



Full length article

The efficacy of the Friendly Attac serious digital game to promote prosocial bystander behavior in cyberbullying among young adolescents: A cluster-randomized controlled trial



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ABSTRACT

Cyberbullying is a social phenomenon which can bring severe harm to victims. Bystanders can show positive bystander behavior (e.g. defending) and decrease cyberbullying and its harm, or negative behavior (e.g. passive bystanding, joining) and sustain cyberbullying and its negative effects. Few interventions have currently targeted bystanders and evaluated results on their behavior or its determinants. The intervention consisted of a serious game specifically targeting cyberbullying bystander behavior. A cluster-randomized controlled trial was conducted among 8th graders ($n = 216$) in two schools. Measurements were taken at baseline, immediately after the intervention and at 4-week follow-up. The serious game intervention resulted in significant improvements in self-efficacy, prosocial skills, and the intention to act as a positive bystander. These are mainly predictors of positive bystander behavior. No significant effects were found for predictors of negative bystander behavior. The intervention also increased witnessing of cyberbullying incidents, potentially a measure of awareness of cyberbullying taking place, and quality of life. No effects were found on behavior itself, bullying or cyberbullying prevalence. This brief serious game intervention affected determinants of bystander behavior and quality of life among adolescents. Further efforts are needed to address (negative) bystander behavior and cyberbullying involvement.

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1. Introduction

Cyberbullying is generally defined as an intentional act to hurt, socially isolate or cause distress to a victim, which may be characterized by a repeated occurrence or continued exposure, and is performed using electronic or digital media (Kiriakidis & Kavoura, 2010; Tokunaga, 2010). Its prevalence was summarized in a

recent meta-analysis to 15% for cyberbullying victimization, and to 16% for cyberbullying perpetration (Modecki, Minchin, Harbaugh, Guerra, & Runions, 2014). Most studies on cyberbullying have been conducted among teenagers, and show a peak in prevalence among 12–15 year olds (Tokunaga, 2010). Cyberbullying perpetration and victimization are related to diverse psychosocial, physical and mental health problems, such as stress, suicidal ideation, depression, anxiety, loneliness, substance abuse, reduced life satisfaction, reduced self-esteem, somatic problems and lower academic achievement (Kowalski, Giumetti, Schroeder, & Lattaner, 2014).

Given cyberbullying's negative impact, effective interventions

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and prevention programs to reduce cyberbullying perpetration and victimization and to hence optimize youngsters' mental well-being are strongly needed. Systematic reviews on bullying interventions showed that to date few programs existed that target cyberbullying (Cantone et al., 2015; Mishna, Cook, Saini, Wu, & MacFadden, 2011; Van Cleemput et al., 2013), and that effects were often limited to increasing Internet safety knowledge (Mishna et al., 2011). Since these reviews, however, several new intervention and prevention studies against cyberbullying among adolescents have been published (Chaux, Velasquez, Schultze-Krumbholz, & Scheithauer, 2016; Cross et al., 2016; Del Rey, Casas, & Ortega, 2016; Gradinger, Yanagida, Strohmeier, & Spiel, 2016; Palladino, Nocentini, & Menesini, 2016; Schultze-Krumbholz, Schultze, Zagorscak, Wölfer, & Scheithauer, 2016). All these studies showed significant reductions in cyberbullying involvement despite variations in design and focus. The design of these studied interventions varied from extensive school-based programs (Chaux et al., 2016; Schultze-Krumbholz et al., 2016) and whole-school programs (Cross et al., 2016; Del Rey et al., 2016; Gradinger et al., 2016) to peer-led education programs (Palladino et al., 2016). Some focused mainly on traditional bullying (Gradinger et al., 2016), others on cyberbullying (Chaux et al., 2016; Cross et al., 2016; Del Rey et al., 2016; Schultze-Krumbholz et al., 2016), and some on both (Palladino et al., 2016). Some research showed that effects of programs designed for traditional bullying extended to cyberbullying (Williford et al., 2013), and vice versa (Chaux et al., 2016), indicating some shared mechanisms between these phenomena.

Only few cyberbullying interventions specifically targeted a change in the behavior of bystanders, who witnessed the cyberbullying incident (Palladino et al., 2016; Williford et al., 2013), despite the general agreement that cyberbullying is a social phenomenon and that bystanders can play an important role in encouraging or discouraging cyberbullying (Salmivalli, 2010; Slonje, Smith, & Frisén, 2013). Bystanders can show positive bystander behavior (e.g. comforting, giving advice, reporting, confronting the bully) which can decrease cyberbullying or its negative effects, and/or show negative bystander behavior (e.g. reinforcing, joining, ignoring) that can cause the cyberbullying or its effects to continue or worsen (Salmivalli, 2010).

As in offline bullying, cyberbullying takes place in a social context where cyber-perpetrators expect rewards for their cyberbullying acts from their peers, such as increased social status or popularity (Festl & Quandt, 2013; Vanden Abeele & De Cock, 2013; Wegge, Vandebosch, Eggermont, & Pabian, 2016). When bystanders do not act against the cyberbullying, e.g. by not comforting, giving advice, confronting the bully or reporting it to adults, cyber-victims feel let down or isolated (DeSmet et al., 2014b). In offline bullying, defended victims were victimized less often than undefended victims, indicating bystander actions can reduce victimization (Sainio, Veenstra, Huitsing, & Salmivalli, 2011). Defended victims also experienced better social acceptance than undefended victims (Sainio et al., 2011). Promoting positive bystander behavior may thus reduce victimization rates and lessen the harm of cyberbullying for the victim. Negative bystander behavior can cause the bullying to continue, since bullies require the support of joiners or reinforcers to maintain their social status (Huitsing, Snijders, Van Duijn, & Veenstra, 2014). Even passive bystanding, when bystanders do nothing, provides positive feedback to the bully, since the bully may consider this as a silent form of approval of the bullying, and can be considered negative bystander behavior (Salmivalli, 2010). Longitudinal research on offline bullying showed that youngsters who side with the bully are highly likely to also become bullies later on (Huitsing et al., 2014). Since bullying behavior in childhood is related to negative psychosocial outcomes in adulthood (Sourander et al., 2009), reducing negative bystander

behavior may not only protect the victim and end the bullying cycle, but can also reduce the risk of negative psychosocial development for bystanders. In offline bullying, schools where youngsters defended victims rather than acted as passive bystanders were perceived as safer (Gini, Pozzoli, Borghi, & Franzoni, 2008), and interventions to promote positive bystander behavior and reduce negative bystander behavior may thus benefit a broad population of adolescents.

Given the limited number of intervention programs available to address bystander behavior and the importance of bystanders in ending or lessening cyberbullying's harm, the [identifying info omitted] project ([identifying info omitted]) aimed to design an intervention to increase positive bystander behavior and decrease negative bystander behavior in cyberbullying among young adolescents. The program design was based on behavior change theories and evidence specifically relating to bystander behavior in cyberbullying. Certain mechanisms for bystanding in cyberbullying have been reported to deviate from offline bullying, e.g. the bystander effect (Allison & Bussey, 2016). Being founded in specific evidence on bystanding in cyberbullying is thus important for the effectiveness of an intervention focused on bystanders. Also, the use of behavior prediction and change theories has been hypothesized as a way to advance cyberbullying understanding and intervention effectiveness (Tokunaga, 2010). Public health programs based on behavior change theories were indeed found to be more effective (Glanz & Bishop, 2010). These are important additions to existing literature, where intervention studies addressing cyberbullying bystander behavior were based on insights from offline bullying e.g. (Williford et al., 2013), or where intervention content was not based on behavior change theory and determinants of bystander behavior in cyberbullying, but e.g. on participatory development with peers and subject teachers (Menesini, Nocentini, & Palladino, 2012). The intervention development was conducted according to the Intervention Mapping protocol (IMP) (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011), which presents guidelines for an evidence-based and systematic development of behavior change programs. It aims to increase both efficacy and effectiveness of interventions, by a reiterative process of evidence review, application of theory-based strategies and stakeholder consultation. The six IMP steps are: 1) needs assessment (e.g. risk groups, health impact); 2) preparing matrices of change objectives (e.g. target behavior, predictors of these new behaviors); 3) selection of theory-informed intervention methods and practical strategies (e.g. modeling, feedback); 4) development of the intervention program (e.g. material design); 5) planning for adoption, implementation and sustainability (e.g. school-based); 6) development of an evaluation design (e.g. randomized controlled trial). The design of the intervention according to these six steps has been elaborately described elsewhere (DeSmet et al., 2016b).

A serious game intervention was designed to promote positive bystander behavior and reduce negative bystander behavior. Serious digital games are a form of organized play, using computer technology and video graphics, and are intended to be both entertaining and provide instruction, training or achieve attitude change (Blumberg, Almonte, Anthony, & Hashimoto, 2013). They aspire to be highly enjoyable, attention-captivating and intrinsically motivating (Graesser, Chipman, Leeming, & Biedenbach, 2009; Prensky, 2007). Serious digital games have shown to be effective in promoting healthy lifestyles, amongst which social behavior (DeSmet et al., 2014a), and have been used in other anti-bullying interventions such as KiVA (Kärnä et al., 2011; Salmivalli, Kärnä, & Poskiparta, 2011; Williford et al., 2013), FearNot! (Sapouna et al., 2010), Quest for the Golden Rule (Rubin-Vaughan, Pepler, Brown, & Craig, 2011), and Cyberhero Mobile Safety (Hswen,

Rubenzahl, & Bickham, 2016). The game is intended to be incorporated in a whole-school program against bullying, but is evaluated here as a separate component. A whole-school approach applies an ecological model, and requires all parties (school, parents, pupils, peers) to be involved. It usually includes a coordination group, staff training and discussion groups, behavioral monitoring via surveys, a school-wide program launch event, school or class rules, parental involvement, and classroom and individual interventions (Olweus, 2004). This approach was more effective in reducing offline bullying than other approaches (Ttofi & Farrington, 2011) and has shown to be effective in cyberbullying as well (Williford et al., 2013). Designing the game as a separate component follows the recommendation of the [Friendly ATTAC] project's stakeholders (e.g. school representatives, governmental department of education, parent associations, youth advisory centers) to create an intervention that can be added to whole-school approaches already employed at schools. Testing components separately gives an indication of the effectiveness of each part and can help create a leaner intervention, that does not unnecessarily burden school staff and pupils. A leaner intervention may be adopted by more schools and result in higher adherence, which ultimately would result in a higher public health impact for adolescents than a larger, burdensome intervention. This can also allow to create an inventory of evidence-based components that can be used in combination (e.g. with existing evidence-based interventions), to amplify effects on particular predictors or behaviors.

The aim of this study was to evaluate the efficacy of a digital serious game intervention component that targeted an increase in positive bystander behavior and reduction in negative bystander behavior, on: 1) bystander behavioral determinants; 2) bystander behavior in cyberbullying incidents; 3) cyberbullying perpetration and victimization; and on 4) youngsters' mental well-being.

In line with the Precede-Proceed model (Green & Kreuter, 2005), the final goal of the intervention is to reach an improvement in quality-of-life or health of the participants. To reach this goal, the predisposing factors need to be changed, namely a reduction in risk behaviors (cyberbullying, negative bystander behavior) and promotion of desired behaviors (e.g. positive bystander behavior), which can be changed by targeting the underlying determinants.

2. Methods

2.1. Participants and procedure

This study was a cluster-randomized controlled trial conducted in secondary education schools in [Flanders]. Four schools were contacted and requested to provide information on school size, perceived prevalence of cyberbullying at their school and their current actions against cyberbullying. Two schools matched well on these criteria and were included in the study. One school was by lottery draw performed by one researcher, randomly allocated to the intervention condition, and the other was allocated to the control condition. Within each school, all 8th grade classes (13–14 year olds) were included. No other inclusion or exclusion criteria applied. Eighth graders were chosen as a homogeneous age group among those at highest risk. Parents were informed by the school and provided passive consent, youngsters were requested to provide active informed consent. Ethical approval for the study was provided by the Ethics Committee of the [Ghent University Hospital]. Response rates are shown in Fig. 1. No a priori power analyses were conducted to determine sample size. Post hoc power analyses showed the sample size had a sufficient power to detect a small effect size, with the exception of effects on behavior which were

underpowered (G*Power 3.1.9.2). Subjects were blinded to the research questions, assessors were for practical reasons not blind to condition allocation.

Three measurements were made: one week prior to the intervention (T0), immediately after the intervention or one week after T0 for the control group (T1), and at 4-week follow-up (T2). The control condition received the intervention after the follow-up measurement was completed. These measurements included the self-report questionnaire that assessed sociodemographic information, cyberbullying prevalence, bystander behavior and determinants of this behavior. These measurements were identical across three time points to allow the detection of changes after the intervention. A follow-up measurement was used to assess the maintained effects on behavior after the intervention was no longer provided. Youngsters were instructed to play the game only once. Support was only provided for technical problems. Data were collected by researchers with no teachers present.

2.2. Intervention

The serious game was intended as part of a whole-school program but evaluated here as a single component. A serious digital game was developed as part of the [Friendly ATTAC] project. The [identifying info omitted] game specifically targeted adolescent bystander behavior in cyberbullying. The game is set against the background story of an 'ugly people page'. This resembles a hate page, that as the story tells, has been constructed on a social networking site (SNS) by someone to make fun of pupils at school by posting their pictures and calling them ugly. The player in the story is transferred from the future to this school in the year 2015, to solve this problem by talking to pupils, responding to cyberbullying by using positive bystander behavior, and thus help end the cyberbullying and get the 'ugly people page' removed. The story is shown in a short animated video, after which the player can start the game. The original story was written by a professional story-writer and adapted based on formative research with end users (van Cleemput et al., 2015).

In the game, the player walked through a school and could meet other non-playable game characters, who are fictitious characters. Clicking on these game characters showed a recent activity on their SNS profile and presented the player with four options on how to react to these. The activity also shows the number of likes and dislikes for this post, giving an indication of how other bystanders behaved and of social influence. Activities were presented to players at random and varied in whether they could be considered neutral, a mild form, or a severe form of cyberbullying. When a positive type of bystander behavior was chosen, the player would hear a pleasant buzz tone and a negative one for a negative type of bystander behavior. A special game character (the droid 'BOB') followed the player throughout the game and would provide help when clicked on, e.g. by showing all recent SNS posts for a non-playable character. When a predetermined number of cyberbullying activities was handled, the game episode ended with a mission failed/accomplished message and detailed feedback. Feedback included which types of behavior they chose (in)correctly, why this was a good/bad option, and where relevant how to improve their future bystander behavior. Other game features included first-person control, music, and personalization of the avatar (gender, clothing style). There was no set time limit for achieving the game goal. The game was a single-player format and their actions were not known to other players known in real-life, creating an anonymous and safe environment to practice bystander behavior. Setting and scenarios were extensively tested in formative research with users for degree of realism (e.g. think aloud procedures, focus groups) (Van Cleemput et al., 2015; DeSmet et al., 2016b). Users

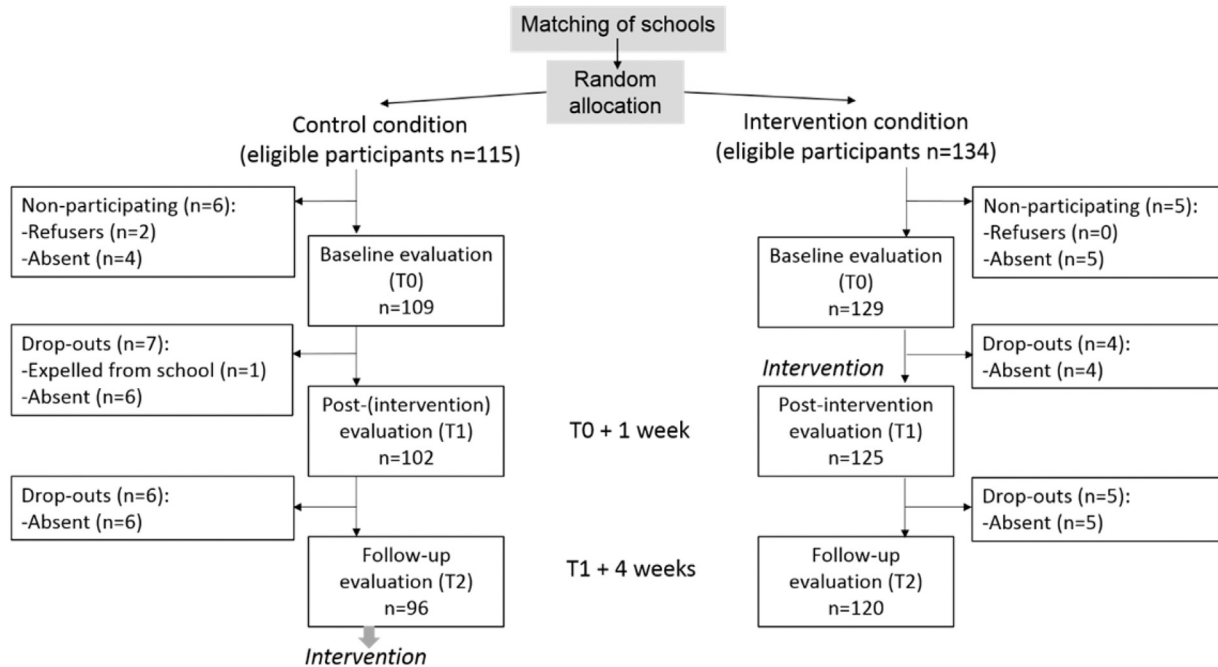


Fig. 1. Sample flow chart.

suggested the social media look of the game, and also adjusted the content of the scenarios to fit more with their jargon.

The game design was based on several theoretical frameworks: Reasoned Action Approach (Fishbein & Ajzen, 2010), Social Cognitive Theory (Bandura, 2002, 2007) and Bystander Intervention Model (Latane & Darley, 1970) for individual and environmental determinants that influence bystander behavior; Self Determination Theory (Ryan, Rigby, & Przybylski, 2006) for motivational appeal of the game play; and the Mechanics, Dynamics, Aesthetics (MDA) framework for an engaging game design (Hunicke, LeBlanc, & Zubek, 2004). For a more detailed description of the theoretical basis and development of the game, see Authors et al. (DeSmet et al., 2016b). For a technical description of the game development, see Authors et al. (Samyn et al., 2015). A specific modeling language was developed for this game, see Authors et al. for further details (Van Broeckhoven and De Troyer, 2013).

Behavior change components were selected based on an overview of strategies in the IMP and by behavior change technique taxonomies (Bartholomew et al., 2011; Michie et al., 2011, 2013) and a list of strategies that were most effective in several meta-analyses (Dombrowski et al., 2012; Dusseldorp, van Genugten, van Buuren, Verheijden, & van Empelen, 2014; van Genugten, Dusseldorp, Webb, & van Empelen, 2016). Specific attention was given to creating effective clusters of strategies, since the effectiveness of some strategies may depend on their combination with other strategies (Dusseldorp et al., 2014; van Genugten et al., 2016). Independent coders assessed whether the intended strategies were indeed present in the game (DeSmet et al., Data in Brief, submitted). The included behavior change strategies were 'instructions on how to perform the behavior', 'active learning and guided practice', 'performance feedback', 'rewards', 'identification as role model' and 'information on approval from others'.

2.3. Instruments

A self-report questionnaire was composed of several parts (all reflecting real-life information and not in-game aspects): 1) socio-

demographic information; 2) bystander behavior and determinants of bystander behavior; 3) involvement in bullying (perpetrator, victim) and cyberbullying (perpetrator, victim, bystander); and 4) quality of life. Face validity and readability was assessed prior to administration among five adolescents.

2.3.1. Socio-demographic variables

Socio-demographic variables included age, gender, type of education, country of birth, family living situation, and socio-economic status. These demographic variables were derived from the questionnaire of the Health Behavior in School-Aged Children (HBSC). This part also comprised the validated self-report scale for adolescents 'Family Affluence Scale' (FAS), to measure family wealth and socio-economic status (Boyce, Torsheim, Currie, & Zambon, 2006). FAS is a summative scale consisting of four items (i.e. own bedroom, number of holidays per year, number of cars and computers owned). The summed index ranges from 0 to 9, with the following internationally used cut-off points: low FAS = score of 0–2; medium FAS = score of 3–5; high FAS = score of 6–9. This survey part also addressed mobile phone possession, having Internet access on phone, and game play experience. A list of five items measured significant life events (e.g. changed schools, moved house, parents got divorced, severe disease or death in the family, other major life event), inspired by the study by Mitchell et al. (Mitchell, Ybarra, & Finkelhor, 2007). These were summed to represent external factors which may have impacted adolescents' well-being.

2.3.2. Behavior and behavioral determinants of cyberbullying bystander behavior

Questions for behavior and behavioral determinants were designed using guidelines from behavior change theories on constructing behavioral determinant scales (Fishbein & Ajzen, 2010). The content of the questions was based on a questionnaire used in previous research (DeSmet et al., 2016a), but slightly adapted to reflect elements that the [Friendly ATTAC] intervention focused on (DeSmet et al., 2016b). All behavior and behavioral determinants

reflected the real-life situation of the adolescents, and not the behavior they exhibited during game play. The studied determinants included intention, behavioral attitudes, moral disengagement attitudes, outcome expectations, self-efficacy, subjective norm, social skills and empathic skills. Psychometric information of the not earlier validated scales is provided in [Authors, submitted](#). An overview of included determinants is provided in [Table 1](#).

2.3.2.1. Empathic skills. The affective empathy subscale of the Dutch version of the Interpersonal Reactivity Index was used to measure empathic skills (e.g. 'I am often concerned about people who are less fortunate than me') ([De Corte et al., 2007](#)). This subscale with seven items had poor internal consistency ($\alpha = 0.57$), which was improved to $\alpha = 0.61$, when removing one item. Items were rated on a 5-point Likert scale.

2.3.3. Bullying and cyberbullying prevalence (perpetration, victimization, bystanding)

Questions on bullying and cyberbullying involvement were preceded by a definition of bullying, distinguishing it from unintentional acts or arguments between children of equal power, ([DeSmet et al., Data in Brief, submitted](#)) and were rated on a frequency scale reflecting involving in the past six months ([Solberg & Olweus, 2003](#)) and the past month. This question on past-month involvement was included to allow finding effects on prevalence at 4-week follow-up. Questions for bullying involvement included experiences as a victim and perpetrator, questions for cyberbullying involvement included those as a victim, perpetrator and bystander.

2.3.4. Mental well-being

The validated KIDSCREEN scale ([Ravens-Sieberer et al., 2010](#)) was used to measure quality-of-life and well-being. The KIDSCREEN-10 consists of ten items, and contains indications of general energy level, depressive emotions, leisure time enjoyment, relationship with parents and peers, and perception of cognitive capacity (e.g. 'Have you felt sad?'; 'Have you been able to do the things that you want to do in your free time?'). Items were answered on a 5-point Likert scale, internal consistency was good ($\alpha = 0.84$).

2.4. Analyses

Repeated Measures Analyses of Variance (RM ANOVA) and Generalized Linear Mixed Models (GLMM) were used in SPSS version 22, to test changes on the dependent variables between the different time points, i.e. baseline (T0), first post-intervention measurement (T1) and follow-up measurement (T2), by the levels

of the independent variable (control and intervention condition). When data were skewed, log-transformed values were used in RM ANOVA analyses. For ease of understanding, non-transformed mean scores will be used for interpretation of findings. The Greenhouse-Geisser correction was used when sphericity could not be assumed. When the data did not approximate a normal distribution after log-transformation as assessed by Q-Q plots, Generalized Linear Mixed Models (GLMM) were used. The appropriate distribution to use in the GLMM analyses was determined based on histograms and -2 log-likelihood ($-2LL$) figures which provide a comparative measure of best model fit.

Baseline differences between the intervention and control condition were assessed on socio-demographic variables via χ^2 tests or independent sample t-tests, and included as covariates in the analyses if significant. The experience of significant life events was included as a covariate in the analysis of the intervention effect on quality of life and well-being, since earlier research showed this was an important mediator in the relation between cyberbullying involvement and well-being ([Yang et al., 2013](#)). Given high multicollinearity between measures at T0, T1 and T2 for this significant life event scale ($r = 0.73$ – 0.75), only the measures at T2 were used as covariate. No intention-to-treat analyses were conducted given the limited participant drop-out. Effect sizes were calculated based on F-values for difference in change using Hedges' g in Comprehensive Meta-Analysis CMA software version 2 (Biostat Inc., Englewood NJ, USA). Effect sizes between 0.20 and 0.49 were considered small, between 0.50 and 0.79 moderate and ≥ 0.80 were considered large ([Cohen, 1988](#)). Positive effect sizes reflected an improvement in the intervention condition larger than in the control condition, in a desired direction for the particular outcome. Negative effect sizes reflected a deterioration of a desired outcome in the intervention condition larger than in the control condition, or an improvement that was smaller in the intervention condition than in the control condition.

3. Results

In total, 96% of pupils provided consent to participate in the study. At T2, 7.0% were lost to follow-up in the intervention school and 11.9% in the control school, in both cases mainly due to illness on the day of measurement ([Fig. 1](#)). There were no significant differences between completers and non-completers by gender ($\chi^2 = 0.153$, $p = 0.70$), by place of birth ($\chi^2 = 0.081$, $p = 0.78$), family composition ($\chi^2 = 0.721$, $p = 0.40$) or family affluence ($\chi^2 = 0.651$, $p = 0.42$). There were, however, significant differences between completers and non-completers by educational type: non-completers were significantly more often found in the educational track that prepares for vocational or technical education

Table 1
Scale definitions.

Behavioral determinant	Definition
Behavioral intention	Intention to act in a particular way the next time the occasion arises.
Behavioral attitude	Attitudes are tendencies to respond positively or negatively to someone, something, or towards performing a behavior (Bartholomew et al., 2011), and can be cognitive, affective or conative. Behavior-specific attitudes (e.g. bad-good; cowardly-brave) were measured.
Moral disengagement attitudes	Moral disengagement attitudes are ways to avoid self-condemnation when behavior is not in accordance with an individual's moral values (Bandura, 2004). Literature documents several moral disengagement attitudes, such as diffusion and displacement of responsibility, moral justification, euphemistic labeling, advantageous comparisons, denying negative consequences, and blaming or dehumanizing the victim (Bandura, 2002). Previous research showed that victim blaming was the most predictive of bystander behavior, only this subscale is therefore included (DeSmet et al., 2016a).
Outcome expectations	Evaluations of how likely certain consequences will result from a behavior (Bartholomew et al., 2011)
Self-efficacy	Self-efficacy is the belief in one's capabilities to perform the behavior.
Subjective norm	Perceived norms comprise injunctive or subjective norms (e.g. what you think others expect you to do) and descriptive norms (e.g. what you perceive others do) (Fishbein, 2008).

Table 2
Participant characteristics.

	Intervention group (N = 120)	Control group (N = 96)	Test for difference, P-value
Gender (% girls)	58.5	65.3	$\chi^2 = 1.024, p = 0.311$
Age (mean, sd)	13.52 (0.61)	13.47 (0.54)	$t = 0.586, p = 0.559$
Ethnicity (% born in [Belgium])	96.7	90.5	$\chi^2 = 3.519, p = 0.061$
Family situation (% living with mother and father)	77.5	65.6	$\chi^2 = 3.749, p = 0.053$
Family affluence (% high)	72.0	71.6	$\chi^2 = 0.005, p = 0.942$
Educational track (% vocational/technical)	16.7	26.0	$\chi^2 = 2.842, p = 0.092$
Offline victimization (% at least 2–3 times/month in past 6 months)	4.2	8.4	$\chi^2 = 1.689, p = 0.194$
Offline perpetration (% at least 2–3 times/month in past 6 months)	1.7	1.1	$\chi^2 = 0.145, p = 0.703$
Cyberbullying victimization (% at least 2–3 times/month in past 6 months)	0.8	4.2	$\chi^2 = 2.662, p = 0.103$
Cyberbullying perpetration (% at least 2–3 times/month in past 6 months)	0.8	1.1	$\chi^2 = 0.026, p = 0.873$
Cyberbullying bystanding (% at least 2–3 times/month in past 6 months)	12.5	22.1	$\chi^2 = 3.509, p = 0.061$

($\chi^2 = 7.705, p < 0.01$) than in the generic academic track. Non-completers ($M = 13.80, SD = 0.45$) were also significantly older ($t = 2.403, p < 0.05$) than completers ($M = 13.49, SD = 0.57$).

3.1. Descriptive statistics

Full data could be analyzed for 120 participants in the intervention group and 96 participants in the control condition (Table 1). There were no significant differences on sociodemographic variables between the intervention and control group. The majority in both conditions had a high family affluence, consistent with information from the [identifying info omitted] adolescent population in the Health Behavior in School-Aged Children study, i.e. 72.7% (Buijs, T., personal communication). There were no significant differences in victimization, bystanding or perpetration rates between intervention and control condition. Baseline values on bullying involvement were taken into account in the analyses for these behaviors (Table 2).

3.2. Intervention effects

Several variables (i.e. offline bullying victimization and perpetration, cyberbullying victimization and perpetration, negative bystander behavior, attitudes towards getting back at the bully) showed a non-normal distribution, even after log-transformation. All of these non-normal variables showed the best fit with a negative binomial model. Effects on these variables were thus analyzed via Generalized Linear Mixed Models, using a negative binomial model.

Overall, the serious game resulted in significant, small, desired effects on certain behavioral determinants and on quality of life. However, cyberbullying witnessing decreased less in the intervention condition than in the control condition, which may possibly be considered a negative intervention effect. No significant effects were found on bystander behavior or on (cyber-) bullying victimization and perpetration (Table 3).

Specifically, there was a significant, small, desired effect on self-efficacy to end cyberbullying. Self-efficacy was measured in two separate constructs: statements reflecting low feelings of self-efficacy and statements reflecting high level of self-efficacy to end cyberbullying. The construct measuring low levels of self-efficacy decreased in the intervention condition, whereas this strongly increased in the control condition ($F(2, 389) = 4.80, p < 0.05, g = 0.30$). High levels of self-efficacy slightly increased in the intervention condition, whereas they decreased in the control condition ($F(2, 408) = 4.23, p < 0.05, g = 0.28$). Small yet significant desired effects were also observed on appropriate social skills, which slightly increased in the intervention condition and decreased in the control condition ($F(2,422) = 4.20, p < 0.05, g = 0.28$). The intervention moreover resulted in small yet

significant desired effects on the intention to show positive bystander behavior: this intention increased in the intervention condition, whereas it decreased in the control condition ($F(2, 410) = 3.49, p < 0.05, g = 0.26$). There was a significant, small, desired effect on adolescents' quality of life and wellbeing, after controlling for the influence of other significant life events adolescents had experienced in the past six months ($F(2, 404) = 3.09, p < 0.05, g = 0.25$).

The intervention also showed a potentially undesired effect. There was a small but significant, effect of witnessing cyberbullying: this had decreased in both conditions, but the decrease was stronger in the control condition ($F(2, 377) = 4.72, p < 0.05, g = -0.30$). No significant intervention effects were found for the other outcomes.

Average play time was 16.6 min ($SD = 5.02$). Overall, the players moderately appreciated the game: 52% (fully) agreed that they enjoyed playing the game. More detailed user appreciation information is provided elsewhere (Herrewijn et al. in preparation).

4. Discussion

This study tested the efficacy of a serious game intervention to promote positive bystander behavior, reduce cyberbullying prevalence and increase quality-of-life among adolescents in 8th grade. Effects were measured immediately after the intervention and at 4-week follow-up measurement. This study was the first to directly target bystander behavior in cyberbullying in an intervention based on evidence from predictors of bystander behavior in cyberbullying (DeSmet et al., 2016a); and to measure effects on cyberbullying bystander behavior and its predictors, as well as on bullying involvement and quality of life. The foundation of this intervention in a specific etiological model for bystander behavior in cyberbullying is innovative, since cyberbullying interventions are often built on knowledge derived from traditional bullying (e.g. Gradinger et al., 2016; Williford et al., 2013). This intervention was a very short, stand-alone game intervention that was intended as part of a whole-school approach but was evaluated as one component. Testing this separately can allow to create an inventory of tools that can be integrated in existing interventions to further optimize these intervention packages on particular predictors or behaviors.

The serious game resulted in significant small, positive effects on behavioral determinants and on quality-of-life, but not in significant effects on bystander behavior or (cyber-)bullying victimization or perpetration. Considering that playing the game took less than 30 min to play and required no teacher assistance or other activities, these significant effects are a very encouraging finding in building a lean evidence-based intervention with a low burden for the school. The magnitude of effects is similar to those found in a meta-analysis of 12 interventions to change bystander behavior in offline bullying. This study reported significant, small effects, with

Table 3
Intervention effects on behavioral determinants, behavior, (cyber-) bullying prevalence and quality of life.

	Intervention condition M (SD) n = 120			Control condition M (SD) n = 96			Overall interaction effect Time x condition	Effects at T1 (ref=T0)	Effects at T2 (ref=T0)	Overall effect size g
	T0	T1	T2	T0	T1	T2				
Behavioral determinants										
Attitudes on comforting the victim	4.73 (0.98)	4.63 (1.23)	4.81 (0.99)	4.45 (1.31)	4.65 (1.14)	4.67 (1.11)	F (2, 408) = 0.54	F (1, 204) = 1.09	F (1, 206) = 0.46	−0.10
Attitudes on giving the victim advice ^b	5.02 (0.92)	5.08 (0.98)	5.04 (0.96)	4.92 (0.98)	4.98 (0.96)	4.82 (1.09)	F (2, 396) = 1.06	F (1, 206) = 0.36	F (1, 208) = 1.13	0.14
Attitudes on reporting to adults	4.80 (1.11)	4.78 (1.09)	4.81 (1.14)	4.70 (1.17)	4.55 (1.14)	4.57 (1.11)	F (2, 418) = 1.24	F (1, 209) = 1.48	F (1, 211) = 1.12	0.15
Attitudes on telling the bully it is not cool	4.48 (1.05)	4.27 (1.07)	4.47 (1.16)	4.28 (1.23)	4.14 (1.19)	4.05 (1.24)	F (2, 406) = 2.72 [°]	F (1, 204) = 0.06	F (1, 207) = 2.26	0.23
Attitudes on getting back at the bully ^a	2.05 (1.21)	2.15 (1.25)	2.12 (1.07)	2.22 (1.30)	2.25 (1.30)	1.93 (1.06)	F (2, 381) = 0.97	t = −0.03	t = 0.19	−0.13
Attitudes on doing nothing ^b	1.95 (1.03)	1.91 (0.90)	1.95 (0.96)	1.98 (1.13)	2.04 (0.99)	2.06 (0.99)	F (2, 406) = 0.92	F (1, 206) = 0.63	F (1, 207) = 1.15	0.13
Moral disengagement attitudes	3.24 (1.25)	3.36 (1.19)	3.49 (1.16)	3.29 (1.38)	3.34 (1.27)	3.38 (1.24)	F (2, 398) = 2.65 [°]	F (1, 210) = 0.14	F (1, 210) = 2.68	−0.22
Outcome expectations	2.71 (1.04)	2.85 (0.92)	2.70 (1.03)	2.83 (1.01)	2.70 (0.92)	2.60 (1.04)	F (2, 392) = 1.57	F (1, 204) = 3.72 [°]	F (1, 203) = 1.46	0.26
Low self-efficacy	2.47 (0.79)	2.37 (0.80)	2.30 (0.76)	2.64 (0.71)	2.56 (0.79)	3.41 (0.53)	F (2, 389) = 4.80 [*]	F (1, 205) = 0.01	F (1, 207) = 7.79 ^{**}	0.30
High self-efficacy	3.49 (0.58)	3.53 (0.60)	3.56 (0.63)	3.54 (0.58)	3.43 (0.60)	3.41 (0.53)	F (2, 408) = 4.23 [*]	F (1, 210) = 4.60 [*]	F (1, 210) = 6.73 [*]	0.28
Subjective norm for positive bystander behavior	4.24 (0.52)	4.16 (0.58)	4.19 (0.57)	4.19 (0.55)	4.14 (0.61)	4.09 (0.50)	F (2, 424) = 0.82	F (1, 212) = 0.44	F (1, 213) = 0.43	0.12
Inappropriate social skills ^b	1.61 (0.60)	1.66 (0.63)	1.62 (0.61)	1.76 (0.67)	1.72 (0.63)	1.68 (0.60)	F (2, 422) = 0.81	F (1, 211) = 0.93	F (1, 211) = 1.35	−0.12
Appropriate social skills ^b	4.40 (0.50)	4.37 (0.56)	4.45 (0.47)	4.33 (0.64)	4.26 (0.67)	4.23 (0.59)	F (2, 422) = 4.20 [*]	F (1, 211) = 0.77	F (1, 211) = 7.65 ^{**}	0.28
Empathic skills	3.39 (0.49)	3.39 (0.53)	3.44 (0.53)	3.40 (0.51)	3.46 (0.51)	3.38 (0.56)	F (2, 418) = 1.40	F (1, 209) = 0.62	F (1, 209) = 0.79	0.16
Behavioral intention positive bystanding	3.76 (0.73)	3.71 (0.73)	3.81 (0.75)	3.86 (0.72)	3.63 (0.81)	3.70 (0.70)	F (2, 410) = 3.49 [*]	F (1, 205) = 4.30 [*]	F (1, 209) = 5.57 [*]	0.26
Behavioral intention negative bystanding ^b	1.23 (0.50)	1.19 (0.48)	1.16 (0.33)	1.25 (0.43)	1.16 (0.35)	1.24 (0.48)	F (2, 392) = 0.92	F (1, 205) = 0.67	F (1, 209) = 0.38	0.13
	Intervention condition			Control condition			Interaction effect	Effects at T1	Effects at T2	Effect size g
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	Time x condition	(ref=T0)	(ref=T0)	
	n	n	n	n	n	n				
Bystander behavior										
Positive bystander behavior	2.74 (2.21), n = 34	3.24 (2.30) n = 25	3.65 (2.48) n = 20	3.83 (1.89) n = 29	4.50 (2.03) n = 14	4.91 (2.12) n = 11	F (2, 36) = 1.37	F (1, 27) = 2.10	F (1, 22) = 0.02	−0.43
Negative bystander behavior ^a	0.16 (0.50), n = 37	0.12 (0.33) n = 26	0.05 (0.22) n = 20	0.10 (0.31) n = 29	0.07 (0.27) n = 14	0.18 (0.40) n = 11	F (2, 126) = 0.79	t = −0.08	t = −0.18	0.33
	Intervention condition			Control condition			Interaction effect	Effects at T1	Effects at T2	Effect size g
	% at least once in past month, n = 120			% at least once in past month, n = 96			Time x condition	(ref=T0)	(ref=T0)	
(Cyber)bullying involvement										
Offline bullying victimization ^a	6.7%	8.5%	8.3%	11.6%	10.4%	7.3%	F (2, 639) = 1.21	t = 0.63	t = 1.18	−0.15
Offline bullying perpetration ^a	5.0%	2.5%	1.7%	5.3%	5.2%	3.1%	F (2, 639) = 0.39	t = −0.67	t = −0.87	0.09
Cyberbullying victimization ^a	4.2%	3.3%	3.3%	4.2%	7.3%	5.2%	F (2, 641) = 0.03	t = −0.07	t = 0.17	0.02
Cyberbullying perpetration ^a	5.0%	2.5%	0.8%	2.1%	2.1%	1.0%	F (2, 640) = 0.11	t = −0.58	t = 0.02	0.05
Cyberbullying witnessing ^b	28.3%	21.8%	17.5%	33.0%	14.9%	13.5%	F (2, 378) = 4.72 [*]	F (1, 210) = 7.67 ^{**}	F (1, 212) = 4.12 [*]	−0.30
	Intervention condition			Control condition			Interaction effect	Effects at T1	Effects at T2	Effect size g
	M (SD) n = 120			M (SD) n = 96			Time x condition	(ref=T0)	(ref=T0)	
Mental well-being										
Quality of life and well-being	3.40 (0.62)	3.94 (0.60)	4.13 (0.59)	3.81 (0.58)	3.79 (0.65)	3.80 (0.61)	F (2, 392) = 3.27 [*]	F (1, 196) = 0.22	F (1, 198) = 3.54 [°]	0.25

Significance levels: [°] p < 0.1; ^{*} p < 0.05; ^{**} p < 0.01; ^{***} p < 0.001.

^a Generalized linear mixed model was used due to severely skewed data.

^b RM ANOVA was performed based on log-transformed data.

an average $g = 0.20$ (Polanin, Espelage, & Pigott, 2012). The larger effects in our study on behavioral determinants than on behavior are in line with meta-analytic findings of serious games for healthy lifestyle promotion (also comprising social behavior), where across studies small significant effects were noted for behavioral determinants, but only very small effects on behavior (DeSmet et al., 2014a). Bystander behavior was studied among a small sub-sample in our study of those who had recently indeed witnessed an incident. This was a deliberate choice since studying behavior in relation to a hypothetical situation as some studies do, in our opinion is a closer reflection of behavioral intention than of behavior itself. Limiting the sample to those with a recent real-life experience of bystanding in our study, however, may have resulted in analyses that were likely to be underpowered. Our small intervention effects may also be related to the short duration of the intervention. Similar results were found in the cyberbullying Media Heroes intervention study that compared a one-day program to a 10-week intervention. Their one-day program only succeeded in changing behavioral determinants, i.e. empathy, whereas a program running over a longer period was needed to affect cyberbullying rates (Schultze-Krumbholz et al., 2016). This suggests our findings are as expected for a very brief intervention to target bystander behavior using a serious digital game.

Overall, the intervention mostly had effects on determinants for positive bystander behavior (e.g. ending cyberbullying, pro-social skills, intention to act as a positive bystander), whereas no effects on negative bystander behavior or its behavioral predictors were found. Each randomly presented cyberbullying scenario in the game offered two positive response options and two negative response options, theoretically providing equal practice opportunities for positive and negative bystander behavior. However, an insufficient number of scenarios may have possibly been offered that would normally elicit negative bystander behavior, such as when victims are thought to be to blame for being cyberbullied. The range of 'moral disengagement' scenarios was indeed limited and this presents an area for future improvement of the serious game. It is also possible that some pupils who tend to display negative bystander behavior required more practice than other pupils, whereas the random provision of scenarios did not tailor to their specific needs for practice. Dynamically tailoring to the choices players make by offering more scenarios on behaviors that adolescents chose wrongly, may thus improve effects on negative bystander behavior. This could ensure the game presents all players with an optimal level of challenge and also improve their game experience (Charles et al., 2005; Wilson et al., 2009). Lastly, reducing negative behavior may be more difficult than increasing positive behavior, as has been documented for other health behavior where a reduction of risk behavior was harder to achieve than the promotion of a health-improving behavior (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). This did not appear to be the case in offline bullying, where intervention effects showed similar reductions in bullying perpetration as in victimization (Ttofi & Farrington, 2011). A meta-analysis conducted on a small number of cyberbullying intervention studies, however, indeed found lower effects for cyberperpetration than for-victimization (Van Cleemput et al., 2014). A recent study published since then showed significant effects on cybervictimization but only partial effects on cyberperpetration (Del Rey et al., 2016). Other recent studies reported significant effects on both cybervictimization and -perpetration (Cross et al., 2016; Palladino et al., 2016). A comprehensive updated meta-analysis of studies would be required to assess whether negative behaviors in cyberbullying, such as negative bystander behavior and cyberperpetration are indeed harder to change, and what the active ingredients are for each outcome to ensure effects on both outcomes.

All significant effects that were found at immediate post-intervention measurement were maintained at follow-up, which is a positive finding. In fact, for some outcomes, significant effects only showed at follow-up measurement and not immediately after the intervention, such as for low self-efficacy and appropriate social skills. This may be understood by needing some practice in real-life before the strategies learned in the game can affect the perceived skills in real-life situations.

Small positive effects were shown for three behavioral determinants of positive bystander behavior. First, a small positive effect was noted for self-efficacy to end the cyberbullying. Previous research showed that self-efficacy to end cyberbullying was a strong predictor of both the intention to show positive bystander behavior and the positive bystander behavior itself (DeSmet et al., 2016a). It is thus an encouraging finding that this brief serious game intervention succeeded in increasing self-efficacy to act as a positive bystander. Serious games have been hypothesized to increase self-efficacy, since they provide the opportunity for active and repeated practice in a safe environment, without real-life consequences of making wrong decisions (Peng, 2009; Prensky, 2007). A meta-analysis on serious games for healthy lifestyle promotion confirmed games can significantly increase self-efficacy to perform a certain behavior (DeSmet et al., 2014a) and our results lend further support to this statement. In offline bullying, self-efficacy to intervene was found to distinguish between passive bystanding and positive bystander behavior, whereas moral attitudes distinguished between these behaviors and other forms of negative bystander behavior, such as joining or reinforcing (Thornberg & Jungert, 2013). Since a high percentage of bystanders, between 50 and 90%, is passive and does nothing when they witness cyberbullying (Allison & Bussey, 2016), increasing self-efficacy to intervene could make a substantial difference in breaking the cyberbullying cycle and decreasing harm for the victim. Other anti-bullying interventions that included a serious game (Hswen et al., 2016; Rubin-Vaughan et al., 2011; Sapouna et al., 2010; Williford et al., 2013) have not reported effects on self-efficacy to perform positive bystander behavior, precluding any comparisons.

Second, the intervention showed positive effects on appropriate social skills (e.g. helping others). Appropriate social skills were a significant predictor of the intention to act as a positive bystander, but not of positive bystander behavior itself. Future adaptations to the intervention should, however, also effectively address inappropriate social skills (e.g. not caring about others' misfortune). No significant intervention effects were found here, whereas these skills do predict negative bystander behavior. Since both positive and negative forms of bystander behavior may occur jointly in cyberbullying (DeSmet et al., 2014b), it is important for interventions to effectively address predictors of both behavior types.

Third, the game also had positive effects on the intention to act as a positive bystander. Behavioral intention was shown to be the strongest predictor of behavior in general health promotion literature (Webb & Sheeran, 2006), and was also a strong predictor of positive bystander behavior in cyberbullying (DeSmet et al., 2016a). Having a positive impact on intention is thus a promising finding. Albeit a strong predictor, high intentions do not always lead to achieving the behavior. Self-regulatory processes have been mentioned as a cause for the intention-behavior gap. Ways to improve these self-regulatory processes are setting personal goals, designing action (i.e. how the goal will be achieved) and coping plans (i.e. how to handle potential barriers), and setting implementation intentions (i.e. weighing possible options and selecting those most likely to lead to goal achievement). Implementation intentions had a strong effect on achieving a personally set goal (Gollwitzer & Sheeran, 2006). Using self-regulation techniques in serious games requires some adaptation to fit an entertainment

context. Examples of their use in a game can be found in a serious game, 'Squire's Quest II', to improve a healthy diet for children, where real-life goal attainment was linked to advancing in the game, by receiving enough badges to become a knight (Thompson et al., 2015). In a serious game for a healthy diet and physical activity among adolescents, 'Balance It', real-life goal evaluation and achievement were linked to receiving rewards, since these actions provided building blocks players needed to construct their 'Angry Birds'-like tower in the game (Spook et al., 2015). Certain game types, such as adventure games, role-playing games and strategy games (Prensky, 2007), may be well-suited to the use of self-regulation techniques, where the game also requires meeting goals, proactively avoiding barriers and picking the best strategies to reach these goals. Real-life goals and achievement could thus be linked to in-game goals and achievement.

This intention-behavior gap may also be present in our study. No significant effects were indeed found on actual bystander behavior. The effects obtained by our intervention on just a few of these determinants may have been insufficient to create a significant change in bystander behavior. Additional components should be provided that can change other significant determinants, such as moral disengagement mechanisms and attitudes towards different types of bystander behavior, which are predictors of both positive and negative bystander behavior. Effective methods to change attitudes include having adolescents shift perspectives, realize the negative impact of their behavior, re-evaluate their self-image, methods such as stimulating imagery, anticipated regret and adding personal meaning to a situation (Bartholomew et al., 2011). In a serious game, changing attitudes may be achieved by including a narrative. By creating attractive characters and game challenges that resemble real-life issues for the players, a narrative can enhance identification of the players with game characters and create a sense that the game experiences are personal experiences (Lu, Baranowski, Thompson, & Buday, 2012). In the (Friendly ATTAC) game, it was decided to reduce the linear narrative since formative research showed it reduced the freedom of the player to control the game (DeSmet et al., 2016b; van Cleemput et al., 2015). It is a known challenge in designing games to provide an optimal trade-off between sufficient player control and active practice, and story elements to increase identification and enable attitude change (Brand et al., 2015; Lu et al., 2012). Inspired by a game study using narratives as a back scene of the game but not driving the gameplay (Brand et al., 2015), the Friendly Attac game provided a short story clip at the start of the game. This story was, however, not interactive and may not have yielded sufficient opportunities for identification and experiencing outcomes of their in-game actions. Interactive narratives have been hypothesized as a way to provide benefits from both storytelling and player control (Ryan, 2009). Future research should indicate if an approach where the story after the game adapts to certain choices made in the game can indeed be more effective. Changing attitudes may moreover be more feasible in non-game components provided in curriculum materials or classroom discussions. Only one cyberbullying study was found that investigated intervention effects on bullying attitudes and moral disengagement among youngsters (Barkoukis, Lazuras, Ourda, & Tsorbatzoudis, 2016). They found non-significant intervention effects on attitudes and a significant effect of their school-based program on moral disengagement attitudes. Other non-game interventions on cyberbullying have included components to change attitudes and moral disengagement, but have not investigated effects on these outcomes (e.g. Cross et al., 2016; Palladino et al., 2016). Measuring and reporting effects on specific outcomes can help create an inventory of evidence-based programs and provide insight in tools to optimize existing interventions. More intervention research is needed that reports specific

intervention effects on behavioral predictors and behaviors, as well as on prevalence.

Some evidence is available on intervention effects on the specific predictor of empathy in cyberbullying programs (Barkoukis et al., 2016; Del Rey et al., 2016; Schultze-Krumbholz et al., 2016). This is an important determinant of bystander behavior (Allison & Bussey, 2016; DeSmet et al., 2016a), and may especially be predictive of negative bystander behavior and intention for this behavior (Barlińska, Szuster, & Winiewski, 2013; DeSmet et al., 2016a). Effects on empathy were mixed, with some studies reporting significant effects (Del Rey et al., 2016; Schultze-Krumbholz et al., 2016) and others (Barkoukis et al., 2016), as ours, reporting no significant effects on empathy. The study of Del Rey et al. (2016) may be of particular interest since they also reported empathy increases among bystanders of cyberbullying. Their intervention used a curriculum-based approach that focused on social competencies and positive emotions to increase empathy. These methods may be useful to explore when aiming to improve the effectiveness of (identifying info omitted) game in enhancing empathy.

Our intervention also had a potentially negative effect, where cyberbullying witnessing decreased stronger in the control condition than in the intervention condition. It is unclear if this is truly an undesired effect, since it may both cover the number of cyberbullying cases that occurred in their social circle, but also the awareness and attention that adolescents paid to cyberbullying when it took place in their social environment. Since cyberbullying victimization and perpetration decreased more in the intervention group than in the control group (no significant differences), this explanation of higher awareness of cyberbullying in the intervention group seems plausible.

As may be expected from a lack of effect on bystander behavior, the (identifying info omitted) game did not result in a change of cyberbullying or –victimization prevalence. It could be expected that when bystanders react more positively towards the victim and show less negative bystander behavior, prevalence rates would decrease. With a lack of change in behavior, a lack of change in cyberbullying prevalence can be expected. It is possible effects were measured at too short follow-up time. Moreover, cyberbullying perpetration (see e.g. Heirman & Walrave, 2012; Kowalski et al., 2014; Pabian & Vandebosch, 2014a, 2014b) and victimization (see e.g. Kowalski et al., 2014; Pabian & Vandebosch, 2015) are also determined by other predictors apart from the bystanders' feedback. Addressing those predictors of victimization and perpetration behaviors as well can be expected to yield higher effects on prevalence.

And lastly, small but significant, positive effects were noted for quality-of-life of adolescents. This may be surprising since no significant effect was found for (cyber-) bullying prevalence. Quality of life was hypothesized to increase when cyberbullying prevalence decreased. The increased intention to show positive bystander behavior and more appropriate social skills, may have however created a more positive school climate characterized by solidarity and helping others, and have thus positively impacted youngsters' quality-of-life. In traditional bullying, it was indeed shown that increasing positive bystander behavior helped to create a school climate that was perceived as safer (Gini et al., 2008).

5. Practical implications

This intervention was a very brief, stand-alone game intervention that was intended as part of a whole-school approach but was evaluated as one component. Previous cyberbullying interventions have shown that keys to success can be close teacher involvement (Menesini et al., 2012; Palladino, Nocentini, & Menesini, 2012), and using an intensive program of longer duration (Schultze-

Krumbholz et al., 2016). Effects of this brief serious game can thus be expected to increase when integrated in a 'whole-school' program rather than when using as a single component. This intervention was an individual component and the interactions with peers, parents and teachers provided in whole-school programs can be expected to also change environmental influences in bystander behavior, such as class moral norms (DeSmet et al., 2016a), appropriate teachers' interventions against cyberbullying (DeSmet et al., 2015), and parental involvement in online behavior and their relationship with the adolescent (Cross et al., 2015). The [identifying info omitted] game succeeded as a very brief intervention to improve positive bystander self-efficacy, prosocial skills, intention to act as a positive bystander, potentially awareness to cyberbullying, and adolescents' quality-of-life. It could easily be integrated in other intervention programs where these effects are lacking. To successfully change bystander behavior, and more particularly negative bystander behavior, the [identifying info omitted] game could in turn benefit from methods used to increase empathy and reduce moral disengagement, as in the ConRed program (Del Rey et al., 2016), MediaHeroes (Schultze-Krumbholz et al., 2016) or a whole-school intervention designed in Greece (Barkoukis et al., 2016). More insight is, however, needed in the components necessary to create a lean intervention that can maximize effectiveness on cyberbullying as well as reduce burden for pupils and school staff.

6. Conclusions

This study was the first to evaluate effects of an intervention designed to change bystander behavior in cyberbullying, using a specific etiological, behavior change model based on cyberbullying bystander evidence. The [identifying info omitted] game consisted of a brief serious game intervention to increase positive bystander behavior, reduce negative bystander behavior, and thus decrease cyberbullying prevalence rates and improve adolescents' quality of life. A cluster-randomized trial with two matched schools was conducted among 8th graders, with immediate follow-up and measurement after 4 weeks, and showed effects on behavioral determinants for positive behavior, but not on determinants of negative behavior or the behavior itself. An increase in cyberbullying bystander prevalence may indicate increased awareness after the intervention. Quality of life improved significantly more in the intervention than in the control condition. This very brief game intervention succeeded in achieving effects that may impact cyberbullying, and may be a useful addition to interventions where these effects are lacking. Some recommendations for future intervention iterations and future research include analyzing active ingredients of available cyberbullying interventions, using dynamic tailoring to users' needs, integrating self-regulation methods, increasing attitude change by using an interactive story, and including empathy training to change negative bystander behavior.

7. Strengths and limitations

Due to time limitations, the sample was small and consisted of a matched convenience sample of two schools. Future research on [identifying info omitted] game should collect data among a larger pool of randomly selected schools. As recommended for small samples, however, a matching procedure was used to limit the effect of differences between schools at baseline. No significant differences were indeed found between these samples at baseline. Within a cluster-randomized controlled trial as used here, there is also a possibility that selection-history effects took place, e.g. when events at one school affected scores between baseline and follow-up which did not take place in another school. Indeed, in our

study one participant was expelled for traditional bullying behavior between T0 and T1 and this may have temporarily affected scores. For school-based interventions, it is however impractical to randomize participants at an individual level, which would create the risk of social threats to validity (Portney & Watkins, 2009). With the exception of analyses on behavior, our total sample size was, however, also sufficiently powered to detect a small effect size. Finally, the study had a short follow-up time and future research should investigate whether effects can be maintained at longer follow-up. The study had several strengths. First, the intervention was developed using a systematic and evidence-based design process. Targeting determinants that can significantly predict the desired behavior is more likely to effect change in that behavior (Bartholomew et al., 2011). Second, the study was innovative in its approach of targeting bystanders of cyberbullying. Few intervention studies have targeted bystander behavior, and our study adds to scarce literature by being based in evidence specifically related to cyberbullying and founded in behavior change theories. Third, studying the game as a separate component can provide more information on active ingredients in an intervention for certain outcomes and result in more effective and leaner interventions.

Disclosure statement

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.chb.2017.10.011>.

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