



What characterizes schools and students participating in health promoting school-based intervention studies? Findings from the healthy high school study

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ARTICLE INFO

Keywords:

School-based intervention
Cluster randomized controlled trial
Students
Baseline findings
Recruitment
Representativeness
Well-being

ABSTRACT

The Healthy High School (HHS) intervention was developed to promote well-being among first-year high school students (~16 years of age) in Denmark by targeting stress, physical activity, meal habits, sleep, and sense of community. Thirty-one schools were randomly allocated to intervention (16 schools) or control (15 schools) groups in a cluster-randomized controlled trial. The purpose of this short communication was to compare characteristics of students and schools between 1) schools accepting to participate in the HHS study and non-participating schools using national survey data and 2) intervention and control schools using HHS baseline data. We included cross-sectional data from the Danish National Youth Study 2014 on 119 schools and 22,935 first-year students to characterize participating schools and students. At baseline (August 2016), students ($n = 4577$; 88.0%) and principals ($n = 29$; 96.7%) completed online questionnaires. Compared to non-participating schools, fewer HHS schools perceived their school as being popular and offered weekly sport activities outside school hours. More HHS schools had teachers engaged in health promotion activities and focused on stress prevention. The characteristics of HHS students did not differ markedly from non-participating high school students. There were no socio-demographic, outcome or contextual differences between the study arms. To ensure successful recruitment of schools it is important that the intervention meets the need of the schools and that the advantages of participation are explicit. This underlines the need for a thorough needs assessment prior to intervention development, co-creation of intervention activities with school staff, and a well-planned recruitment strategy.

1. Introduction

Similar to other European countries (Inchley et al., 2020), many students in Denmark report mental health problems such as low life satisfaction (8%), loneliness (9%) and daily stress (12%) (Bendtsen et al., 2015). Moreover, 84% of students are not sufficiently physically active (Bendtsen et al., 2015; World Health Organization, 2011), one third skip breakfast, and one fifth do not sleep enough (Bendtsen et al., 2015). Health-related behaviors established during youth tend to persist into adulthood and affect health (Kemper et al., 1990; Malina, 1996; Eisenmann et al., 2005).

A systematic review (Busch et al., 2013) found that school-based

interventions targeting multiple behaviors have most potential to promote healthy behaviors among adolescents. However, few interventions have been conducted to simultaneously improve healthy behaviors and mental health outcomes among high school students. Therefore, we developed the multi-component Healthy High School (HHS)¹ intervention to promote well-being among Danish high school students. Recruiting schools into an intervention study can be difficult, and participation rates at the school level are often low. Consequently, it is important to explore if schools which accept the invitation to participate in health promoting intervention studies differ from non-participating schools. In this short communication we compare characteristics of students and schools between 1) schools which have accepted the

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¹ HHS: Healthy High School; DNYS: Danish National Youth Study

<https://doi.org/10.1016/j.pmedr.2021.101491>

Received 30 September 2020; Received in revised form 3 July 2021; Accepted 10 July 2021

Available online 15 July 2021

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invitation to participate in the HHS study and non-participating schools and 2) intervention and control schools at baseline.

2. Methods

2.1. The HHS intervention

The intervention was tested in a cluster-randomized trial and addressed five pathways to higher levels of well-being (primary outcome); stress prevention, promotion of regular sleep and meal habits, physical activity (PA) and sense of community (secondary outcomes). It was implemented in the school year 2016/17 (nine months) and comprised four components: Structural initiatives at the school level (16 initiatives, e.g. a health and well-being policy, changes in the school canteen); teaching material (17 lessons); a 3-hour peer-led innovation workshop which inspired students to initiate school-based activities focusing on PA and sense of community before, during or after school, and a smartphone app (e.g. articles, tracking options, recipes). The trial is registered in Current Controlled Trials (ID: ISRCTN43284296, 28 April 2017) and has been described in detail elsewhere (Bonnesen et al., 2020).

2.2. Recruitment and study population

Ninety-two of 119 schools participating in the Danish National Youth Study 2014 (DNYS) (Pisinger et al., 2020) were invited to participate in the HHS study in 2016. DNYS included 22,935 first-year students who had completed a school-based online survey on health and well-being. The DNYS study population was representative of high school students in Denmark, and 86.9% of all Danish high schools participated (Pisinger et al., 2020). DNYS schools which were invited to participate in another study by our colleagues in the same period (N = 24) or with a majority of boarding school students (N = 3) were not invited to the HHS study (N = 27). Thirty-one DNYS schools accepted the invitation and were randomized into 16 intervention and 15 control schools. After randomization, one intervention school withdrew from the study. All first-year students were included in the intervention (N = 5201).

We applied the 'double-entry bookkeeping of organizational change' planning tool (Olsson et al., 2016) to develop the recruitment strategy and material. Prior to recruitment, existing fora and communication channels for high schools were used to sharpen schools' interest in the study. The Danish Association of Upper Secondary Schools recommended schools to participate in the study in their electronic newsletter. We informed teachers about the project and forthcoming recruitment through a specialist journal for teachers. We introduced principals to the study by telephone followed by dissemination of information material to principals, teachers, and student councils by e-mail and post. The material explained the potentials and implications of participation. Within two weeks, each principal was contacted again to follow-up on the invitation.

2.3. Data collection and measurements

The HHS research group contributed to the development of questions related to stress, sleep, PA, and eating habits for the DNYS study and included several identical items in the HHS study. The HHS baseline data collection was conducted in August/September 2016. Students completed a 45-minute online questionnaire on socio-demographics, primary and secondary outcomes and determinants of behavior change in the classroom after a standardized instruction given by a teacher. Primary outcome measures: Student well-being measured by the Cantril Ladder (Levin and Currie, 2014; Cantril, 1965) and the World Health Organisation Well-being Index (Bech et al., 2003; Topp et al., 2015). Secondary outcome measures: Stress (10-item Perceived Stress Scale) (Eskildsen et al., 2015), sleep (quantity and quality), PA (hours of moderate-to-vigorous PA per week), meal habits (daily intake of

breakfast, lunch, fruit, vegetables and water), and sense of community in class and at school. Principals received a 20-minute online questionnaire by e-mail about the structural, physical, and social school environment; past and ongoing health promoting initiatives, and implementation capacity. The HHS questionnaires included items from the DNYS (Pisinger et al., 2020), the Health Behaviour in School-aged Children study (Roberts et al., 2009), the Boost study (Krølner et al., 2012), the Pro Children study (De Bourdeaudhuij et al., 2005), and the X:IT study (Andersen et al., 2014). The items were either transferred directly or adapted to our study population (Bonnesen et al., 2020).

2.4. Statistical analyses

We employed descriptive statistics to compare student and school characteristics between: 1) schools participating in the HHS study (hereinafter HHS schools) and non-participating schools using DNYS data and 2) trial arms using HHS baseline data.

For research question 1) we used two comparison groups: Declining schools: DNYS schools invited to participate in the HHS study but which declined the invitation (N = 61) and non-trial schools: DNYS schools which did not participate in the HHS study (N = 88) either because they declined the invitation (N = 61) or were not invited (N = 27).

For research question 1) we supplemented by chi-square tests, and t-tests, whereas we did not perform any statistical tests for research question 2) as recommended by the CONSORT 2010 Statement (Moher et al., 2012). Student characteristics included e.g. life satisfaction, stress, and health behaviors. School characteristics included contextual factors, implementation capacity, and health promotion activities. Missing data was excluded from the study. The statistical analyses were carried out using SAS, version 9.4 (SAS Institute Inc). Based on the number of data units, a significance level of 0.001 for student characteristics and 0.05 for school characteristics was chosen a priori.

2.5. Ethical issues

The study fulfills all Danish laws with regards to data collection, storage, and analysis. There is no formal agency for approval of questionnaires in Denmark. The Danish Data Protection Authority (J.no. 2015-57-0008) and the local Data Protection Agency at the University of Southern Denmark (J.no. 10.703) approved the study and concluded that all confidentiality and privacy requirements were met. Participants received oral and written information that participation was voluntary, and that their data would be used for research purposes only and treated confidentially. No parental consent was obtained for study participants in this age group (Bonnesen et al., 2020).

3. Results

3.1. Differences between participating and non-participating schools and students

Characteristics of the HHS population compared to non-participants are shown in Table 1. Compared to non-participating schools, fewer HHS schools reported to be a popular school and to offer weekly sport activities outside school hours. More HHS schools reported to have teachers engaged in health promotion activities and to focus on stress prevention compared to non-participating schools (non-significant). Finally, more HHS schools had problems with stress among students compared to non-trial schools (non-significant).

The descriptive statistics showed no differences between students at HHS schools and non-participating schools. However, the HHS student sample was statistically different from non-participating students in terms of physical activity and intake of breakfast. Compared to DNYS students, fewer students ate lunch, fruit, and vegetables (Table 1).

Table 1

Differences between students and schools in the Healthy High School (HHS) sample and non-participants based on data from the Danish National Youth Study 2014 (DNYS) (percentages and numbers unless otherwise specified).

	HHS schools: DNYS schools which accepted the invitation to participate in the HHS study (N = 31)	Declining schools: DNYS schools which declined the invitation to participate in the HHS study (N = 61)	Non-trial schools: DNYS schools which declined the invitation to participate in the HHS study or were not invited (N = 88)
STUDENT LEVEL CHARACTERISTICS	N = 4504	N = 12,971	18,431
Girls	62.1 (2795)	60.8 (7882)	60.8 (11208)
Life satisfaction, mean (SD)	7.2 (1.8)	7.3 (1.7)	7.3 (1.7)
Life satisfaction			
High life satisfaction (9–10)	22.2 (993)	21.7 (2792)	22.2 (4057)
Medium life satisfaction (6–8)	62.2 (2780)	64.0 (8237)	64.0 (11678)
Low life satisfaction (0–5)	15.6 (697)	14.3 (1834)	13.8 (2519)
Daily stress	11.7 (522)	10.1 (1298)	10.1 (1843)
Meeting national guidelines of 8–10 h of sleep duration	41.3 (1798)	41.7 (5235)	42.5 (7577)
Meeting national guidelines of at least 60 min of moderate- to vigorous-intensity physical activity daily	14.6 (643)	16.8 (2141) *	16.8 (3035) *
Daily intake of breakfast	56.9 (2511)	61.5 (7842) *	62.0 (11202) *
Daily intake of lunch	55.3 (2429)	57.4 (7275)	57.9 (10417) *
Daily intake of fruit	38.8 (1730)	41.5 (5245)	42.3 (7491) *
Daily intake of vegetables	39.8 (1766)	42.4 (5345)	43.0 (7584) *
Students liking school at present	89.9 (3986)	90.4 (11547)	90.9 (16462)
Students who feel that the school is a nice place to be	90.1 (3933)	90.2 (11384)	90.6 (16213)
Students who feel they belong to the school	78.4 (3470)	78.6 (10019)	79.2 (14320)
Students who feel lonely	49.5 (2204)	47.9 (6148)	47.6 (18214)
SCHOOL LEVEL CHARACTERISTICS	N = 31	N = 61	N = 88
Implementation capacity			
The municipality support health promotion in the school	63.3 (19)	69.0 (40)	63.5 (54)
The school has a team working with health promotion and well-being	46.7 (14)	47.5 (28)	42.4 (36)
Most teachers are engaged in health promotion activities in the school	53.3 (16)	39.0 (23)	36.1 (31)
Contextual factors			
The school has problems with stress among teachers	13.3 (4)	10.0 (6)	9.2 (8)
The school has problems with stress among students	26.7 (8)	20.0 (12)	17.2 (15)
The school has problems with sick leave among teachers	0.0	3.3 (2)	3.5 (3)
The school is a popular school	66.7 (20)	90.0 (54) *	92.0 (80) *
Possible to buy healthy lunch in school	90.0 (27)	89.8 (53)	90.7 (78)

Table 1 (continued)

	HHS schools: DNYS schools which accepted the invitation to participate in the HHS study (N = 31)	Declining schools: DNYS schools which declined the invitation to participate in the HHS study (N = 61)	Non-trial schools: DNYS schools which declined the invitation to participate in the HHS study or were not invited (N = 88)
Possible to buy breakfast in school	86.7 (26)	90.0 (54)	88.5 (26)
Access to outdoor sport field	83.3 (25)	85.0 (51)	87.4 (76)
Access to sports hall	83.3 (25)	89.8 (53)	89.5 (77)
Prior treatment			
Previous focus on promotion of well-being	82.1 (23)	89.1 (49)	88.8 (71)
Previous focus on stress prevention	56.0 (14)	40.4 (19)	45.6 (31)
Previous focus on physical activity	70.4 (19)	69.4 (34)	70.3 (52)
Previous focus on healthy food	69.2 (18)	61.2 (30)	63.5 (47)
Ongoing initiatives similar to the HHS study			
Weekly homework club	96.7 (29)	100.0 (59)	100.0 (86)
Free breakfast	17.2 (5)	17.0 (10)	14.1 (12)
Weekly sport activities outside school hours	75.9 (22)	93.2 (55) *	93.0 (80) *

* Statistically significant

3.2. Baseline characteristics of students and schools by study arms

The student and school questionnaires were completed by 4577 students (response rate = 88.0%) and 29 principals (response rate = 96.7%). There were no socio-demographic or outcome differences between the intervention and control groups at the student level (Table 2).

In the total student population, the mean age was 16.2 years (SD 1.1), 63.0% were female, 85.3% of Danish origin, and 47% were categorized as high occupational social class. Ten percent of students reported low levels of life satisfaction, half of students reported moderate or high levels of stress, and six out of ten students did not sleep the recommended 8–10 hours. Moreover, 86% of students were not sufficiently physical active, and half of the students did not eat breakfast or lunch every day.

The median school size was higher at intervention schools compared to control schools (600 students vs. 473 students). For the total school sample, two-thirds of schools were already engaged in other health promotion activities and had classrooms in good condition, a well-functioning student council, and minimum one fast food restaurant near the school. Half of the schools reported to be a popular school and had a team working with health promotion. Six schools had a health and well-being policy, and one school reported to have problems with long-term sick leave among teachers (Table 2).

4. Discussion

It is important to explore potential selection mechanisms that affect internal and external validity of school-based interventions. This is often not possible due to missing data on school and student characteristics from non-participants. We had a unique opportunity to examine the representativeness of the sample in the HHS study as all invited schools had participated in the DNYS previously. For most school-level factors, the HHS and non-participating schools were similar. Fewer HHS schools reported to be a popular school and to offer weekly sport activities outside school hours. Attracting many students is a key goal of schools' management teams (Pisinger et al., 2020). Moreover, qualitative process

Table 2
Baseline characteristics of students and schools participating in the Healthy High School study by study arms: Socio-demographics, outcome measures and school characteristics (numbers and percentages unless otherwise specified).

Characteristics of students (individual level)	Intervention group n = 2222	Control group n = 2355
Socio-demographic characteristics		
Girls	61.7 (1371)	64.1 (1510)
Age, median [IQR]	16.0 [16–17]	16.0 [16–17]
Family occupational social class		
High social class (I + II)	47.6 (1077)	47.0 (1137)
Middle social class (III + IV)	33.8 (765)	33.9 (821)
Low social class (V + VI)	13.0 (293)	12.9 (311)
Unclassifiable	5.7 (128)	6.2 (151)
Immigrant background		
Danish origin	83.9 (1899)	86.6 (2093)
Descendant	13.3 (301)	9.6 (233)
Immigrant	2.6 (59)	3.7 (90)
Unclassifiable	<5	<5
Primary outcomes		
Life satisfaction, mean (SD)	7.6 (1.6)	7.5 (1.6)
Life satisfaction		
High life satisfaction (9–10)	27.4 (607)	26.6 (624)
Medium life satisfaction (6–8)	63.0 (1397)	62.6 (1466)
Low life satisfaction (0–5)	9.7 (214)	10.8 (252)
WHO-5, mean (SD)	65.4 (16.7)	64.9 (16.5)
Secondary outcomes		
Perceived Stress Scale score, mean (SD)	13.8 (6.5)	14.2 (6.4)
Low perceived stress (0–13)		
Moderate perceived stress (14–26)	52.1 (1122)	48.8 (1114)
High perceived stress (27–40)	43.9 (944)	47.1 (1074)
High perceived stress (27–40)	4.0 (87)	4.1 (93)
Meeting national guidelines of 8–10 h of sleep duration		
Never sleeping fitfully	37.7 (830)	36.9 (859)
Never sleeping fitfully	21.5 (479)	22.5 (522)
Meeting national guidelines of at least 60 min of moderate- to vigorous-intensity physical activity daily		
Daily intake of breakfast	15.2 (331)	13.4 (309)
Daily intake of breakfast	55.0 (1204)	54.5 (1263)
Daily intake of lunch	50.3 (1096)	52.1 (1205)
Daily intake of fruit	32.9 (723)	30.2 (702)
Daily intake of vegetables	36.6 (801)	36.7 (847)
Daily intake of minimum 1 L of water (4–8 glass)	69.8 (1531)	67.9 (1578)
Students liking school at present*	92.3 (2001)	92.7 (2131)
Students who feel that the school is a nice place to be*	90.2 (1906)	89.8 (2024)
Students who feel they belong to the school*	75.1 (1624)	76.5 (1756)
Students who feel lonely*	40.3 (889)	40.0 (937)
School level profile (cluster level)		
Contextual factors		
School size (number of students per school); median [IQR]	600 [274–721]	473 [331–770]
The school has a health and well-being policy	2 (13.3)	4 (28.6)
Classrooms are in good condition	10 (66.7)	12 (85.7)
The school has problems with long-term sick leave among teachers	1 (6.7)	0 (0.0)
The school is a popular school	6 (40.0)	9 (64.3)
Implementation capacity		
The school has a well-functioning student council	10 (66.7)	12 (85.7)
The school has a team working with health promotion and well-being	6 (40.0)	9 (64.3)
Prior treatment		
Number of health and well-being initiatives the school has been involved in the previous two years; median; [IQR]	3 [1–4]	2.5 [2–4]
Competing initiatives		
The school is engaged in other health promotion initiatives	12 (80.0)	11 (78.6)
Local food environment		
There is minimum one fast food restaurant near the school	12 (80.0)	9 (64.3)

Analyses are based on data from the Healthy High School baseline study and include available cases. IQR = interquartile range. *The secondary outcome

measure sense of community was measured at 1st follow-up only. However, the four stated measures are closely related to sense of community.

evaluation data indicated that high schools used their participation in the HHS study to become more popular by branding the school as an organization which prioritize student well-being (). More HHS schools had teachers engaged in health promotion activities which indicates that they had a more motivated staff to deliver the intervention and thereby better implementation capacity than non-participating schools. Finally, more HHS schools reported to have problems with stress among students and to have implemented stress prevention previously. The HHS intervention included several stress preventive initiatives and thus addressed the HHS school's needs and priorities.

The statistical tests showed significant differences between participating and non-participating students. However, the descriptive statistics indicated that the differences are nonsignificant in practice as there were no significant differences in means and frequencies between the two student samples. The results of this study were based on a large sample size (Pisinger et al., 2020) which is often characterized by highly statistical significance despite small practical differences (Lantz, 2013). This suggests that future results of the trial can be generalized to high school students not included in the HHS study (high external validity).

We found no systematic sociodemographic, outcome or contextual differences between the trial arms indicating high internal validity of the intervention. Consistent with national survey data (Bendtsen et al., 2015; Pisinger et al., 2019), the HHS baseline study showed a high prevalence of low life satisfaction, stress and unhealthy behaviors among students. Only six out of 29 schools had a health and well-being policy prior to the study. This underlines the need for interventions to improve well-being and a healthy lifestyle in the high school setting.

4.1. Methodological issues

Strengths include large samples of students and schools; combination of student and principal data, and high response rates among participants in the HHS study and the DNYS. Only one third of invited schools accepted to participate in the HHS study which may be a study limitation. The main reasons for declining the invitation were related to external ministerial demands including implementation of a new education reform and extensive spending costs. The DNYS was carried out two years before the HHS baseline data collection. It is, therefore, possible that the high schools have undergone some physical or structural changes between the two data collections.

5. Conclusion

In the HHS study, a comprehensive recruitment strategy was employed, and a large nationally representative sample of schools and students were successfully recruited. There were no systematic socio-demographic, outcome or contextual differences between the intervention and control groups indicating high internal validity of the HHS study.

This study indicates that schools that accepted to participate in a health and well-being intervention are schools with good implementation capacity, and schools that find the intervention meaningful either because they see the intervention as a means to increase the school's popularity or feel the intervention address the school's needs and priorities. Therefore, future school-based interventionists should in collaboration with school stakeholders consider how their intervention may boost the school's image and how it may help the schools in solving challenges related to student health, well-being, peer relations and learning outcomes. It is important to conduct a thorough needs and capacity assessment each time new interventions are developed and as preparation for recruitment to understand the needs and capacities of the school, the school organization, and culture.

Funding

This work was supported by TrygFonden [30035], Nordea-fonden [02–2015-1364], and the University of Southern Denmark [no grant number]. No sponsors had any role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank all participating students and high schools.

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