one available was used in the analyses.

Body mass index (BMI) was calculated as weight/height². Weight and height were objectively measured at baseline. The age and gender specific BMI cut-off values proposed by the International Obesity Task Force were used in order to categorize the adolescents into non-OW and OW/OB (Cole et al., 2000).

Two psychological correlates, enjoyment of PA, and self-efficacy related to barriers for PA were assessed using 5-item scales. Four social-environmental correlates were included: perceived social support for PA from friends (3-item scale), perceived social support for PA from parents (5-item scale), perceived social support for PA from teachers (3-item scale), and perceived social capital related to the school and class environment (6-item scale). The validity of these scales has previously been documented (Gebremariam et al., 2012). The test-retest and internal consistency reliability of the scales were found to be adequate (Gebremariam et al., 2012). A detailed description of these scales has been provided elsewhere (Gebremariam et al., 2012).

2.3. Statistical analysis

Descriptive analyses were first conducted to assess the participants' perceived dose of intervention received and their satisfaction with the intervention components. Multilevel analyses were conducted to assess the percentage of the variance in the total dose of intervention received that was at the school level. Multilevel logistic regression analyses were used to assess whether gender, parental education, weight status and the behavioral and social environmental correlates were related to the dose of intervention received (high vs. low). Significant variables in univariate analyses were included in the final models. Gender and parental education were adjusted for in all analyses. Analyses were conducted using SPSS version 24.

3. Results

The mean age of participants was 11.2 (0.3) and 49% were females. The percentage of those with low, middle and high parental education was 26, 38 and 36. A large proportion of participants (75% and above) reported receiving the different intervention components at mid-way and post-intervention. The intervention components for which the lowest intervention dose received were reported were the use of PA-related equipment during recess and during physical education classes (Table 1). The proportion of those with a high dose of intervention received at mid-way was 67% (72% among females and 62% among males); at post-intervention it was 78% (79% among females and 77% among males). It was 70%, 75% and 56% among those with high, medium and low education respectively at mid-way and 81%, 82% and 72% respectively at post-intervention (Table 1).

Multilevel analyses showed that 19% of the variance in the dose of intervention received at mid-way and 20% at post-intervention was at

Table 1
Intervention dose received (exposure) and satisfaction with the intervention by study participants mid-way and post intervention.

	Gender			Parental education			Gender			Parental education				
	M		F	Low		Med.	High	M		F	Low		Med.	High
Dose of intervention received														
Mid-way (n = 542)														
Have you completed in class assignment about diet, PA and SB?	91,5	94,1	89,1	94,7	93,5									
Have you completed in class assignment about meals?	86	90,7	88,3	87,6	88,4									
Have you completed in class assignment about 5 a day?	82,1	87,6	81,1	88,9	85,9									
Have you completed in class assignment about sugary drinks?	80	82,9	75,8	83,7	83,1									
Have you noticed HEIA posters in the classroom?	78,8	83,3	76,5	83,2	83									
Have you participated in one or more HEIA fruit/vegetable breaks?	81,1	83,3	77	83,1	84,9									
Have you participated in the active transport campaign?	86,2	90,8	82,6	92,1	89,8									
Have you participated in one or more HEIA PA breaks?	79,3	85,2	75,9	83,1	85,4									
Have you used the equipment in the "activity box" during recess?*	57,7	60,1	63,7	56,5	61									
Have you used movement bands in the PE classes? **	37,1	57,5	40,4	45,5	53,7									
Post-intervention (n = 519)														
Have you completed the computer tailoring session about fruits?	86,3	89,1	85,8	89,5	87									
Have you completed the computer tailoring session about vegetables?	87,4	87,4	86,6	88,4	86,3									
Have you completed the computer tailoring session about PA?	86,7	89,5	83,5	90,7	88,7									
Have you completed the computer tailoring session about TV and comp/game?	85,5	89	84,1	88,4	87,6									
Have you completed the computer tailoring session about SSBs?	86,1	88,7	84,1	90,1	87									
Have you noticed HEIA posters in the classroom?	72,5	77,7	74	74,3	77,5									
Have you participated in one or both pedometer challenges?***	82,5	84,5	80,5	86,8	85,2									
Have you participated in one or more HEIA fruit/vegetable breaks?	83,7	86,1	78,5	89,5	85,1									
Have you participated in one or more HEIA physical activity breaks?	79,2	77,3	75,8	81,1	76,7									
Have you used the equipment in the "activity box" during recess?*	41,3	36,9	38,5	42,9	39									
Have you used basse (ball made of rubber bike wheels) during school hours? **	23,6	29,9	21,9	29,5	26,5									
Satisfaction with the intervention (% reporting very much/quite a lot)														
Mid-way (n=542)														
How did you like the class assignment in the HEIA project? #	72,4	86,7	77,1	80,4	79,6									
How did you enjoy participating in the active transport campaign?	91,9	95,3	93,5	94,2	93,4									
How did you like HEIA fruit/vegetable breaks?	96,2	99,1	98,1	96,8	98,7									
How did you like the HEIA physical activity breaks?	97,6	98,6	98	97,4	99,4									
How did you like the equipment in the activity box? #	91,1	96	95,5	94,1	94									
How did you like the activity with movement bands in the PE classes? #	78,8	91,9	83	88,5	86,1									
All in all, how did you like the HEIA project? #	88,3	93,8	91	92,4	91,1									
Post-intervention (n = 519)														
How did you like the computer tailoring?	72,2	73,4	69	76,6	72,1									
How did you like the pedometer challenge?	77,5	85	82,1	82,1	81,5									
How did you like the fruit/vegetable breaks? #	95,6	94,9	95	95,1	97,4									
How did you like the physical activity breaks?	92,4	90,6	91,8	92,5	90,6									
How did you like RORIS? #	59,6	71,6	63,9	62,3	71,7									
How much did you like the equipment in the activity box? #	86,5	93,7	91,1	89,6	91,5									
All in all, how did you like the HEIA project?	81,9	86,7	83,4	86,5	83,6									

PA = physical activity.

SB = sedentary behavior.

SSB = sugar-sweetened beverages.

* Yes (each school day or almost each school day) vs. No (once a week, rarely or never).

** Yes vs. no (no, does not know).

*** Yes (participated in both) vs. no.

Significant gender differences.

Table 2
Factors associated with the dose of intervention received at mid-way and post-intervention.

n = 542	aOR (CI)
Mid-way	
Gender	
Female	1.95 (1.23-3.10)
Male	1
Parental education	
Middle	2.22 (1.25-3.93)
High	1.36 (0.76-2.44)
Low	1
Perceived social capital	1.65 (1.11-2.45)
Perceived support from friends for physical activity	1.27 (1.01-1.60)
Post-intervention	
Gender	
Female	1.05 (0.63-1.75)
Male	1
Parental education	
Middle	1.75 (0.92-3.35)
High	1.47 (0.75-2.86)
Low	1
Perceived social capital	1.76 (1.32-2.33)

aOR = adjusted odds ratio, CI = confidence interval.

the school level. At mid-way, females were significantly more likely to report a high dose of intervention received (OR = 1.95 (95% CI:1.23–3.10)); the same was true for those with middle (vs. low) parental education (OR = 2.22 (95% CI:1.25–3.93)). A higher perceived social capital related to the school and class environment (OR = 1.65 (95% CI: 1.11–2.45)) and a higher perceived social support for PA (OR = 1.27 (95% CI: 1.01–1.60)) were associated with a higher dose of intervention received at mid-way assessment.

A higher perceived social capital was associated with a higher dose of intervention received at post-intervention (OR = 1.76 (95% CI: 1.32–2.33)).

Satisfaction with the intervention was high (Table 2). Satisfaction was significantly higher for females compared to males for 4 of the 7 components at mid-way and for 3 of the 7 components at post-intervention. No parental educational or weight-related differences in satisfaction with the intervention were found (Table 2).

4. Discussion

This study found a high uptake of different intervention components except for the use of PA equipment during recess and during physical education classes/school hours. The lower uptake of these intervention components might be related to a low reinforcement by school personnel. In addition, school personnel responsible for the intervention reported on a logbook that a lot of the provided equipment was easily broken and equipment had to be shared between classes.

Twenty percent of the variability in the dose of intervention received was at the school level, indicating potential variability in intervention implementation between schools, although other factors could also contribute to this variability. Several factors have previously been identified as potentially influencing school-level implementation of interventions (e.g. supportive school climate), potentially resulting in between-school variations in implementation (Naylor et al., 2015). Unpublished data from teachers involved in the current intervention indicated differences in the level of intervention implementation between schools. However, 80% of the variability in the reported intervention dose received was at the student level. Although school personnel implemented and encouraged participation in the intervention, some activities, in particular those outside the classroom such as use of

PA equipment, active transport campaigns and breaks, might have been more difficult to reinforce and monitor. At mid-way assessment, females and those with medium (vs low) parental education reported a higher intervention dose. Evidence shows that school-based interventions on energy balance-related behaviors appear to work better for girls than boys (Yildirim et al., 2011; Brown and Summerbell, 2009). Similar findings were documented in the present intervention for BMI and dietary behaviors for which intervention effects were found to be higher among females (Grydeland et al., 2014; Bjelland et al., 2011). It is possible that some intervention components are more appealing or easier to adopt for females. In addition, the study group had a particular focus on enhancing the appeal of the intervention components to inactive girls. Low threshold activities were offered to encourage less active participants to take part. The intervention was developed by female researchers; the majority of teachers involved in the intervention were women. Unintentionally, intervention components may thus have been better adapted and delivered to girls than to boys. This can also partly explain the higher satisfaction with different intervention components reported by females compared to males. Those with medium vs. low parental education reported a higher dose of intervention received at mid-way. These findings are in line with literature suggesting that more advantaged groups might have better opportunities to better take up some intervention components (McGill et al., 2015; White et al., 2009). Process evaluation studies using qualitative approaches are needed to shed light on factors mediating such socioeconomic differences.

The gender and socioeconomic differences were however not documented at post-intervention assessment. More familiarity with the intervention might also have contributed to the disappearance of the gender and parental educational differences at post-intervention.

Perceived social capital related to the school and class environment was found to be positively related to the intervention dose received at both time points. Adolescents perceiving a higher social inclusion at school might be more motivated as well as more supported to participate in different activities/intervention components. Perceived social inclusion has been found to be positively related to PA levels (Hume et al., 2009). Literature also shows the important impact of social capital on the dietary behaviors of adolescents (Carrillo-Álvarez et al., 2018).

Satisfaction with the different intervention components among participating adolescents was in general high, as has previously been documented in a review of school-based obesity prevention interventions, including interventions from Norway (Langford et al., 2015).

4.1. Strengths and limitations

Several process evaluation components such as fidelity, reach and context were not included in this study. However, this study adds to the limited literature showing the sociodemographic and social-environmental factors that can affect the uptake of intervention components.

5. Conclusions

A large percentage of the variability in intervention dose received was at the student level. Females and those with medium vs. low parental education reported a higher dose of intervention received at mid-way. Perceived social capital at the school and neighborhood level was positively related to a higher uptake of intervention components at mid-way and post-intervention. It is important to consider these factors when planning and implementing school-based obesity prevention interventions.

Declaration of competing interests

The authors declare that there is no conflict of interest.

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