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Chapter 6

Effectiveness of Adolescent Suicide Prevention E-Learning Modules for Gatekeepers: A Randomized Controlled Trial

Abstract

Objective: This RCT study investigated the effectiveness of an online adolescent suicide prevention program called *Mental Health Online* which aimed to improve the knowledge and the self-confidence of gatekeepers working with adolescents (12–20 years old). The program consisted of eight short e-learning modules each capturing an important aspect of the process of early recognition, guidance and referral of suicidal adolescents, alongside additional information on the topic of (adolescent) suicide prevention.

Method: A total of 190 gatekeepers (ages 21 to 62 years) participated in this study and were randomized to either the experimental group or the waitlist control group. Participants from both groups were assessed three times (pretest, posttest and three month follow-up). The outcome measures of this study were actual knowledge, and participant's ratings on perceived knowledge and perceived self-confidence using questionnaires developed specifically for this study.

Results: The actual knowledge, perceived knowledge, and perceived self-confidence of gate-keepers in the experimental group improved significantly compared to those in the waitlist control group at posttest, and the effects remained significant at three month follow-up. The overall effect sizes were 0.76, 1.20, and 1.02 respectively, across assessments.

Conclusions: The findings of this study indicate that online suicide prevention e-learning modules can be an effective educational method to enhance knowledge and self-confidence of gatekeepers with regard to adolescent suicide prevention. Gatekeepers with limited time and resources can benefit from the accessibility, simplicity and flexibility of online trainings.

Introduction

According to the World Health Organization (WHO) every year approximately one million people die worldwide due to suicide (WHO, 2014). Suicide is the second leading cause of death in the age category 10 to 24 years and according to a WHO report suicide rates are rising faster among adolescents compared to any other age category (WHO, 2014). Moreover, for every adolescent suicide, there are at least 40 non-fatal suicide attempts (WHO, 2001). Thus, development and deployment of adolescent suicide prevention strategies are crucial.

Over the past years it has become widely accepted that gatekeepers can play an essential role in suicide prevention, and as a result training gatekeepers has been identified as an important and promising prevention strategy (Gould & Kramer, 2001; Kalafat, 2003; Mann et al., 2005; Isaac et al., 2009; WHO, 2012). Gatekeepers are professionals that due to their profession can come in contact with people at-risk for suicide and, thus, the main purpose of training gatekeepers is to educate them in the necessary steps concerning recognition, guidance and referral of people at-risk for suicide (Gould, Greenberg, Velting, & Shaffer, 2003; Mann et al., 2005; Isaac et al., 2009). For instance, primary health care providers, school staff and police are all gatekeepers (Gould & Kramer, 2001; WHO, 2012). There are several suicide prevention gatekeeper programs available which have been widely adopted (e.g. Question, Persuade, Refer (QPR), Sources of Strength (SOS), Applied Suicide Intervention Skills Training (ASIST), Yellow Ribbon and safeTALK) (Lipson, 2013). The QPR Gatekeeper Training (Quinnet, 2012) is one of the most well-known and used gatekeeper trainings in suicide prevention (Reis & Cornell, 2008).

The QPR Gatekeeper Training is based on the QPR model which was developed and introduced in 1995 (Quinnett, 2012). According to this model, learning three simple steps can prevent someone from committing suicide. First, it is essential that people learn how to recognize warning signs associated with suicide and how to ask questions about the presence of suicidal thoughts and feelings (Question). The earlier warning signs are recognized and the person at-risk receives help, the better the outcome will be. Second, questioning the person at-risk for suicide could lead to a conversation in which the person can be encouraged to accept a referral for help (Persuade). Lastly, referral will lead to early intervention and treatment which again will lead to better outcomes (Refer) (Quinnet, 2012). Over the past years several studies have investigated the effectiveness of the QPR Gatekeeper Training and the results are promising. These studies have targeted various types of gatekeepers including veterans affairs staff, veteran health administration staff, college residence advisers, university faculty staff and social work students, and have shown that the gatekeeper's actual or perceived knowledge and perceived self-efficacy with regard to suicide prevention improves after attending the training

(Matthieu, Cross, Batres, Flora, & Knox, 2008; Matthieu, Chen, Schon, Lantinga, & Knox, 2009; Tompkins & Witt, 2009; Cross, Matthieu, Lezine, & Knox, 2010; Indelicato, Mirsu-Paun, & Griffin, 2011; Cerel, Padgett, Robbins, & Kaminer, 2012; Jacobson, Osteen, Sharpe, & Pastoor; 2012).

Additionally, several studies have studied the effectiveness of the QPR Gatekeeper Training in gatekeepers working with adolescents (Wyman et al., 2008; Reis & Cornell, 2008; Tompkins, Witt, & Abraibesh, 2009; Johnson & Parsons, 2012). A randomized controlled trial with an average of one year follow-up tested the impact of the training in school staff (health and social services staff, administrators, teacher and support staff) and showed enhancement of perceived knowledge, perceived efficacy and preparedness of the trained gatekeepers to perform suicide prevention activities (Wyman et al., 2008). Another study using a non-equivalent control group design with a three months follow-up, demonstrated increased knowledge in trained teachers and counselors working in elementary, middle and high schools (Reis & Cornell, 2008). Another non-equivalent control group design with a three month follow-up, showed gains in knowledge and self-efficacy in trained school personnel at posttest (Tompkins et al., 2009). Moreover, the self-efficacy gain was maintained at follow-up, but this was not the case for knowledge. According to the authors this could be explained by the limited sub-sample that completed the follow-up measures (Tompkins et al., 2009). Finally, a study targeting faculty and staff who worked regularly with middle and high school students showed that the knowledge of the participants increased after completing the training (Johnson & Parsons, 2012).

The results of the discussed papers demonstrate that in-person gatekeeper training can be an effective strategy in enhancement of professionals' knowledge and self-efficacy in adolescent suicide prevention. However, for several reasons gatekeepers may be kept from attending training sessions. The most important barrier for gatekeepers is the lack of time and resources to attend in-person training sessions. Another obstacle has to do with the usually inflexible nature of in-person training which obligates each participant to sit throughout the entire training course, thus, not taking into consideration prior knowledge and current needs of individual participants. With the growth of internet usage worldwide, new developments have occurred in the way people gather information and subsequently information providers are using this medium increasingly to transfer knowledge to their target groups. The use of e-learning modules in particular could be an effective technique to transfer needed knowledge with regard to adolescent suicide prevention to the gatekeeper. 'E-learning' also known as computer-based learning, online learning, distributed learning or web-based learning describes the use of computers to transfer knowledge to the learner mainly through intranet

or internet (Welsh, Wanberg, Brown, & Simmering, 2003). This method has several advantages over the more traditional in-person training.

First, the online character makes the training highly accessible from any given location as long the gatekeeper has access to internet. Second, by offering information on the process of recognition, guidance and referral of suicidal adolescents in separate short modules, the gatekeeper is provided the opportunity to compose his or her own custom-made training. Lastly, this type of training can be composed and maintained with limited resources and as a result the training can be offered at a low price. Thus, gatekeepers could have easy, fast and instant access to needed knowledge with regards to adolescent suicide prevention at any time point, from any given location. Additionally, they can refresh their knowledge whenever needed. In 2012 a systematic review was carried out aiming to provide a first overview of the existing e-learning modules on suicide prevention designed for gatekeepers, and their effectiveness (Ghoncheh, Koot, & Kerkhof, 2014b). For this study a *Google* search showed that worldwide e-learning modules are increasingly available on this topic. A literature search, however, yielded no published papers on the same topic. This led the authors to conclude that this discrepancy in existence of e-learning modules and lack of research regarding their effectiveness points to a need for research, especially randomized controlled trials (RCTs) (Ghoncheh et al., 2014).

In 2011 the VU University in Amsterdam started a program called Mental Health Online (MHO) aiming to develop adolescent suicide prevention e-learning modules for gatekeepers and to test the effectiveness of these modules (Ghoncheh, Vos, Koot, & Kerkhof, 2013). Eight e-learning modules were developed, each capturing an important aspect of the process of recognition, guidance and referral of suicidal adolescents (12–20 years old). The content of the modules followed the QPR model focusing on essential knowledge and frameworks that enhance early detection, assistance and referral of adolescents at-risk for suicide. Although the QPR Institute Inc. has also made the QPR Gatekeeper Training available online, it was decided not to use that version because it focuses on 'suicidal people' in general while we aimed the e-learning modules of the MHO program to only address adolescent suicidality. Further, the QPR Online Gatekeeper Training takes approximately one hour to complete while for this study it was chosen to divide the process of recognition, guidance, and referral in short modules so that participants would have the liberty to create their own custom-made training based on their previous knowledge and experiences. Lastly, the training license of the QPR Online Training becomes available only after paying a fee. It was expected that payment requirements would affect the willingness of the gatekeepers to participate in this study.

In the present paper the results of an RCT addressing the effectiveness of the MHO program are presented. Effectiveness of the program was determined by measuring change

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in (1) actual knowledge, (2) perceived knowledge, and (3) perceived self-confidence of the gatekeepers after the training compared to a waitlist control group. It was expected that the gatekeepers' actual knowledge, perceived knowledge, and perceived self-confidence with regard to adolescent suicide prevention would improve after attending the MHO program compared to those in the waitlist control group. To our knowledge this is the first time that the effectiveness of an online adolescent suicide prevention gatekeeper training is being investigated in an RCT.

Method

The detailed study protocol for this RCT can be found elsewhere (Ghoncheh, Kerkhof, & Koot, 2014a). The first group of participants started the study in the second half of 2012, and the last group of participants finished the study in the second half of 2013.

Design
This study was a randomized trial in a *pretest, posttest, and three month follow-up design* with two arms: an experimental group and a waitlist control group. The intervention was not masked. The experimental group received the intervention during the study, and the waitlist control group received the intervention after completion of the study. Participants did not receive any type of compensation for participation in this study.

Participants
The participants of this study were Dutch speaking gatekeepers who worked with adolescents. The inclusion criteria were: gatekeepers who are 18 years and older (1), work frequently with adolescents from 12 to 20 years (2), whose profession involves responsibilities with regard to the (mental) healthcare of adolescents (3), and who have access to internet (4). Although every individual that met the inclusion criteria of the study was eligible to participate in this study, three main target groups were identified for recruitment based on the inclusion criteria: members of mental healthcare teams of schools, youth health care nurses, and (mental) healthcare employees.

Intervention: MHO program
The intervention of this study consisted of eight e-learning modules including voice-over, case descriptions, and quizzes pertaining to information needed for effective suicide prevention in adolescents, alongside additional information regarding adolescent suicide prevention. Both the modules and the additional information were made accessible through the website

www.MentalHealthOnline.nl for participants of this study. Each of the modules of the program addresses an important aspect of the process of recognition, guidance, and referral of suicidal adolescents (12–20 years old). By offering the process in eight separate modules, it was aimed to give the participants the opportunity to create their own custom-made training based on their previous knowledge and needs. Thus, it was up to the participants to decide how many modules they would follow, and in what order.

The e-learning modules

The first module is titled 'suicidality among adolescents' and gives a general introduction to the topic of adolescent suicidality including statistics and figures. Risk factors associated with adolescent suicidality are discussed in the second module named 'risk factors'. The third module 'ethnicity' addresses the relationship between ethnicity and adolescent suicidality in the Netherlands. Warning signs associated with adolescent suicidality are presented in the fourth module entitled 'recognition of suicidality'. The fifth module titled 'conversation with the suicidal adolescent' and the sixth module called 'conversation with the parents' discusses the needed tools and skills when engaging in a conversation with suicidal adolescents or their parents. A seventh module titled 'suicide first-aid' gives practical information about how first-aid should be given once an adolescent attempts suicide. The eighth and final module called 'care and aftercare' was especially designed for schools and offers guidelines needed to arrange the process of care and aftercare after suicide (attempt) of a student. Each module took approximately four to ten minutes to complete.

Additional information

Since it was attempted to create short modules, only containing the necessary information with regard to the purpose of the module, a separate section was created on the website which contained additional information (literature, documentaries, and links to other informative websites) on (adolescent) suicidality for those who wished to receive more information. Furthermore, an online discussion board was created where participants could interact with each other, but also ask experts questions or present cases regarding adolescent suicidality.

Instruments

The MHO program was developed especially for this study and there were no suitable instruments available that could be used for this study. As a result three questionnaires were developed to measure the outcomes of this study. The outcomes were (1) participants' answers to questions tapping their actual knowledge, and their ratings of (2) perceived knowledge, and (3) perceived self-confidence with regard to adolescent suicidality and suicide prevention.

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The three questionnaires were filled out by the participants during the three assessment points: pretest (baseline assessment, T_0), posttest (second assessment, T_1) and follow-up (third assessment, T_2). In addition, at the beginning of the follow-up assessment participants in the experimental group received two questions about implementation of their gained knowledge. Furthermore, during the baseline assessment information about demographics was gathered. Lastly, participants in the experimental group were asked to fill out an evaluation questionnaire during the posttest which aimed to assess to what extent they were satisfied with different aspects of the program and which modifications they thought could improve the program. Results of the evaluation questionnaire (incl. insights regarding the construction of the e-learning modules) are not presented in this paper, but are discussed in a separate paper (Ghoncheh, Kerkhof, & Koot, 2015).

Actual knowledge questionnaire

The *actual knowledge questionnaire* consisted of six cases each starting with a photograph and several characteristics of a fictional adolescent displayed in the photograph. Each case was followed by two general questions (yes/no), and eight specific questions (multiple choice, one correct answer) each pertaining to the content of one of the e-learning modules of the program MHO. The total number of questions each participant would receive depended on the answer they gave on the two general questions. The scores per case could vary from 0 (wrong answers to all questions) to 10 (correct answers to all questions). Two cases were presented during each assessment point, a case about a native Dutch adolescent, and an adolescent originating from an ethnic minority group in the Netherlands. Since three items of this questionnaire were conditional and the items were not related to each other, psychometric characteristics for this questionnaire could not be tested.

Perceived knowledge questionnaire

The *perceived knowledge questionnaire* consisted of nine statements to be rated on a three point Likert scale (0 = disagree, 1 = partially agree, 2 = agree). The first item of the questionnaire was a general statement regarding knowledge in adolescent suicide prevention, and the following eight items each captured the essence of one of the e-learning modules of the MHO program. The scores could vary from 0 (disagree on all statements) to 18 (agree to all statements). During pre-, posttest and follow-up the participants received the same questionnaire. Principal Component Analysis (PCA) revealed the presence of one component. The Cronbach's alpha coefficient for the perceived knowledge questionnaire was at pretest .89 (experimental .89, waitlist control .90), at posttest .93 (experimental .88, waitlist control .87) and follow-up .92 (experimental .82, waitlist control .88).

Perceived self-confidence questionnaire

A 16 item questionnaire was developed which consisted of statements regarding the necessary skills and attitudes when dealing with adolescent suicide prevention. The statements could be rated on a three point Likert scale (0 = disagree, 1 = partially agree, 2 = agree) and were related to the eight e-learning modules. The scores could vary from 0 (disagree on all statements) to 32 (agree to all statements). The same questionnaire was used during each of the three assessment points. PCA revealed the presence of one component. The Cronbach's alpha coefficient for the perceived self-confidence questionnaire was at pretest .93 (experimental .93, waitlist control .92), at posttest .95 (experimental .93, waitlist control .93) and at follow-up .95 (experimental .91, waitlist control .94).

Recruitment

The recruitment for this study was carried out in the second half of 2012. A broad and stepwise recruitment strategy was used. First, the domain name http://www.MentalHealthOnline.nl was registered and information regarding the study was posted on the website. Second, almost all education partnerships in the Netherlands were contacted by e-mail and were asked to distribute the e-mail among their mailing list. In addition, those interested were given the opportunity to invite the main researcher of this study for an on-site presentation. Third, several informational websites that are followed by gatekeepers were asked to place a summary of the research and a link to MHO on their website. Fourth, the main researcher attended seminars and conferences organized for potential participants and handed out flyers. Fifth, the VU University Amsterdam released a press release about the study that was distributed through several newsletters, and lead to two interviews with national newspapers. Lastly, a twitter- and a Facebook account were created for this study. Promotion materials regarding the study, and up-to-date information about the study were shared with followers on both accounts.

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Procedure

This was an online study and as a result every aspect of the study took place online, including communication and data collection which was done by the main researcher. All participants were required to register themselves by sending an e-mail to this address and include their name, position, affiliation, and email address. The baseline assessment was sent to the participants by e-mail and after completion of this assessment participants were randomized to one of the experimental of control group. If participants had been assigned to the experimental group, they received a personal username and password, alongside a guideline to the website and

gained access to the website one week after completing the baseline assessment for a period of 14 days.

Four weeks after completing the baseline assessment the link to the second assessment was sent to the participants by e-mail. After finishing the second assessment, those in the experimental group regained access to the website until one week prior to receiving the third assessment. The link to the third and final assessment was sent to the participants twelve weeks after finishing the second assessment. After completing the third assessment, participants in the waitlist control group gained access to the website by receiving an e-mail containing a personal username and password. At the same moment, those in the experimental group also received an e-mail in which they were notified that they had regained access to the website in case they wanted to refresh their knowledge or use the additional information.

Participation was monitored by the main researcher and participants received reminders or were contacted if necessary.

Data Analyses

All analyses were carried out on the intention-to-treat sample. Hierarchical linear modeling (HLM) was conducted in MLwiN version 2.28 to determine whether differences between the two groups existed in actual knowledge, perceived knowledge, and self-confidence after the experimental group received the intervention. MLwiN integrates data from participants missing one or more measurements, or one or more questionnaires into the analysis. A two-level HLM was conducted for each outcome measure (perceived knowledge, perceived self-confidence and actual knowledge) where the outcome measures (level-1) were nested within gatekeepers (level-2). In order to determine the intervention effect, two separate models were tested for each of the three outcome measures. The first model explored the overall effect of the intervention across time correcting for the baseline assessment. The second model explored the effects of the intervention at posttest and follow-up by adding the interaction term *Group* and *Time* to the previous model.

Other analyses conducted for this study were done using IBM SPSS Statistics version 21.

Results

Response rates

A total of 211 gatekeepers registered for the study of which 190 completed the baseline assessment and were enrolled in the study. The enrolled participants were randomized to either the experimental group (*n*= 94) or the waitlist control group (*n*= 96). Four participants in the experimental group did not follow the e-learning modules and subsequently did not

receive the second assessment. The remaining 90 participants received the second assessment and 84 completed the second assessment (response rate 89.4%), all participants in the waitlist control group completed the second assessment (response rate 100%). The third assessment was completed by 82 participants in the experimental group (response rate 87.2%) and 92 participants in the waitlist control group (response rate 97.9%). Figure 1 illustrates the flow of participants through each stage of the study.
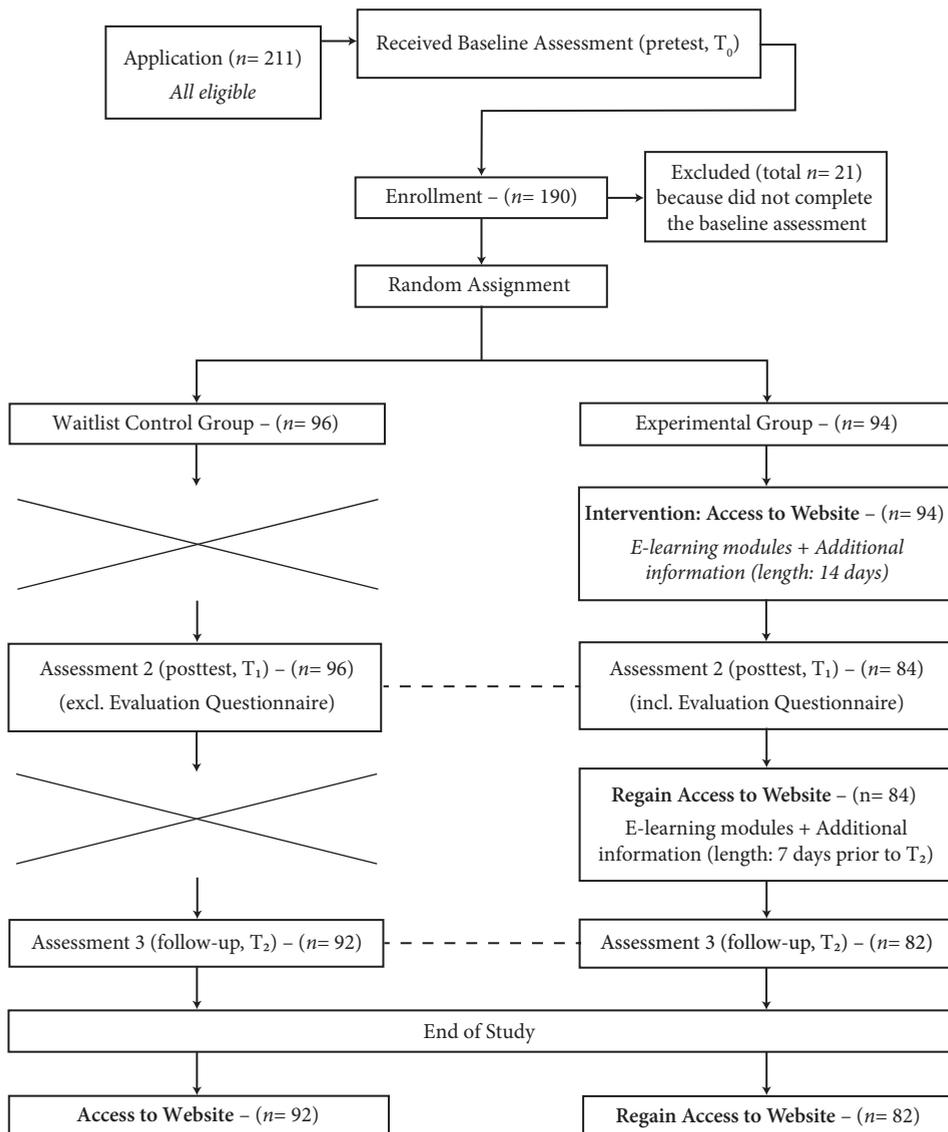

Figure 1. Flow of Participants Through Each Stage of the Study

The sixteen participants who dropped out of the study were contacted by the main researcher. The following reasons were given by the participants for not completing the study: lack of time (n= 7), family circumstances (n= 2), unable to open the questionnaire at work and lack of time to fill out the questionnaire at home (n= 2), pregnancy leave (n= 1), absence due to vacation (n= 1), and objection regarding the nature of testing (n= 1). The remaining two participants did not respond.

No differences were found between the groups with regard to the mean scores of the participants that completed the study and those that dropped out the study: actual knowledge at pretest (t = 1.271, df = 188, p = 0.205, two-tailed), actual knowledge at posttest (t = 1.709, df = 180, p = 0.089, two-tailed), perceived knowledge at pretest (t = -0.200, df = 188, p = 0.842), perceived knowledge at posttest (t = 1.107, df = 182, p = 0.270, two-tailed), perceived self-confidence at pretest (t = 0.269, df = 188, p = 0.789, two-tailed), and perceived self-confidence at posttest (t = -0.168, df = 181, p = 0.867, two-tailed).

Descriptive analysis

Gatekeepers in this study were 21 to 62 years of age (M = 43.55, SD = 10.96), the majority were female (81.6%) and had a higher vocational (55.8%) or university (38.4%) degree. The majority (67.9%) of the gatekeepers worked within a school setting (such as mentors, counselors, teachers and social workers) while the rest worked in a (mental) health care related setting or institute (such as psychologists, behavioral scientists, youth health care nurses and psychiatrists). The participants of this study had 0 to 30 years of experience in their current job (M = 8.28, SD = 7.16). Moreover, 78.9% of the participants stated to have known at least one adolescent who performed a non-fatal suicide attempt, and 39.5% of the gatekeepers stated to have known at least one adolescent who died due to suicide. All participants were from the Netherlands except one gatekeeper who lived in Belgium. No differences were found between the experimental group and the waitlist control group on the demographics.

Table 1 shows the mean scores and standard deviations of both groups on actual knowledge, perceived knowledge and perceived self-confidence at baseline, posttest and follow-up. The groups mean scores at the three assessment points are also illustrated in Figure 2. At baseline no significant differences were found between the waitlist control group and the experimental group on actual knowledge (t = 1.106, df = 188, p = 0.270, two-tailed), the perceived knowledge (t = -1.042, df = 188, p = 0.299, two-tailed), and perceived self-confidence (t = -1.301, df = 188, p = 0.195, two-tailed).

a) Mean Score Actual Knowledge
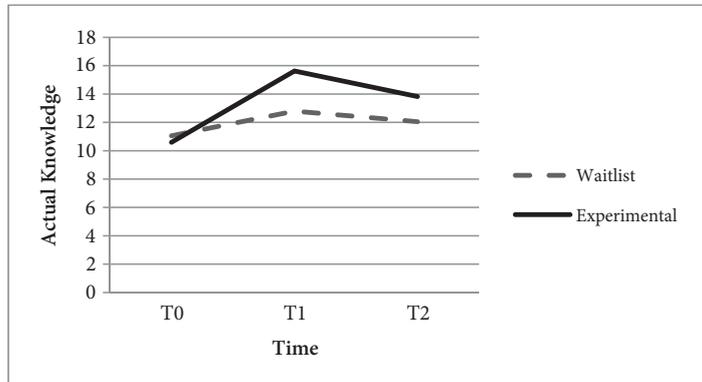
b) Mean Score Perceived Knowledge
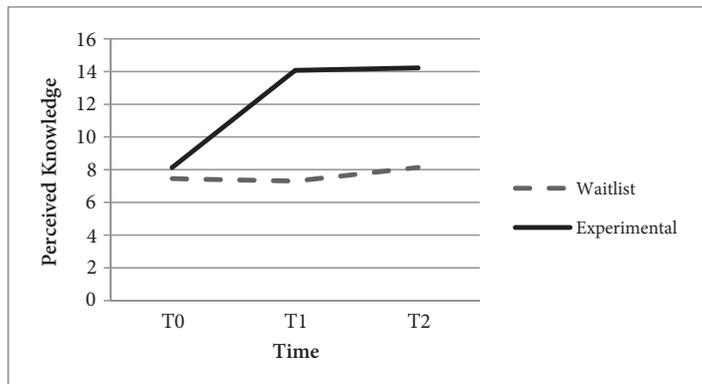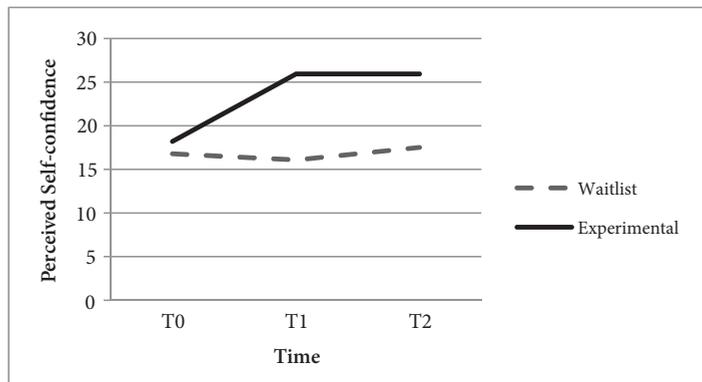

c) Mean Score Perceived Self-confidence

Figure 2. Mean Scores of the Groups on the Three Questionnaires During T_0, T_1 and T_2

Outcome measures across time by condition

As shown in Table 2, the overall effect of the intervention was highly significant across time and resulted in large overall effect sizes for actual knowledge (ES = .76), perceived knowledge (ES = 1.20) and perceived self-confidence (ES = 1.02). This indicates, first, that the MHO program had a large positive effect on the actual knowledge, perceived knowledge and perceived self-confidence of the participants attending the program compared to those in the waitlist control group, and, second, that the found effects remained significant at three month follow-up. Further analyses showed that the intervention effect was strongest at posttest compared to follow-up for actual knowledge (ES = .94), perceived knowledge (ES = 1.30) and perceived self-confidence (ES = 1.12), and that the effects remained large for perceived knowledge (ES = 1.09) and perceived self-confidence (ES = .90) after three months. For actual knowledge a medium effect size (ES = .57) was found at follow-up indicating a decrease in the actual knowledge of the participants over a period of three months.

Of the 84 participants in the experimental group that finished the second assessment, 71 (85%) completed all eight e-learning modules of the MHO program. For this reason further analyses exploring whether the amount of e-learning modules a participant follows has an effect on the actual knowledge, perceived knowledge and perceived self-confidence were not conducted.

Application of gained knowledge

At three month follow-up we asked gatekeepers from the experimental group (*n*= 82) whether they had applied the knowledge gained from the e-learning modules into practice, and 45% mentioned to have applied the gained knowledge over the past three months of which 36 elaborated on their answer. Implementation of the gained knowledge was done in the following ways: recognition of and/or engaging in conversation about suicidality (*n*= 25), all the steps from recognition to referral (*n*= 5), advising and sharing knowledge with other gatekeepers (*n*= 3), awareness (*n*= 2) and other (*n*= 1).

Table 1. Mean Scores Actual Knowledge, Perceived Knowledge and Perceived Self-Confidence over Time

	Baseline, T_0		Posttest, T_1		Follow-up, T_2	
Questionnaire	Waitlist Control ($n=96$) M (SD)	Experimental ($n=94$) M (SD)	Waitlist Control ($n=96$) M (SD)	Experimental ($n=88$) M (SD)	Waitlist Control ($n=92$) M (SD)	Experimental ($n=82$) M (SD)
Actual Knowledge	11.05 (3.07)	10.59 (2.74)	12.79 (2.30)	15.63 (2.97)	12.05 (3.30)	13.82 (3.00)
Perceived Knowledge	7.45 (4.44)	8.13 (4.55)	7.30 (3.99)	14.07 (3.66)	8.14 (4.02)	14.22 (2.98)
Perceived Self-confidence	16.78 (7.44)	18.21 (7.73)	16.08 (7.29)	25.94 (5.81)	17.52 (7.34)	25.93 (5.34)

Table 2. Training Impact

Variable	B	Overall effect Confidence interval	ES	B	Effect at post-test Confidence interval	ES	B	Effect at follow-up Confidence interval	ES
Actual Knowledge	2.415	[1.76, 3.07]	0.76	2.995	[2.19, 3.80]	0.94	1.828	[1.00, 2.65]	0.57
Perceived Knowledge	5.883	[5.12, 6.65]	1.20	6.363	[5.52, 7.21]	1.30	5.359	[4.92, 6.22]	1.09
Perceived Self-confidence	8.112	[6.82, 9.41]	1.02	8.942	[7.49, 10.39]	1.12	7.216	[5.74, 8.69]	0.90

Note
Effect size (ES) is the regression coefficient divided by the total standard deviation. All models were significant at a $p < .001$

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Discussion

This RCT investigated the effectiveness of an online adolescent suicide prevention gatekeeper training called MHO, consisting of eight e-learning modules and additional information. The results of this study show that the actual knowledge, perceived knowledge, and perceived self-confidence of gatekeepers who enrolled in the MHO program improved significantly compared to the gatekeepers who did not have access to the program, and that the effects found immediately after the training remained significant at three month follow-up. Moreover, almost half of the participants that had access to the intervention of this study mentioned to have implemented the gained knowledge into practice during the three month follow-up.

Our findings are in accordance with previous studies that investigated the effectiveness of the QPR Gatekeeper Training delivered in-person to gatekeepers working with adolescents (Wyman et al., 2008; Reis & Cornell, 2008; Tompkins et al., 2009; Johnson & Parsons, 2012). These studies also found gain in (perceived) knowledge and perceived self-confidence of gatekeepers attending the training. The study of Wyman et al. (2008) is the only study we found testing the impact of QPR Gatekeeper Training in gatekeepers working with adolescents using an RCT. In that study a large effect size was found for perceived knowledge (ES = 1.32), and perceived efficacy (ES = 1.22), and a medium effect size (ES = 0.41) for the QPR knowledge at a one year follow-up (Wyman et al., 2008). In our study we found a large overall effect size for actual knowledge, perceived knowledge, and perceived self-confidence across time, and immediately after finishing the training. However, similar to the study of Wyman et al. (2008), we found a large effect size for the training for perceived knowledge and perceived self-confidence, and a medium effect size for actual knowledge at (three month) follow-up.

Although this study suggests that online training of gatekeepers in adolescent suicide prevention has similar effects as in-person training aiming for the same, we did not compared these two methods to each other and to the best of our knowledge this has not been done before in the field of suicide prevention. As a result it remains unclear whether online adolescent suicide prevention training for gatekeepers is actually as effective as in-person training. Interaction with the trainer and other participants in person, and the opportunity to practice the gained knowledge during role-play are probably the most important advantages of in-person trainings compared to distance learning. However, it remains questionable whether these elements actually contribute to additional increases in knowledge, self-confidence and perhaps skills of gatekeepers since the only way to implement and practice the gained knowledge for the participant is to interact with a suicidal adolescent which is similar for online learning. The fact that almost half of the participants of this study stated to have implemented the gained knowledge from the e-learning modules during the three month follow-up suggests that the

gained knowledge has indeed led to increase in self-confidence and implementation of the required steps in adolescent suicide prevention which could indicate skill improvement.

Future research is needed to replicate the findings of this study and in addition to determine which features enhance its learning outcomes. As mentioned earlier, we have also asked the participants of our study to evaluate the MHO program to get more understanding of what gatekeepers need in order to improve the program. The results of the evaluation are discussed in a separate paper (Ghoncheh et al., 2015). Furthermore future research should also investigate to what extent web-based learning can replace or supplement the currently existing traditional educational strategies in suicide prevention. Even if results of future research would favor traditional methods compared to online training, for example regarding acquired skills, the results of this study showed that online training is effective in knowledge gain and self-confidence enhancement. Thus, based on the findings of this study we recommend that evidence based online adolescent suicide prevention trainings should be offered as a base training to gatekeepers. This way gatekeepers working with adolescents will become familiar with the necessary steps in adolescent suicide prevention which is likely to result in detecting adolescents in need and referring them to professionals that can assist them. Thereafter those in need for more in-depth information and personal interaction or practice opportunities can attend in-person trainings. Subsequently, this could be beneficial to in-person trainings because a more homogenous group of gatekeepers will attend them and a custom-made content can be created solely for those looking for advanced material in adolescent suicide prevention.

The findings of this study have potential implications for education on prevention of other mental health issues. Although this study focused on adolescent suicide prevention, its results show that online training is a promising tool in gatekeeper's education and that the findings are probably generalizable to any other topic. Gatekeepers can easily get educated in various and highly important topics such as adult suicide, depression, and eating disorders, and child/adolescent behavioral, emotional and developmental problems and disorders. For example, in the Netherlands especially gatekeepers working in places where a large group of adolescents can be reached, such as schools, can benefit from the advantages of the online training since governments have assigned them prevention and intervention responsibilities when it comes to the (mental) healthcare of their students (Deen & Laan, 2010). This way adolescents at-risk can be detected early on and can be referred for help.

Although this study had several strengths including being an RCT with enough statistical power, the study also had several limitations. A possible, yet inevitable, limitation of this study is that no standardized instruments were available to test the outcome measurements of this study. Nevertheless, the perceived knowledge and perceived self-confidence questionnaires had high reliability across the three measurements and PCA revealed the presence of one

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component for both questionnaires. Unfortunately, psychometric characteristics of the actual knowledge questionnaire could not be tested as the item content was based on specific cases and several questions were conditional. Second, due to privacy reasons it was not possible to monitor the gatekeepers who participated in this study or to obtain information on referrals they made. As a result we could not measure changes in the actual suicide prevention skills and performance. Future research should determine whether distance learning actually improves the behaviors of gatekeepers necessary for preventive activities and eventually leads to more detection of suicidal adolescents, and correct referrals. Third, although we included a three month follow-up maintenance of the intervention effects across a longer time period was not ascertained.

Conclusion

Despite its limitations, this study is of value for gaining insight into the potential of e-education for professionals involved in the field of prevention of undesirable outcomes. It is the first study that tested the effectiveness of adolescent suicide prevention e-learning modules targeting gatekeepers in an RCT. The findings are promising and provide evidence that the use of online resources, such as e-learning modules, could be an effective strategy in improvement of the gatekeeper's actual knowledge, perceived knowledge, and perceived self-confidence in adolescent suicide prevention. Future research is needed to support the findings of this study.

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