Effects of the social norms intervention *The GOOD Life* on norm perceptions, binge drinking and alcohol-related harms: A cluster-randomised controlled trial

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ABSTRACT

The study aimed to investigate if the school-based social norms intervention *The GOOD Life* was effective in reducing misperceptions, heavy alcohol use and alcohol-related harms among Danish pupils aged 13–17 years.

In total 38 schools were included in a cluster-randomised controlled trial and allocated to either intervention ($n = 641$) or control group ($n = 714$) during 2015/2016. Both groups completed an online survey before the intervention and 3 months after baseline. *The GOOD Life* intervention provided normative feedback tailored for each school-grade using three communication channels: classroom sessions, posters and web application. Outcome measures were overestimation of peers' lifetime binge drinking, binge drinking (5 or more drinks on one occasion) and alcohol-related harms. Intervention effects at follow-up were examined using multilevel logistic regression models.

Pupils in the intervention group were less likely to overestimate peers' lifetime binge drinking compared to those in the control group (OR: 0.52, 95%CI: 0.33–0.83) and were less likely to report two or more alcohol-related harms (OR: 0.59, 95%CI: 0.37–0.93). Overall, no significant effect of the intervention was found on binge drinking. However, among pupils stating it would be ok, if they drank more ($n = 296$), a preventive effect was found on binge drinking four or more times during the last 30 days (OR: 0.37, 95%CI: 0.15–0.95). Additionally, the intervention effect on overestimation was higher among pupils who reported binge drinking at baseline.

Receiving the intervention had a positive effect on norm perceptions and alcohol-related harms. We also found that the intervention effect differed by baseline status of alcohol use.

1. Introduction

Alcohol is one of the most commonly used substances among adolescents and is known to be related to several alcohol-related harms such as missing classes, getting into fights or damaging property (Carey et al., 2007; Crosnoe et al., 2012). Many studies have found that school-based alcohol prevention programmes have the potential to reduce alcohol use and prevent some of the harmful consequence related to alcohol (Carey et al., 2007; Foxcroft and Tsertsvadze, 2011). However, the effectiveness of such programmes is still inconclusive (Carney et al., 2016; Foxcroft and Tsertsvadze, 2011) because of the inconsistency of content and the diversity of the theoretical frameworks of successful programmes (Carney et al., 2016; Cuijpers, 2002; Foxcroft and Tsertsvadze, 2011). Nevertheless, systematic reviews have found social norms influences to be a dominant factor in effective school-based drug

prevention programmes (Carey et al., 2007; Foxcroft and Tsertsvadze, 2011; Reid and Carey, 2015; Simpson and Freeman, 2004).

Interventions based on social norms theory have shown promising results in reducing alcohol use in different educational settings (Bewick et al., 2013; Ellickson et al., 2003; Faggiano et al., 2008; Haines and Barker, 2003; Kypri et al., 2009; Morgenstern et al., 2009) as well as among subgroups of harmful drinkers (Bertholet et al., 2016; Voogt et al., 2013). These interventions work on the premise that young people's exaggerated perceptions of their peers' risk behaviour, so called misperceptions, predict own risk behaviour including alcohol use (McAlaney et al., 2012; Vallentin-Holbech et al., 2017). Challenging such misperceptions would lessen the social pressure on individuals and consequently decrease their own rate of consumption. School-based drug prevention based on the social norms theory clearly depicts credible messages that focus on both the positive behaviour and
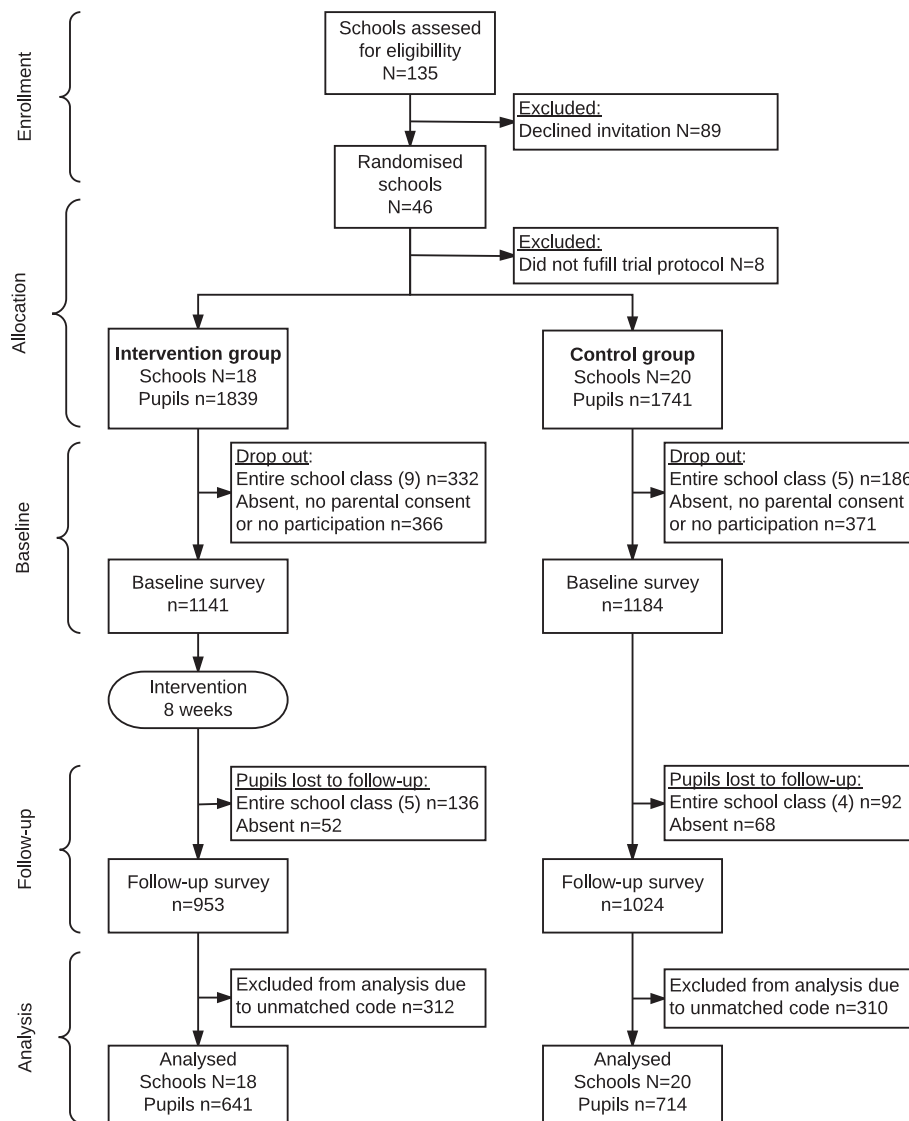

Fig. 1. Participant flow through the trial - Secondary schools from the Region of Southern Denmark, 2015/2016.

positive attitudes of the majority of the target group and does not contain any moralistic messages about how the target population should behave or what their attitudes should be (Berkowitz, 2005). Also, by depicting both the desirable behaviour of the majority and the socially approved behaviour the power of normative appeals can be optimised (Cialdini, 2003).

Even though interventions based on social norms theory are widely used to target risk behaviour among adolescents under 18 years (Balvig and Holmberg, 2014; Ellickson et al., 2003; Long and Ravey, 2012; Strøm et al., 2015) only few are evaluated in Europe with rigorous research methods and under controlled conditions (Faggiano et al., 2008; Koning et al., 2009; Morgenstern et al., 2009). In Denmark, the only previous controlled trial investigating the effect of a school-based social norms intervention had a limited sample size and was inconclusive regarding the effect on alcohol consumption (Balvig and Holmberg, 2011).

Social norms interventions in school settings typically use social marketing and normative feedback to demonstrate the discrepancy between personal behaviour and the perceived behaviour of the peer group. The interventions are often delivered only once via mail, website, classroom sessions or motivational interview within a timeframe of 10 to 90 min (Carney et al., 2016; Foxcroft and Tsertsvadze, 2011; Miller and Prentice, 2016), but not much knowledge exists on other

forms of delivery or duration of the programmes. Also, combinations of many different elements within programmes, that do not take account for the changes in adolescents' developmental stages, makes it difficult to conclude which is or is not the decisive ingredient of successful interventions (Carney et al., 2016; Foxcroft and Tsertsvadze, 2011; Onrust et al., 2016; Yeager et al., 2018). Nevertheless, some reviews conclude that successful school-based interventions include some form of interactive delivery methods that actively engage students (Cuijpers, 2002; Miller and Prentice, 2016).

In order to establish more evidence on the effectiveness of social norms interventions in secondary schools in general and specifically in Denmark the school-based social norm intervention, *The GOOD Life* was developed targeting Danish pupils aged 13–17 years. Previous social norms programmes have been criticised for certain shortcomings that would limit the effectiveness, namely a too short duration of exposure to messages, too little engagement of pupils, not addressing injunctive norms or lack of taking developmental tasks of adolescents into account (e.g. obtaining group acceptance) (Cuijpers, 2002; Onrust et al., 2016; Schultz et al., 2007; Yeager et al., 2018). *The GOOD Life* was designed to address the shortcomings mentioned above. However, we did not aim to test which of the components is most important for the effectiveness, because this would require a very complex study design with several intervention arms.

The GOOD Life aimed at influencing norm perceptions and harmful drinking among all pupils exposed to the intervention, but we hypothesised that pupils with drinking experience or those who believe it would be ok if they drank more would benefit more from the intervention. This is supported by Voogt et al. (2013), who found that a social norms intervention was more effective among college students with intentions to drink more in the near future. Other studies suggest that pupils with a higher personal alcohol use than the average in their peer group are more likely to align their own behaviour to the norm (Miller and Prentice, 2016; Onrust et al., 2016) and might therefore respond better to social norms messages.

The current study aimed to assess the effects of the school-based social norms intervention *The GOOD Life* for pupils aged 13–17 years in public schools in Denmark. The specific objectives were; 1) to examine the effect of the intervention on pupils' perception of peer drinking, on binge drinking and on alcohol-related harms as a priori defined outcomes of the trial, and 2) to assess, if interaction between baseline status of alcohol use and intervention effects exist and if sub-groups of pupils that reported any lifetime alcohol use, any lifetime binge drinking as well as those, who stated that it would be ok, if they drank more would benefit more from the intervention.

2. Methods

The study was designed as a school-based cluster-randomised controlled trial where data were collected before the intervention (baseline) and 3-months after the baseline (follow-up) (Fig. 1). The trial was approved by the Ethical Committee of the Region of Southern Denmark (Project-ID: S-20140185) and registered at Current Controlled Trials with study ID: ISRCTN27491960.

2.1. The GOOD Life intervention

The duration of *The GOOD Life* was eight weeks and normative feedback messages were delivered to pupils through three social norms components representing different communication channels: interactive classroom sessions, printed posters and interactive online media (web application). All three components contained normative messages based on the results from all responses to the baseline survey ($n = 2325$). To facilitate ownership among the pupils each message reflected a positive behaviour of the majority and it was emphasised that the data displayed were specifically tailored for each participating school and grade. The social norms messages were phrased to challenge misperceptions of peer behaviour (descriptive norms) and attitudes towards alcohol use (injunctive norms), such as "8 out of 10 pupils in 8th grade at [school name] have NEVER been drunk" and "89% of pupils in 8th grade at [school name] think it's NOT okay to drink alcohol if it affects school (Stock et al., 2016). At each school, *The GOOD Life* intervention started with a 40-min classroom feedback session facilitated by the research team. Pupils were briefly introduced into the principles of social norms. This included giving examples of how social norms typically influence the daily life of adolescents in order to relate to the age-specific the desire to obtain independence and being accepted by peers. The remaining part of the sessions was based on pupils' participation in a Student Response System (SRS) that engaged the pupils in a quiz with four to five social norms messages on the most pronounced discrepancies for the school-grade in question. The SRS displayed the discrepancies between perceived and actual norms and a general discussion with the pupils was facilitated by members of the research team. The SRS protection function was activated to make sure that the group result was presented only after all pupils have entered their response in order to minimise that pupils would influence each other during the voting. Finally, the discrepancy between the measured and the perceived frequency of last 30-days alcohol use was illustrated by a bar-chart. After the feedback session, schools received 4–6 posters with additional school-specific social norms messages. The coordinating

teachers were asked to display them in areas where pupils would see them daily for the remaining weeks of the intervention period. The posters served as a reminder of the intervention and increased pupils' exposure to the messages. At the feedback session and through posters pupils were encouraged to use QR codes to access the quiz in the web application. The web application was designed for individual users and, like the feedback session, the setup involved a multiple-choice quiz that instantly showed the correct answer. The web application was developed by Social Sense Ltd. (UK), modified for use in *The GOOD Life* in close collaboration with the research team (Stock et al., 2016) and used in accordance to a temporary licence agreement.

2.2. Study design

Public schools ($N = 46$) in the Region of Southern Denmark were enrolled in the trial between February 2015 and August 2016 and randomly allocated to either intervention or control (assessment only) group (Fig. 1). Randomisation was performed using the Microsoft Excel randomisation function. Pupils in grade 8 and 9 were invited to participate in the study through the school principal or teachers. Parents provided written consents and all pupils were informed that data were collected anonymously and treated confidentially.

Data collection was facilitated by the corresponding teachers and conducted during school hours via an online questionnaire that pupils accessed by self-registration via the survey web-site. Similar to descriptions from Galanti et al. (2007) baseline and follow-up responses from individuals were linked using a 7-digit code individually generated by each pupil. Codes that could not be located both in the baseline and the follow-up survey remained "unmatched" and were excluded from the analyses (See Fig. 1).

In total 970 pupils (42%) were lost to follow-up leaving 1355 pupils from 38 schools to be included in the analyses. Out of 2325 pupils participating in the baseline survey, 348 pupils (15%) did not complete the follow-up survey, and 622 (27%) were excluded from the analyses based on the individually generated identification code (unmatched cases). The main reason for attrition was schools withdrawing, because they lacked time and resources. For example, on schools that enrolled three to four classes, only two classes fulfilled the trial protocol (e.g. kept the deadline for consent or survey response).

An overview of the entire study, including a description of the school setting, the recruitment of schools for the study and details on the intervention, is provided elsewhere (Stock et al., 2016; Vallentin-Holbech, 2018).

2.3. Measures

The baseline questionnaire covered demographic information on age, grade and sex. Perceived Family Affluence from the Health Behaviour in School-aged Children survey was used as a proxy for information on family socioeconomic status (Currie et al., 2014). At 3-months follow-up pupils were asked if they have participated in the classroom feedback session, if they have seen the posters, and if they have used the web application with yes/no response option.

2.3.1. Outcomes

Three measures were used to examine the effects of the intervention, 1) overestimation of lifetime binge drinking was used to examine the programme theory about changes in perceived social norms, 2) frequency of binge drinking representing pupils' harmful alcohol use, and 3) change in reported alcohol-related harms.

Overestimation/underestimation of their peers' lifetime binge drinking was assessed by calculating the prevalence of lifetime binge drinking for each grade and school and using this estimate as the measure of the actual norm regarding binge drinking. Additionally, pupils were asked to rate the percentage (0–100%) of peers at their own grade and school, who have ever drunk 5 or more drinks on one

occasion. Similar to other studies (Bertholet et al., 2016), pupils who estimated the prevalence of binge drinking among their peers to be > 10% above the actual prevalence were classified as having over-estimated the prevalence of lifetime binge drinking among their peers, resulting in a dichotomous variable (yes/no). Accordingly, we also created a variable for underestimation for pupils who estimated the prevalence of binge drinking among their peers to be < 10% below the actual prevalence.

Frequency of binge drinking was measured by asking pupils how many times they have been drinking 5 or more drinks on one occasion (binge drinking) in the last 30 days. The response options were never to more than ten times. For the analyses, we divided the response options into five categories: Never, one or more times, two or more times, three or more times and four or more times. The latter category is corresponding to previous studies categorising frequent binge drinking as: "two or more episodes of binge drinking in the previous two weeks" (Viner and Taylor, 2007), which is equivalent to "four or more times in the last 30 days".

Alcohol-related harms were measured among pupils reporting lifetime alcohol use, using a summary measure based on a scale used in the SNIPE study (Pischke et al., 2012). The scale consists of ten items: missed class or other obligations, performed poorly on an exam or assignment, experienced memory loss, experienced discomfort or had a hangover, have been short of money because too much was spent on alcohol, had been injured or hurt, treatment in the emergency room, damaged others or public property, got into a fight, had a quarrel or other confrontations and got in trouble with the police. To tailor the scale to the study population of Danish adolescents we added five items from the Danish youth survey MULD (Nielsen et al., 2002): lost money or other things of value, ruined clothes or other things of value, got in trouble with your friends, got in trouble with your parents and got in trouble with your teacher. Each item had response options indicating whether pupils did or did not experience the specific problem. All 15 items were combined into an additive score (Cronbach's alpha = 0.75). Due to non-normal distribution of the score, it was categorised into: no alcohol-related harms, one or more alcohol-related harms and two or more alcohol-related harms.

2.3.2. Variables for stratification

Any lifetime alcohol use and lifetime binge drinking were measured at baseline by pupils answering yes to: *Have you ever drunk at least one drink of alcohol* and *Have you ever drunk 5 or more drinks on one occasion*, respectively.

In the baseline survey pupils were asked to state how they regarded their own alcohol consumption. The response options were: *It would be okay if I drank more, I drink an adequate amount, I drink a little too much* and *I drink too much*. For the interaction analysis, we divided the response options into two groups. Pupils who answered *It would be okay if I drank more*, were categorised as 'stating it would be ok if I drank more' while all other categories were categorised as 'not stating it would be ok if I drank more'.

Details of the origin of the measures of alcohol consumption and of pupils' norm perceptions have been reported in a study design article (Stock et al., 2016; Stock et al., 2017).

2.4. Statistical analyses

All analyses were performed using the statistical package STATA 14.1. Using Pearson's Chi-square test (Chi2) baseline differences between groups (intervention and control) were analysed.

Due to the hierarchical structure of the data multilevel logistic regression models with random intercept for school were fitted to investigate the intervention effect, using two levels: school and pupils. Cluster-size varied from 2 to 91 pupils, but did not significantly differ between control and intervention condition (Pearson Chi2 (8) = 9.874, $p = 0.274$). Baseline values for the outcome variables were controlled

for by including them into the models as well as age, sex and perceived family affluence. To minimise the risk of misclassification, sensitivity analyses were conducted for the outcomes binge drinking and alcohol-related harms using the different cut-offs described for each outcome variable above. The model for alcohol-related harms could only be fitted for 540 cases due to an error in the electronic questionnaire in the 2016 data collection that systematically left out this scale. Imputation was not undertaken because the variable in question could not be considered as missing at random (Rubin, 1996; StataCorp, 2017). Differences between pupils responding to this scale and pupils not responding to this scale were analysed using Chi2 test. Also, attrition analyses were conducted for schools not fulfilling the trial protocol.

To test if the hypothesised subgroups of the study population would benefit more from the intervention we assessed the interaction between the intervention and each of the three dichotomous baseline variables: any lifetime alcohol use, any lifetime binge drinking and stating it would be ok if they drank more. The models were stratified based on interaction terms with $p < 0.10$. As recommended by Durand (2013) for models with a priori hypothesis, the significance level was adjusted to $p < 0.10$ in order to minimise the risk of type 1 error due to the typically lower power for interactions than for main effects. All stratified models included baseline values, age, sex and perceived family affluence and used the control group as reference. Stratum-specific estimates were reported, because the variables of interest for the interaction as well as the outcomes were dichotomous (Knol and VanderWeele, 2012).

All analyses on intervention effects were conducted according to the intention-to-treat principle, but limited to cases with both baseline and follow-up data in order to be able to adjust for baseline differences between intervention and control group. The intervention effects were expressed as Odds Ratio (OR) with corresponding Confidence Intervals (95%CI) and are reported as of small, medium and large effect size using the OR limits corresponding to preventive effects suggested by Chen et al. (2010). Additionally, Absolute Risk Reduction (ARR) was calculated using the prevalence at follow-up for the respective outcomes (Altman, 1998).

The sample size calculation was based on an estimated intra-class correlation of 0.02 (Siddiqui et al., 1996). The calculation showed that to detect a 20% difference between intervention and control schools in the prevalence of binge drinking at follow-up with 80% power and $\alpha = 0.05$, 39 schools with 35 pupils per school ($n = 1.400$ pupils) needed to be included in the analysis.

2.5. Attrition analyses

Using Pearson's Chi-square test (Chi2) we found that boys (Chi2(1) = 4.6, $p = 0.031$) and older pupils (Chi2(4) = 35.6, $p < 0.001$) had higher attrition rates than girls and younger pupils. Also, higher attrition rates were found for the baseline measures of lifetime alcohol use (Chi2(1) = 17.6, $p < 0.001$), binge drinking (Chi2(10) = 34.3, $p < 0.001$) as well as alcohol-related harms (Chi2(14) = 39.9, $p < 0.001$). No significant differences in attrition were found between intervention and control group.

The majority of pupils (65%) not included in the analyses with alcohol-related harms as outcome ($n = 560$ non-response) were allocated in the control group (Chi2(1) = 57.9, $p < 0.001$). Baseline characteristics of pupils did not significantly differ between non-response and response group except from age (Chi2(4) = 32.5, $p < 0.001$) which was higher in the response group and overestimation (Chi2(1) = 6.9, $p = 0.009$) which was more prevalent in the response group.

3. Results

Table 1 presents the baseline measures for the analysed study population comprised of 1355 pupils of whom 54.0% were girls. Age ranged from 13 to 17 years with a higher proportion of older pupils in

Table 1
Characteristics of the study population at baseline by control and intervention group - Secondary schools from the Region of Southern Denmark, 2015/2016.

	Total (n = 1355)		Control (n = 714)		Intervention (n = 641)		
	n	%	n	%	n	%	p-value[a]
Sex							
Male	623	46.0	322	45.1	301	47.0	
Female	732	54.0	392	54.9	340	53.0	0.493
Age							
13	7	0.5	5	0.7	2	0.3	
14	472	34.8	255	35.7	217	33.9	
15	702	51.8	397	55.6	305	47.6	
16	170	12.6	57	8.0	113	17.6	
17	4	0.3	0	0.0	4	0.6	< 0.001
Grade							
8th	686	50.6	348	48.7	338	52.7	
9th	669	49.4	366	51.3	303	47.3	0.142
Perceived family affluence							
Very well off	308	22.7	179	25.1	129	20.1	
Quite well off	487	35.9	256	35.9	231	36.0	
Average	524	38.7	263	36.8	261	40.7	
Not well off[b]	36	2.6	16	2.2	20	3.1	0.192
Lifetime alcohol use (at least 1 drink)							
No	539	39.8	295	41.3	244	38.1	
Yes	815	60.2	419	58.7	396	61.9	0.231
Lifetime binge drinking							
No	901	66.5	475	66.5	426	66.6	
Yes	453	33.5	239	33.5	214	33.4	0.989
Ok to drink more[c]							
Stating ok if I drank more	296	36.4	153	36.5	143	36.2	
Not stating ok if I drank more	518	63.6	266	63.5	252	63.8	0.926
Binge drinking within the last 30 days							
Never	1031	76.1	540	75.6	491	76.7	
One time	140	10.3	68	9.5	72	11.3	
Two times	93	6.9	55	7.7	38	5.9	
Three times	37	2.7	26	3.6	11	1.7	
Four or more times	53	3.9	25	3.5	28	4.4	0.100
Perception of lifetime binge drinking among peers							
No overestimation	743	55.1	429	60.3	314	49.4	
Overestimation	605	44.9	283	39.7	322	50.6	< 0.001
Alcohol-related harms[c]							
None	324	39.8	129	30.8	195	49.2	
One	71	8.7	41	9.8	30	7.6	
Two or more	145	17.8	64	15.3	81	20.5	
Missing[d]	275	33.7	185	44.2	90	22.7	0.292

[a] Chi^2-test for differences between intervention and control group.
[b] Response options 'Not so well off' and 'Not at all well off' combined.
[c] Only measured among pupils with lifetime alcohol use (n = 815).
[d] Data missing due to an error in the electronic questionnaire in the 2016 data collection.

the intervention group. However, no significant difference between groups was observed for grade. The majority (58.6%) of the pupils reported a perceived family affluence above average. Any lifetime alcohol use was reported by 60.2% of the pupils, 33.5% reported lifetime binge drinking and 23.8% reported binge drinking within the last 30 days. Pupils in the intervention group were significantly more likely to overestimate their peers' lifetime binge drinking compared to pupils in the control group. Among pupils reporting any lifetime alcohol use (n = 815), 36.4% indicated it would be ok if they drank more and 26.5% had experienced one or more alcohol-related harms. In the follow-up survey 82% (n = 523) of the pupils indicated that they attended the classroom feedback session, 54% (n = 343) indicated having seen the posters and 33% (n = 211) indicated accessing the quiz in the

web-application.

Among pupils in the intervention group the prevalence of overestimation of peers' lifetime binge drinking decreased considerably from 51% at baseline to 38% at follow-up. Contrary, it increased slightly among pupils in the control group (from 40% to 46%). In contrast to this, among pupils in the intervention group the prevalence of underestimation of peers' lifetime binge drinking increased considerably from 37% at baseline to 46% at follow-up. Contrary, it decreased among pupils in the control group (from 51% to 44%) (see Table 4 in supplementary material). Table 2 presents the intervention effect showing that pupils in the intervention group were significantly less likely to overestimate lifetime binge drinking among their peers compared with pupils in the control group with medium effect size (OR: 0.52, 95%CI: 0.33–0.83).

At 3-months follow-up, there was an increase of binge drinking (e.g. frequent binge drinking from 4% to 10% in the intervention and from 4% to 11% in the control group) as well as of two or more alcohol-related harms (from 27% to 31% in the intervention and from 27% to 38% in the control group) for both groups. The analyses showed a significant intervention effect for two or more alcohol-related harms of low to medium effect size (OR: 0.59, 95%CI: 0.37–0.93), but no significant effects for any frequency of binge drinking.

Intraclass correlation (ICC) was calculated for all models and ranged from 0.004 to 0.099, indicating low to medium correlation between pupils at the same school.

Next, we entered interaction terms between intervention status x baseline status of any alcohol use, any lifetime binge drinking and stating it would be ok if I drank more, into the models depicted in Table 2. We found the following significant interactions: For the outcome overestimation of peer lifetime binge drinking we found significant interaction between intervention x baseline lifetime binge drinking (OR: 0.45, 95%CI: 0.26–0.78, p < 0.004). For the outcome binge drinking four or more times we found marginally significant interaction between intervention x baseline lifetime binge drinking (OR: 0.36, 95%CI: 0.12–1.03, p < 0.057) and with stating it would be ok if I drank more (OR: 0.43, 95%CI: 0.16–1.12, p < 0.084,). For the outcome two or more alcohol-related harm we found marginally significant interaction between intervention x baseline lifetime binge drinking (OR: 0.36, 95%CI: 0.13–1.00, p < 0.051,). No significant interaction between intervention x baseline status of any alcohol use was found for the three outcomes.

For significant and marginally significant interactions we stratified the analyses. Table 3 shows intervention effects stratified for baseline status of lifetime binge drinking and for pupils stating it would be ok if they drank more alcohol. The stratified analyses showed a significant intervention effect on overestimation of peers' lifetime binge drinking for pupils with lifetime binge drinking at baseline with medium effect size, but not for those without. There was a significant effect of the intervention on frequent binge drinking (four or more times) among pupils who stated it would be ok if they drank more with medium effect size, but not among pupils not stating this at baseline.

For two or more alcohol-related harms, the stratified analysis showed a significant intervention effect among pupils with lifetime binge drinking of medium effect size, while for those without lifetime binge drinking at baseline the analysis was not performed due to a very low number of cases.

An additional analysis showed that underestimators at baseline did not increase binge drinking at 3-months follow-up compared to the control group and no interaction between (mis)perception at baseline and intervention effect was found (see Table 5 in supplementary material).

4. Discussion

The aim of the current study was to assess the effectiveness of a school-based social norm intervention targeting Danish pupils aged

Table 2

Intervention effects at 3-months follow-up - Secondary schools from the Region of Southern Denmark, 2015/2016.

Outcomes	OR[b]	95% CI	*p*-value	ICC[c]	Control n/N	Intervention n/N	ARR
Overestimation of peers' lifetime binge drinking[a]	0.52	0.33–0.83	0.006	0.088	323/706	241/633	7.7%
Binge drinking within the last 30 days							
One or more times	1.06	0.71–1.60	0.772	0.052	201/713	194/640	− 2.1%
Two or more times	1.02	0.62–1.68	0.943	0.084	140/713	125/640	0.1%
Three or more times	0.92	0.54–1.55	0.743	0.084	103/713	86/640	1.0%
Four or more times	0.89	0.49–1.61	0.709	0.099	77/713	63/640	1.0%
Alcohol-related harms (*n* = 540)							
One or more	0.93	0.55–1.57	0.772	0.019	119/234	140/306	5.1%
Two or more	0.59	0.37–0.93	0.024	0.004	89/234	95/306	7.0%

[a] Perceived prevalence among peers > actual prevalence in own grade and school +10% tolerance.
[b] Odds Ratios based on multilevel logistic regression models adjusted for baseline values, age, sex and perceived family affluence and school included as random effect with corresponding 95% confidence interval (CI) and *p*-value.
[c] Residual intraclass correlation between schools. n/N: Event rate - Number of events out of total number of pupils answering in the 3-months follow-up survey. ARR: Absolute Risk Reduction.

13–17 years. Our results suggest that *The GOOD Life* is an effective intervention to reduce both overestimation of peers' lifetime binge drinking and alcohol-related harms among Danish adolescents. Additionally, the sub-group analyses indicated a preventive effect on frequent binge drinking among pupils stating that it would be ok if they drank more and a larger preventive effect on overestimation among those reporting any lifetime binge drinking at baseline.

All analyses showed a consistently lower overestimation of peers' lifetime binge drinking for pupils receiving *The GOOD Life* with effect estimates reflecting a medium effect size. Attrition bias cannot play a relevant role for this consistent finding, since the attrition analysis did not show significant differences between intervention and control group. Our finding of reduced overestimation in the intervention group is in accordance with previous social norms research that found that misperceptions were corrected among pupils exposed to the intervention (Giannotta et al., 2014; Neighbors et al., 2011; Reid and Carey, 2015). In line with this research our data showed that from baseline to follow-up, the percentage of overestimators decreased in the intervention group, while it increased in the control group. We also found that the intervention increased the percentage of underestimators as compared to the control condition, where a decrease was noted. This indicates an overall preventive effect of *The GOOD Life* regards misperceptions. Further, a post hoc analysis showed that underestimators at baseline did not increase binge drinking at 3-months follow-up compared to the control group and no interaction between (mis)perception at baseline and intervention effect was found. Therefore, a

potential adverse effect of social norms messages on underestimators who could be encouraged to increase their drinking as discussed by others (Schultz et al., 2007) seems to be limited in our study, but cannot be totally ruled out.

Our findings demonstrated no significant decrease in pupils' binge drinking. However, at baseline, in our study, 40% of participating pupils reported no lifetime alcohol use (non-users) and 60% reported no lifetime binge drinking. It can be anticipated that those who do not drink alcohol will not possess intention or motivation to change behaviour (Miller and Prentice, 2016) because they would regard their own behaviour as consistent with the norm displayed in the intervention messages (e.g. no binge drinking). Also, other studies have demonstrated that school-based programmes did not significantly delay alcohol onset among non-users (Carney et al., 2016; Ellickson et al., 2003). Hence, we regard this as the main reason, why the intervention did not show a significant effect on binge drinking in the whole group. Also, as observed in other studies (Biglan et al., 1991; Morgenstern et al., 2009), the loss to follow up in this study occurred more frequently both in the intervention and the control group among older pupils with a higher and more frequent use of alcohol. This attrition effect, where heavier drinkers are more likely to drop out, could underestimate the prevalence of pupils' alcohol use at follow-up and may result in loss of power in studying intervention effects on binge drinking.

Only among pupils stating it would be ok if they drank more at baseline we found a significant intervention effect on frequent binge

Table 3

Stratification of intervention effect in sub-groups of pupils with lifetime binge drinking and those stating it would be ok if they drank more at baseline - Secondary schools from the Region of Southern Denmark, 2015/2016.

Outcomes	OR[b]	95% CI	*p*-value	Control n/N	Intervention n/N	ARR
Overestimation of peers' lifetime binge drinking[a]						
Lifetime binge drinking	0.38	0.23–0.62	< 0.001	130/233	78/211	18.8%
No lifetime binge drinking	0.71	0.43–1.15	0.164	193/473	163/421	2.1%
Binge drinking four or more times within the last 30 days						
Lifetime binge drinking	0.75	0.43–1.31	0.306	70/238	51/214	5.6%
No lifetime binge drinking	NA			7/475	12/425	
Stating ok if I drank more	0.37	0.15–0.95	0.038	24/152	11/142	8.0%
Not stating ok if I drank more	0.98	0.53–1.81	0.948	53/266	47/252	1.3%
Two or more alcohol-related harms (n = 540)						
Lifetime binge drinking	0.49	0.27–0.88	0.016	80/128	76/140	8.2%
No lifetime binge drinking	NA			9/106	19/166	

n/N: Number of cases out of number of pupils in the subgroup answering in the follow-up survey. ARR: Absolute risk reduction. NA indicates not analysed due to too low number of cases (< 10).
[a] Perceived prevalence among peers > actual prevalence in own grade and school +10% tolerance.
[b] Odds Ratios based on multilevel regression models adjusted for baseline values, age, sex and perceived family affluence and school included as random effect with corresponding 95% confidence interval (CI) and *p*-value.

drinking indicating a medium effect size for this specific sub-group. Although one needs to consider the limited power of the relatively small sample size of this sub-group, our finding corresponds well to a previous study showing that among college students with intentions to drink more, a prevention programme led to a significantly lower prevalence of weekly alcohol consumption compared to students with no intentions (Voogt et al., 2013).

In addition, the analyses showed a significant intervention effect on two or more alcohol-related harms reflecting a low to medium effect size. This finding needs to be interpreted with caution due to the fact that this outcome was not measured in the whole sample. However, attrition analyses between responders and non-responders for this variable did not show any relevant differences that would indicate attrition bias. The preventive effect of *The GOOD Life* on alcohol-related harms is consistent with previous studies demonstrating that social norms interventions are especially beneficial for less socially acceptable forms of alcohol-related behaviour such as problem drinking often leading to alcohol-related harms like missing classes (Caria et al., 2011; Kypri et al., 2009).

Moreover, even stronger preventive effects on alcohol-related harms were found among baseline binge drinkers. This could indicate a behavioural change among drinkers, towards a more moderate drinking style where pupils do not encounter as many harmful consequences.

This study had limitations, e.g. the design did not allow for comparison of the different intervention components regards their differential effect on outcomes. Also, the missing data for the outcome alcohol-related harms led to a lower power of these statistical analyses. Further, only one follow-up survey restricts the results to short-term effects. Hence, no opportunity was provided to draw conclusions on any delay in onset of alcohol use among non- and light-drinkers or any long-term effects on norm perceptions or binge drinking. Nevertheless, the 3-months follow-up survey made it possible to measure the more proximal intervention effects without major disruptions to the school curriculum and routines. Since Doumas et al. (2014) found that preventive effects found at a 3-months follow-up were difficult to maintain at 6-months follow-up survey, it is suggested that school-based prevention programmes could benefit from a booster session to obtain sustainable reductions in alcohol use.

This study had a response rate of 65% for the baseline survey and a follow up rate of 58% and hence selection bias cannot be ruled out. However, the attrition for both baseline and follow-up survey mainly occurred at school level and therefore individual selection bias may be limited.

The analyses were based on self-reported alcohol use and response bias cannot be excluded, where the direction would depend on the perceived appeal of drinking alcohol. However, data were collected via a confidential online survey that allowed pupils to answer questions on sensitive issues in an anonymous manner. Also, confidential online surveys have shown to produce high-quality data for substance use in university students (Ekholm et al., 2008).

One major asset of this study was that pupils were asked to relate to a clearly defined peer reference group (the pupils in your own school and grade). Using this definition, it was easy for pupils to understand, which exact group of peers they were supposed to think about when answering the questionnaire (Miller and Prentice, 2016).

5. Conclusion

The results of our trial demonstrated that the existing evidence stating that social norms interventions decrease exaggerated perceptions of peer drinking also applies in a Danish context among adolescents aged 13–17 years. We also demonstrated that the intervention had a preventive effect on alcohol-related harms. Further, our findings indicate that the intervention *The GOOD Life* is most effective for pupils who are at relatively high risk of initiating heavy alcohol consumption. Since we did not find any intervention effects on lower level of alcohol

consumption, we conclude that the programme is less effective in delaying the onset of binge drinking or stimulating abstinence. Similarly, to the findings from the EU-DAP project "Unplugged" (Caria et al., 2011) and Project ALERT (Ellickson et al., 2003) our results suggest that prevention programmes based on social influence theory should be targeted to drinkers at the time of onset of substance use and that such programmes have a greater impact among at-risk adolescents. Further, this study is consistent with the hypothesis that drinking experience and intentions to engage in risky behaviours could serve as moderators for the effect of social norms interventions.

Future research needs to investigate any long-term effects of alcohol prevention programmes based on the social norms approach and needs to test the assumptions of social norms theory with structural equation modelling or mediation analysis. Also, it still needs to be determined which mode of delivery of social norms messages is most effective in reducing excessive alcohol use among adolescents.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2018.10.019.

Conflict of interest

The authors declare that they have no competing interests.

Acknowledgments

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