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ORGINAL ARTICLE

Effectiveness of a prevention campaign on HIV/AIDS knowledge among adolescents in Eastern Slovakia

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Abstract
Objectives The aim of this manuscript was to evaluate results of the questionnaire given to young people before and after the prevention campaign to determine whether the prevention campaign improved HIV/AIDS-related knowledge of young people.
Methods A total of 533 students completed the pre-test and 496 students completed the post-test. Questionnaire was used as pre/post testing tool. Construct validity and measurement scale were assessed using the factor analysis. Rasch scaling was used to establish common scale for pre/post test and to transform raw score into the interval scale. A non-parametric Mann–Whitney U test was used to compare knowledge in pre-test and post-test.
Results Students increased their knowledge of HIV/AIDS (Pearson's measure of effect size $r = 0.74$) and the risk of acquiring HIV infection ($r = 0.68$) statistically significantly ($p = 0.001$). Girls (risk estimation: $r = 0.78$, knowledge: $r = 0.81$) improved much more than boys (risk estimation: $r = 0.57$, knowledge: $r = 0.62$).
Conclusions This study suggests that, for the selected sample, the prevention campaign was an effective tool to increase young people's knowledge of HIV/AIDS. The authors recommend dividing and tailoring interventions by gender to achieve even more efficient preventive future interventions.

Keywords HIV/AIDS prevention · Effectiveness · Questionnaire

Introduction

Human immunodeficiency virus (HIV), the virus that causes acquired immunodeficiency syndrome (AIDS), has become one of the world's most serious health challenges of the 21st century (Ungan et al. 2003). Globally, an estimated 35.3 (32.2–38.8) million people were living with HIV in 2012 (UNAIDS 2013). HIV infection is of major public health importance in Europe. In 2012, 55,494 HIV diagnoses (7.8/100,000) were reported by 51 of the 53 countries in the WHO European Region, of which 29,381 (5.8/100.000) were reported by the countries in the European Union and European Economic Area (EU/EEA). Overall 11 % of all HIV diagnoses were reported among young people aged 15–24 in Europe (ECDC/WHO 2013).

The first case of HIV infection in Slovakia was reported in 1985. From 1985 to 2012, 556 HIV cases were diagnosed (432 Slovak citizens and 124 foreigners). Cumulative incidence reached 8.05 cases/100,000 Slovak citizens. 68 out of 432 Slovak HIV cases developed AIDS and 49 reported deaths occurred (41 cases of AIDS, 8 HIV cases) (PHA SR 2013). Incidence had an increasing trend during the entire time period (1985–2012). In 2012, 50 new HIV diagnoses, including 43 Slovak citizens and 7

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foreigners, were reported in Slovakia (0.93/100,000). Seven new AIDS cases, of which three died, were reported in the same year, all among Slovak citizens (0.13/100,000) (PHA SR 2013). Male-to-male transmission was the predominant mode of transmission in 2012; accounting for 55.81 % (24 diagnoses) of the total Slovak cases (PHA SR 2013). Compared to other EU/EEA countries, Slovakia reported the lowest incidence of HIV diagnoses (0.9/100,000) in 2012. However, of all HIV diagnoses between 1985 and 2012 in Slovakia, around 13 % occurred among young people, above the EU/EEA average (ECDC/WHO 2013). In 2012, 18.6 % of newly infected young Slovak citizens were in the age group 15–24 years (PHA SR 2013).

Young people are one of the most vulnerable population to HIV infections as they find themselves in the transitional period between childhood and adulthood (Ergene et al. 2005; ECDC 2013; Xiao et al. 2013). It is a crucial period for fostering healthy attitudes and behaviors to protect people from diseases (Liao et al. 2010). People younger than 25 years have been shown to have higher rates of partner changes and engage in more high-risk sexual behavior than the general population (ECDC 2013; Kalina et al. 2009). Despite the internet age and oversupply of new information, young people often lack knowledge about HIV/AIDS, modes of transmission and ways of prevention. Many young people still believe that AIDS does not affect them and that they belong to the advantaged social environment, where AIDS will not reach them (Beltzer et al. 2012).

Sunflower, an EU-funded consortium project, ran between 2008 and 2011 in nine European countries, including Slovakia (ANLAIDS 2010). The project was coordinated by an Italian NGO ANLAIDS and consisted of four steps. Initially, partners from nine participating countries (Bulgaria, Czech Republic, Germany, Greece, Italy, Lithuania, Romania, Slovakia, and United Kingdom) carried out analysis of local contexts and the scientific aspects of HIV spreading in Europe.

Secondly, the project partners defined and exchanged good practices, using questionnaires and interviews with opinion leaders and sector workers and semi-structured interviews with social, health, and educational workers working with young people and HIV/AIDS prevention.

After analyzing local contexts and defining and exchanging good practices, the partners organized an European prevention campaign. The prevention campaign was coordinated by a project coordinator and organized by young people, selected through a competition concerning HIV/AIDS issues. The prevention campaign was based on three approaches leading to the creation of supportive environment for adolescents to adopt their beliefs, attitudes and behaviors leading to a reduced risk of HIV infection: advocacy, behavior change communication, and education. Tools used in the prevention campaign included presentations, discussion, flyers with prevention information, posters, and handbooks as well as a project web site.

Finally, the local partners worked to implement the local activities created by young people. Before and after the prevention campaign, participating young people were given a questionnaire to evaluate level of HIV/AIDS knowledge.

Project sunflower (ANLAIDS 2010) highlights innovative strategies to promote safer sex among adolescents, increases access to targeted services and improves awareness of HIV/STIs and emphasizes peer-led interventions as preferred by youths.

The intervention strategies are consistent with the results of a systematic review of interventions to prevent the spread of sexually transmitted infections (STI), including HIV, among young people in Europe, which examined the effectiveness of health promotion and STI risk reduction interventions across the EU/EEA. Peer-led interventions have been found to be more accepted by young people and were successful in improving sexual knowledge (Lazarus et al. 2010). As written elsewhere (CDC 2011), well-designed and well-implemented HIV/STI educational prevention programs have a significant impact on increasing knowledge and reducing risky sexual behavior.

The aim of this manuscript is to evaluate results of the questionnaire given to young people before and after the prevention campaign to determine whether the prevention campaign improved HIV/AIDS-related knowledge of young people.

Methods

Study design and data collection

The prevention campaign was organized by young people selected through a competition in the literature and graphics devoted to the spread of HIV/AIDS among young people. They designed and created content and form of the entire prevention campaign. The prevention campaign was based on three approaches leading to creation of supportive environment for adolescents to adopt their beliefs, attitudes, and behaviors leading to a reduced risk of HIV infection: advocacy, behavior change communication, and education.

Lectures given during the prevention campaign focused on the HIV virus as an etiologic factor, the epidemiological situation of HIV/AIDS worldwide and in Slovakia, modes of transmission, high-risk behaviors, and prevention. Lectures were followed by a discussion including demonstration of correct condom usage. Each student

received an information leaflet and a flash memory stick. A web site was created to facilitate communication with young people. Other tools used in the prevention campaign were flyers with prevention information, posters, and handbooks.

An intervention was employed to conduct the study in Slovakia with a questionnaire used to measure pre/post knowledge. The same questionnaire was administered before and after the prevention campaign. The 12-month interval between the pre-test and post-test essentially eliminated a recall bias. For ethical reasons (to ensure maximum anonymity), within-subject design was not used, i.e. students' answers were not paired with each other (in the pre-test and post-test). For this reason, the autocorrelation estimation in answers was not possible and we considered pre-test and post-test as independent groups.

The questionnaire, designed and provided by the Sunflower project coordinator, included collection of socio-demographic information (age, sex, academic level) and 11 questions about STI and HIV/AIDS knowledge and possibilities to get an HIV test, HIV risk behaviors and situations related to HIV infections, and sources of information about HIV/AIDS. One question concerned whether students know anybody living with an STI. Two questions (Nr 1 and 2) were excluded from the analysis due to inability to assess the correctness of the answer. The remaining nine questions were split into 19 items and analyzed. A full version of the original test and the list of items eligible for the analysis are provided in "Appendix."

Participants

A sample size of approximately 500 students was provided by a project coordinator. The minimal sample size was estimated using the G*Power 3.1.9 software with the assumptions of the equal groups, alpha level equal to 0.01, at least moderate effect size ($d > 0.5$), the statistical power at least 0.95, and normal score distribution. Under these assumptions, the minimal required sample size of one group was $N_{\min} = 128$. We decided to enlarge the sample size, because we did not expect normal score distribution.

The study was conducted in the second largest Slovak city of Košice and its neighboring district from October 2009 to October 2010. Sixty-four secondary schools (ISCED 3), totalling 19,395 students, and 16 separate faculties of 4 universities, totalling 19,715 full-time students, provide education in the Košice city and its neighboring district. All schools had equal probability for selection. Eight secondary schools and one faculty were recruited using simple random sampling. All 15–19 years old students from each selected school could participate at the prevention campaign and complete the test. Tests were handed out and collected by trained investigators during school hours. Student names did not appear on the tests.

Statistical analysis

Prior to pre-test/post-test comparison, we assessed the construct validity of the questionnaire to ensure that the questionnaire measured the intended aspects of HIV/AIDS knowledge. Exploratory factor analysis (EFA) using the maximum likelihood extraction and direct oblimin rotation was used. Results of EFA were tested with confirmatory factor analysis (CFA) using AMOS structural equation modeling software (Byrne 2010) and will be published in detail elsewhere.

Based on the results of CFA, we chose a two-dimensional Rasch model (Bond and Fox 2007) using the weighted maximum likelihood method of a person-parameter estimation. Rasch scaling is necessary to establish the common scale for pre-test and post-test and to transform the raw score (essentially ordinal) into the interval scale. The Rasch score measures participants' ability in two dimensions and is quantified by the logit scale, which theoretically covers all the real numbers. However, under typical circumstances, the score ranges from -4 to $+4$ and it is centred on the average item difficulty. Analysis was performed using the ACER ConQuest 2.0 package (Wu et al. 2007). While Rasch modeling has been frequently used in educational research and psychometrics, it is also increasingly being used in epidemiology and public health (Li et al. 2011; Henson et al. 2010).

The Shapiro–Wilk test was used to assess whether scores of the pre-test and post-test groups were distributed normally.

Although Student's or Welch's t test is used frequently to compare two groups, in the case of non-normal distribution, the use of those two tests may lead to serious errors, largely due to a descrease in the statistical power of the test (Wilcox 2012; Wilcox and Keselman 2003). Due to lack of normal distribution of test scores and an expected strong ceiling effect, neither Student's nor Welch's t test could be used. Instead, Mann–Whitney U test, a non-parametric test, was used to compare the scores. The magnitude of the improvement of the knowledge between pre-test and post-test is described by the effect size. Using Cohen's (1988) proposed interpretation of effect sizes, a "small" effect size is 0.20, a "medium" effect size is 0.50, and a "large" effect size is 0.80.

Results

A total of 533 students (245 boys and 288 girls) completed the test before the prevention campaign, and 496 students

(231 boys and 265 girls) completed test after the prevention campaign. The distribution by gender did not change significantly before and after the prevention campaign (Cramér's $V = 0.006$, $p > 0.84$). The average student age was 15.8 years (interval 14–19 years, SD = 1.35) in pre-test and 16.7 years (interval 15–19 years, SD = 1.1) in post-test.

The CFA results indicate that the questionnaire has a two-dimensional structure, measuring two interrelated dimensions of students' understanding. The two dimensions are titled "Risk estimation" and "HIV knowledge". By scaling the answers to the questionnaire items using the Rasch model, we obtained two scores for each student ("Risk estimation" and "Knowledge").

Descriptive analysis is summarized in Table 1. In the pre-test, the "Risk estimation" median was 1.751 (IQR = 1.254). Either students had good knowledge about the risk of acquiring HIV infection in different situations prior to the prevention campaign, or the test lacked difficulty. The "Risk estimation" median increased to 3.739 (IQR = 1.282) in the post-test, indicating that students who answered incorrectly in the pre-test improved their knowledge about the risk of HIV infection.

In the pre-test, the "Knowledge" median is −0.006 (IQR = 1.484). In the post-test, the "Knowledge" median is 2.968 (IQR = 1.381).

Distribution of scores in both dimensions differs significantly from the normal distribution (Shapiro–$\text{Wilk}_{\text{Risk estimation, pre-test}} = 0.939$, $p < 0.001$; Shapiro–$\text{Wilk}_{\text{Risk estimation, post-test}} = 0.744$, $p < 0.001$; Shapiro-$\text{Wilk}_{\text{Knowledge, pre-test}} = 0.928$, $p < 0.001$; Shapiro-$\text{Wilk}_{\text{Knowledge, post-test}} = 0.686$, $p < 0.001$).

Table 1 Descriptive statistics of the score for pre-test and post-test in two dimensions in the group of selected students in Kosice, Slovakia, 2009/2010

	Risk estimation		Knowledge	
	Pre-test	Post-test	Pre-test	Post-test
N	533	496	533	496
Mean	1.842	3.014	0.110	2.348
Std. deviation	1.196	0.953	1.457	0.924
Skewness	−0.036	−1.152	0.276	−1.184
Std. error of skewness	0.106	0.110	0.106	0.110
Kurtosis	−0.276	0.915	−0.059	0.268
Std. error of kurtosis	0.211	0.219	0.211	0.219
Minimum	−2.508	−1.197	−2.953	−0.746
Maximum	3.739	3.739	2.969	2.969
Percentiles				
25	1.204	2.457	−0.746	1.588
50	1.751	3.739	−0.006	2.968
75	2.457	3.739	0.738	2.969

Using the non-parametric Mann–Whitney *U* test, we found that the above described improvement of students' knowledge expressed by the score in pre-test and pos-test in both dimensions is statistically significant (Mann–Whitney $U_{\text{Risk estimation}} = 29{,}814$, $p < 0.001$; Mann–Whitney $U_{\text{Knowledge}} = 20{,}938$, $p < 0.001$) (Table 2).

The effect size of the whole group is 0.68 in the risk estimation dimension and 0.74 in the knowledge dimension. The effect size among males is lower (risk estimation: $r = 0.57$, knowledge: $r = 0.62$) than among females (risk estimation: $r = 0.78$, knowledge: $r = 0.81$) in both dimensions, indicating that girls showed greater improvement in their knowledge following the campaign than boys.

Following the interpretation suggested by Cohen (1988), we conclude that the effect size of the educational intervention is medium to large (effect size in the knowledge dimension is reasonably higher and among females, the interventions show high effect in both dimensions). The difference is highly significant and the statistical power of the test is sufficient. In both cases, the statistical power converges to 1 ($\beta < 0.084$ in the worst case, given $\alpha = 0.001$).

Comparison according to sex is visualized in Fig. 1.

Discussion

The HIV/AIDS prevention campaign implemented among young people in the schools of Košice, the second largest Slovak city, and its neighboring district was an effective intervention for the selected sample. The results cannot be generalized to the whole population: generalization was not the aim of the study. Students increased their knowledge of HIV/AIDS and the risk of acquiring HIV infection in different situations and, to a much larger degree, their general knowledge on HIV/AIDS. This difference could be due to prior knowledge of risky behaviors. The peer-led prevention campaign's positive

Table 2 Results of the comparison of Rasch scores in pre-test and post-test in the group of selected students in Kosice, Slovakia, 2009/2010

Dimension	Mann–Whitney *U*	*p* value (1-tailed)	$1 - \beta$ (statistical power)	*r* (effect size)
Risk estimation				
Total	29,814	0.001	1	0.68
Males	9806.5	0.001	0.916	0.57
Females	4415.5	0.001	0.999	0.78
Knowledge				
Total	20,938	0.001	1	0.74
Males	8230.5	0.001	0.972	0.62
Females	2847.5	0.001	0.999	0.81

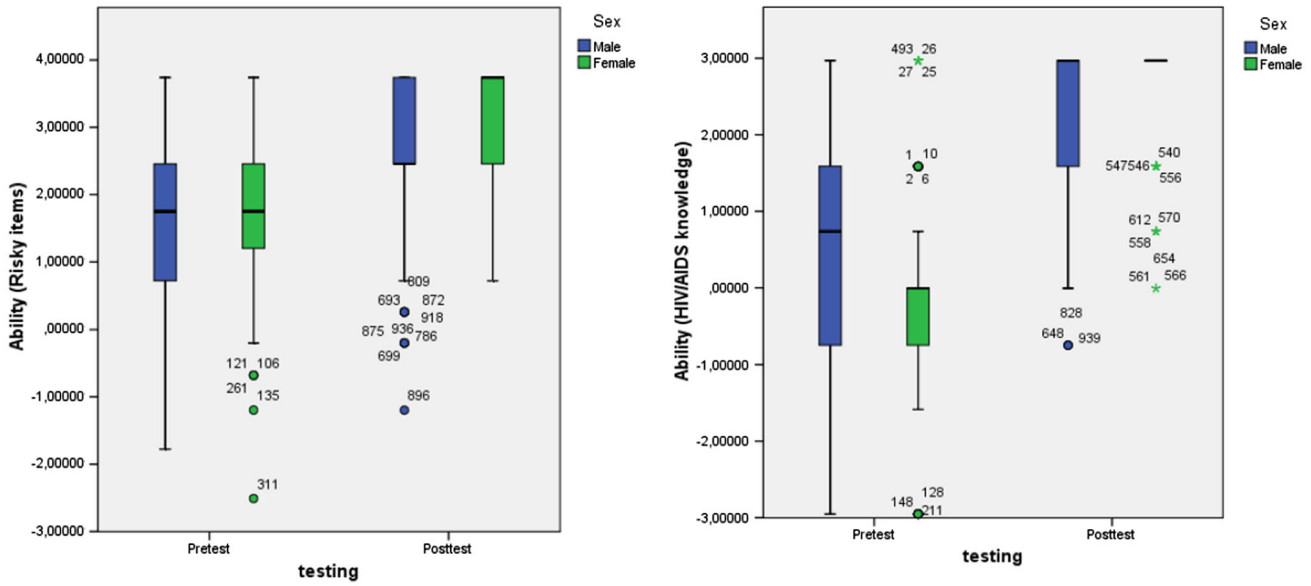

Fig. 1 Ability (Rasch score) in the risk estimation dimension and in the knowledge dimension, according to sex in the group of selected students in Kosice, Slovakia, 2009/2010

impact on the students knowledge is in line with the results of a systematic review of 19 interventions studies to prevent HIV among young people in Europe, which yielded that most of the peer-led interventions improved participants' sexual knowledge and/attitude (Lazarus et al. 2010). Another study conducted by Gao et al. (2012) indicated that HIV/AIDS education programs positively influenced HIV/AIDS-related knowledge and attitudes.

Girls made much greater improvement in knowledge on HIV/AIDS than boys. While in the pre-test, girls knew less about HIV/AIDS, they increased their knowledge much more than boys during the campaign. This may indicate that the prevention campaign was easier to understand for girls. However, their progress could also be due to more self-discipline, patience, and studiousness, as demonstrated by the results of other studies (Duckworth and Seligman 2006; Matthews et al. 2009). A review of 39 interventions by Sales et al. (2006) showed that interventions tailored to particular subgroups including by gender, were more efficient in increasing knowledge and decreasing high-risk sexual behavior. A possible solution for more effective future campaigns could therefore be to divide and tailor interventions by gender.

Limitations of this manuscript include the inability to analyze the impact of HIV/AIDS-related information acquired elsewhere. Students likely learned about HIV/AIDS from additional sources of information, such as the television or friends. To account for this, further work could incorporate the Solomon design by dividing students into intervention and control groups and additionally, into groups receiving either both pre-test and post-test or only the post-test (Babbie 2013).

In addition, we could not match individual student scores before and after the prevention campaign. Therefore, repeated measurement statistics and autocorrelations could not be considered to obtain better estimates of improvement. The results may therefore be biased. However, we do not consider the influence of this bias to be crucial for the interpretation. The confounding effect of autocorrelation (within-subject correlation) may possibly be reduced by the interval of 12 months between both measurements.

An additional limitation is the questionnaire's lack of difficulty. Even prior to the prevention campaign, most items were answered correctly by more than 50 % of students. Due to the strong ceiling effect in both pre-test and post-test, we were not able to estimate improvement of the knowledge very precisely. More differentiated results could have been achieved if a more difficult questionnaire was used.

In conclusion, results of this study suggest that, for the selected sample, the prevention campaign was an effective tool to increase young people's knowledge of HIV/AIDS statistically significantly.

In recent years, access to new modern antiretroviral drugs has changed the perception of HIV. In economically developed countries, people living with HIV live much longer than in the past and increasingly die from chronic diseases rather than AIDS. However, AIDS is still a non-curable disease and, as part of health promotion activities, health education, and disease prevention remain the main

health care priorities in the prevention of HIV/AIDS. It is therefore essential to continue with implementation of the educational prevention programs.

This particular peer-led campaign was very successful and educational materials were attractive for students. We therefore recommend using these materials during the implementation of the educational campaign to other Slovak schools. Since the girls and boys did not improve their knowledge equally, we recommend dividing and tailoring future interventions by gender.

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Conflict of interest The authors declare that they have no conflict of interest.

Appendix

Full version of the original test

No.	Question	Answer options	
	Age		
	Gender		
	Education level	Elementary	
		Secondary	
		Apprentice	
		University	
1.	Which of the following sexual diseases worries you the most? (Please select one)	Syphilis	
		Hepatitis B	
		HIV/AIDS	
		Genital herpes	
2.	Which is the most risky behavior for your health?	Personal hygiene	
		Drug use	
		Car accidents	
		Bad Nutrition	
		HIV/AIDS	
		Sexuality	
		Other	
3.	According to you, which of the following behavior or situations are most at risk of HIV infection and which are not?	Risky	Not risky
	Sexual intercourse using condom		
	Uncontrolled blood transfusion		
	Hug		
	Kissing		
	Sexual intercourse without condom		
	Sharing of plates, cutlery and glasses		
	Sharing of needle or syringe		
	Living with people living with HIV		
	Swimming in a swimming pool		
	Mosquito bites		
	Unprotected sexual intercourse with occasional partners		
4.	Have you ever thought to take an HIV test?	Yes	No
5.	Do you know where you can go if you wish to receive an HIV test?	Yes	No
6.	Can a healthy-looking person have HIV?	Yes	No
7.	Can a person get HIV by sharing food with someone who is infected?	Yes	No
8.	Can a person get HIV by sharing a bathroom with someone who is infected?	Yes	No
9.	Have you ever attended debates or discussions on the protection of HIV infection at school?	Yes	No
10.	Have you ever received proper information about sexuality and STDs?	Yes	No
10.a	If yes please, specify	Parents	
		Siblings	
		Friends	
		Teachers	
		Health experts	
		Others	
11.	Do you know someone in your area who suffers from an STD?	Yes	No

List of items eligible for the analysis

No.	Item
t01	Sexual intercourse using condom—risky or not?
t02	Uncontrolled blood transfusion—risky or not?
t03	Hug—risky or not?
t04	Kissing—risky or not?
t05	Sexual intercourse without condom—risky or not?
t06	Sharing of plates, cutlery and glasses—risky or not?
t07	Sharing of needle or syringe—risky or not?
t08	Living with people living with HIV—risky or not?
t09	Swimming in a swimming pool—risky or not?
t10	Mosquito bites—risky or not?
t11	Unprotected sexual intercourse with occasional partners—risky or not?
t12	Have you ever thought to take an HIV test?
t13	Do you know where you can go if you wish to receive an HIV test?

continued

No.	Item
t14	Can a healthy-looking person have HIV?
t15	Can a person get HIV by sharing food with someone who is infected?
t16	Can a person get HIV by sharing a bathroom with someone who is infected?
t17	Have you ever attended debates or discussions on the protection of HIV infection at school?
t18	Have you ever received proper information about sexuality and STDs?
t19	Do you know someone in your area suffering from an STD?

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