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Original Article

Evaluation of Cognitive and Behavioral Effects of Peer Education Model-Based Intervention to Sun Safe in Children

***Ping HU*[1] *, Lingli HAN*[1] *, Manoj SHARMA*[2] *, Huan ZENG*[1] *, Yong ZHANG*[1] *, Hui LI*[1] *, *Yong ZHAO*[1]

1. *Public Health & Management College, Chongqing Medical University, Chongqing, China*
2. *Health Promotion and Education, University of Cincinnati, Cincinnati, USA*

***Corresponding Author:** Tel: +86-13883460842 Email: zhaoyongzb@qq.com

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Abstract

Background: There have been many studies that evidence the health hazards of sunlight exposure, but less study on sun safe intervention model, especially in China. Our aim was to evaluate the cognitive and behavioral effects of a peer education model-based intervention to sun safe in children.

Methods: Cluster random control intervention was conducted in one district in Chongqing, China. Two primary schools, selected through stratified clustered sampling approach (two grades in each school, three classes in each grade) were designated as intervention (n=304) and control schools (n=305) randomly. 36 students, selected as peer educators in intervention group, were trained for one month. Educational activities such as discussions were organized by peer educator for one month. There was no sun safe education to participants in control school during the project period. The evaluation of changes of sun safe knowledge (the primary outcome), attitude and behavior (the secondary outcome measures) were conducted before intervention and at months of 0, 1 and 6 of the intervention to two groups using quantitative and qualitative methods.

Results: After the intervention, sun safe knowledge score which gained by the students from intervention group has been remarkably improved, compared to baseline survey (24.48±6.17 vs. 29.51±6.75) (P<0.001), and it kept this high level (29.02±7.96 and. 28.65±8.96), while control group students' scores have made no difference (P=0.410). Most of students have changed their sun safe behavior after the intervention.

Conclusion: Peer education program is somewhat effective in some dimensions for improving children's understanding of sun safe knowledge and behavior.

Keyword: Sun safe, Peer education, Children, Behavior, Knowledge, China

Introduction

High UV radiation in sunlight can contribute most to the development of diseases such as melanoma, basal-cell carcinoma and cataract in later life (1, 2). The number of new-onset skin cancer patients is continually growing (3). Study has shown that 1 in 6 individuals will develop a form of skin cancer during their Lifetime (4), and sunlight exposure was recognized as the major preventable cause of the skin cancer (5). Since solar UVB is the primary source of vitamin D, young people should be careful on avoiding burning and overexposure in the sun (3, 6). Appropriate measures of sun safe should be adopted, in order to decrease the risk of melanoma and non-melanoma skin cancer (7).

Sun safe is a double-edged sword. UV radiation plays an important role on human growth and development (8). It can kill or suppress bacteria on the skin's surface and the right amount of it can

promote 7-dehydrocholesterol in the skin into vitamin D3, enhance the excitability and stress ability of sympathetic-epinephrine system, enhance human immunity and promote certain hormones secretion. People with higher serum 25(OH) D concentrations prone to develop higher bone mass density (9, 10).

The children are in the critical period of physical and mental development, Sun safe is an important factor in promoting their physical development. On the other hand, Childhood is considered to be a critical period of vulnerability to the effects of exposure to toxic agents (3). It is much easier damage by UV radiation. Epidemiological evidence suggests that sunburn in childhood may be more harmful than later in life (11), increasing the risk of skin cancer, and that prevention and early detection are crucial in reducing morbidity and mortality from skin cancer (12, 13). Children attending elementary schools are in the most danger of acquiring these diseases later in life (14). The study of Yang Zhusheng et al. (15) and Li Chen et al. (16) reported the result of students on the sun safe's radiation related risks and measures of protection is not satisfied, so we need to strengthen publicity and education in this area, and to obtain some relevant information.

The increase in the incidence of skin cancer is due to each individual's behavior regarding sun protection (17-19). The degree to which children are willing to perform sun protection consistently is especially important (20). Some Western countries have carried out more cognitive activities relating to the sun safe damage, which helps to reduce juvenile sunburn and skin cancer incidence (21, 22), but little study on sun safe intervention model in China. Furthermore, peer education model, widely used in AIDS and drug use education (23), has not been applied on sun safe intervention.

In this study, we used the peer education mode of health education to improve children's sun safe cognition, prompt them to establish health's attitude and choose good sun safe behavior. This model can effectively solve the problem of lack of teaching staff and it also can improve the quality of health and children's ability of self-education. On the other hand, through step-by-step guide by peer educator's effort, higher geometric series of teaching scope and effect should be achieved (24).

Materials and Methods

Design

Cluster random control intervention was conducted in one district in Chongqing, China. The survey was carried out according to the following study flowchart.

Participants

According to the formula ($n=\frac{U^2_{\alpha/2}\pi(1-\pi)}{\delta^2}$, note: π for the estimation of the overall rate of 0.5, δ is permissible error 5%, α=0.05), we calculated the required sample size.

In February 2009, one district (Jiulongpo) was chosen out randomly in Chongqing, Southwest China (We used random numbers generated by computer in randomization). After considering the comparability of school, two primary schools were chosen out randomly in this district, which overall strength of the two schools are similar. Two grades (grade four and grade five) were selected from each school, and three classes were selected from each grade through stratified clustered sampling approach. Then the two schools were designated as intervention school and control school randomly by drawing lots. The investigators who take responsible to assess the outcomes were blinded to group assignment. Participants and care providers were not blinded to group assignment.

All students in the selected classes were recruited in the study. Exclusion criteria: 1) unwilling to participate in the survey; and 2) May be about to change school; and 3) Suffered with severe disease. A total of 305 students were selected as control group and 304 students were in the intervention group. In intervention group, 36 students (3 girls and 3 boys in each class) were selected through a rigid evaluation process as peer educators. Some students, parents, teachers and school doctors were selected by judgmental sampling to receive one-to-one in-depth interviews.

Methods

Peer education intervention

Peer educator selection: In intervention group, 36 students were selected through a rigid evaluation process (Open recruitment → Voluntary application → Preliminary screening → Interview → Merit screening → Merit-based enrollment → Training → Working) as peer educators from classes (3 girls and 3 boys peer class) in intervention school and were unified trained for one month (From February to March 2009, one time peer week).

The training methods for peer educator: 1) contents: By the project team leader unified design preparation, including the health effects of the sun safe, basic knowledge, sun safe protection principles and specific measures, basic skills of being peer-educator; and 2) Method: Teaching the contents of the brochure in simple language in detail; Watching the related teaching video; Simulating peer education process; Through fun games, group discussions, debates and experimental evaluation of a variety of patterns, identify problems promptly corrected, until the student accurately master the relevant knowledge of the sun safe and its behavior. After the training, they carried out peer education on the surrounding classmates for one month (From March to April 2009) in the unit of a class. Mission content must easy to understand, and the main content including geographical environment, the composition of sunlight, sunscreen skills, develop good sun safe behavior, scientific and reasonable to establish healthy sun safe behaviors, etc.

Peer education: Peer educators organized educational activities such as discussions, lectures, pamphlet and competition of sun safe knowledge.

Participants in the control group did not receive the intervention methods but were given a post-test assessment during the same interval as the experimental group.

Investigation method and outcome measures

Outcome measures

The calculation was performed using sun safe knowledge score as the primary outcome measures. The secondary outcome measures were the changes of sun safe attitude and behavior, knowledge requirement of sun safe, sun safe environment of school, and so on.

Investigation method

It is recommended that a combination of qualitative and quantitative methods be used to evaluate health promotion interventions, which consists of several components (25). We used a combination of methods to evaluate the cognitive and behavioral effects of a peer education model-based intervention to sun safe in children.

Quantitative survey

A review of the literature highlighted the lack of an acceptable valid and reliable questionnaire to use with the children in the study. Our survey used two self-reported questionnaires which were self-designed by the research team, the baseline questionnaire and the evaluation questionnaire. The questions of baseline survey (In February 2009) included sun safe knowledge, attitude, behavior, knowledge requirement of sun safe, etc. Taking class as a unit, investigators were unified training, and went to unified interpretation, send and receive questionnaires in each class. The evaluation questionnaire was used for three times including after intervention immediately (In April 2009), one month (In May 2009) and six months after the intervention (In November 2009) to two groups' students. The questionnaire included questions about sun safe knowledge, attitude, behavior and evaluation. Then we compared the change of two schools' students about sun safe knowledge, attitude and behavior.

Qualitative method

Self-designed qualitative interview outline was used to give one-to-one in-depth interviews to certain students, parents, teachers and school doctors in intervention group two times: before and after the peer model-based intervention. The former was to understand the current student's knowledge and behavior problems; the latter was to understand the effects of peer education and their suggestions. The interview included ques-

tions about requirement of sun safe knowledge, attitude and behavior of sun safe and sun protection, sun safe environment of school, and evaluation of peer education model.

Date Analysis

The questionnaires data were checked carefully (all data entries were double-checked for avoiding errors and questionnaires with missing responses pertinent to the items used in this analysis were removed to clean the data) before entering into database of Epidata 3.1 software. After a strict sorting, data cleaning and analyses were conducted using Statistical Program for Social Science (version 17.0; SPSS Institute, Chicago, IL). The qualitative data were selected and shorted in time after the interviews. Statistical analyses mainly used the descriptive statistical analyses. Descriptive data were expressed as mean ± SD (standard deviation) and 95% CI. Analysis of variance (ANOVA) was used to ascertain the significance of differences between continuous variables. Chi-square test was used to test differences of categorical variables between two groups. All statistics were performed using a two-sided test, a *P*-value of less than 0.05 was considered statistically significant.

The calculation of sun safe knowledge: contains 14 questions: 5 multiple choices (four multiple choices have three correct answers and one multiple choice has six correct answers), one answered correctly scored 1 point. 9 single choices, one question answered correctly scored 3 points. Wrong, not sure or missing responses scored 0. Thus the maximum score from the 14 knowledge questions was 45 total score: 45 points. The excel software was used to calculate the score.

Ethical Considerations

All of the participants were informed of the study's purpose, and their participation in the study was voluntary. The participants were given an oral consent. To ensure their anonymity, the students' names were not asked in the questionnaire. The answered questionnaires were stored in a locked cabinet. The survey was conducted in compliance with the Ethical Committee of Chongqing Medical University.

Results

Quantitative Analysis

Participant characteristics

Three hundred and four students in the intervention group and 305 students in the control group all were selected from grade four and grade five in two primary schools respectively, with age ranging from 10 to 12 years. There was no significant difference existed in Children's sex between the intervention group and control group (P=0.710). The Children's age and parent's education were significantly different between the intervention and control groups (P<0.001) (Table 1).

Sun safe knowledge

As shown in Table 2, sun safe knowledge mean score gained by the students from the intervention group at baseline, was slightly higher than control group (24.48±6.17 vs. 23.34±5.98). Referring to total scores (45 points), we can see that children have certain understanding of sun safe, but not comprehensive and accurate. After the peer education intervention, sun safe knowledge mean score gained by the students from intervention group has been remarkably improved compared to baseline survey (24.48±6.17 vs. 29.51±6.75) (P<0.001), and it kept this high level (29.02±7.96 and. 28.65±8.96). There were no significant difference among these different survey times (P=0.627~ 0.948). While the control group students' score had made no difference (P=0.410). The scores of better sun safe practices of intervention were all higher than that of control group after intervention (P<0.05).

Attitude of sun safe

In baseline survey, it revealed that 90.15% of children have certain interest in the sun safe knowledge, 92.54% of the girls and 88.22% of the boys; 58.19% of children were willing to talk about sun safe with the surrounding classmates; 52.75% of children worried about if they will be suntans after overexposure to the sunlight, 69.03% of the girls and 39.58% of the boys; 61.44% of children worried about overexposure to the sunlight will bad to health, 63.81% of the girls and 59.52% of the boys.

Table 1: The characteristics of participants

Characteristic	Intervention n	Intervention %, (95%CI)	Control n	Control %, (95%CI)	χ^2	*P*
Children's sex					0.138	0.710
Male	133	43.75(38.17-49.33)	138	45.25(39.66-50.84)		
Female	171	56.25(50.67-61.83)	167	54.75(49.16-60.34)		
Father's education					165.999	<0.001
High school education or less	73	24.01(19.21-28.81)	230	75.41(70.58-80.24)		
Technical secondary education	40	13.16(9.36-16.96)	20	6.56(3.78-9.34)		
Post-secondary education	59	19.41(14.96-23.86)	25	8.20(5.12-11.28)		
College education or more	132	43.42(37.85-48.99)	30	9.83(6.49-3.17)		
Mother's education					140.962	<0.001
High school education or less	79	25.99(21.06-30.92)	219	71.80(66.75-76.85)		
Technical secondary education	50	16.45(12.28-20.62)	39	12.79(9.04-16.54)		
Post-secondary education	70	23.03(18.30-27.76)	18	5.90(3.26-8.54)		
College education or more	105	34.53(29.19-39.88)	29	9.51(6.22-12.80)		

*P<0.05 (significant difference)
*Abbreviation: CI, confidence interval

Table 2: The scores of sun safe knowledge

Time	Valid questionnaires (n=304)	Score Mean	SD	Valid questionnaires (n=305)	Score Mean	SD
Baseline survey	294	24.48	6.17	305	23.34	5.98
Immediately	247	29.51	6.75	305	23.82	7.18
After one month	302	29.02	7.96	301	23.55	7.28
After six months	304	28.65	8.96	304	23.94	7.12

* SD, standard deviation./ * Analysis of variance (ANOVA) was used./* The intervention group had multiple comparisons: 1. Baseline survey vs. Immediately: *P*<0.001. 2. Baseline survey vs. After one month: *P*<0.001. 3. Baseline survey vs. After three months: *P*<0.001. 4. Immediately vs. After one month: *P*=0.906. 5. Immediately vs. After three months: *P*=0.627. 6. After one month vs. After three months: *P*=0.948. /**P*<0.05 (significant difference).

Requirement of sun safe knowledge

The investigation result showed that students have variety of ways to gain sun safe knowledge (Newspapers and magazines, radio and television, network, classmates, families and school), but through the surrounding classmates was relatively less (just 15.53%); Children had a greatly demand for sun safe knowledge (72.74% students expressed that they willing to accept students teach sun safe knowledge, just 3.51% students said no, 23.24% students showed that depending on situation).

Evaluation of the behavioral effects of a peer education model-based intervention

As shown in table 3, most of students thought that they have changed their sun safe behavior after the intervention.

Table 3: The change of sun safe behavior after the intervention of intervention group (n=304)

Do you change your sun safe behavior after the intervention	n	Yes %, (95%CI)	n	No %, (95%CI)	n	Unclear %, (95%CI)	χ^2	*P*
Immediately	180	72.87 (67.87-77.87)	45	18.22 (13.88-22.56)	22	8.91 (5.71-12.11)	30.969	<0.001
After one month	196	64.90 (59.54-70.27)	64	21.19 (16.60-25.78)	42	13.91 (10.02-17.80)		
After six months	155	50.99 (45.37-56.61)	85	27.96 (22.92-33.01)	64	21.05 (16.47-25.63)		

***** Chi-square test was used/**P*<0.05 (significant difference)/*Abbreviation: CI, confidence interval.

Evaluation of peer-education model

Peer educators gained some nice comments from students who participated in peer education, Including: Very nice: 25.51%; Good: 24.70%; General: 38.87%).

Qualitative Analysis

Analysis of requirement of sun safe knowledge

Both students and parents did not understand much about sun safe knowledge, most people said they did not understand the effects of sun safe on the health, nearly half of the people just think "it can make skin turn black". School doctors and teachers said during this interview "students' understanding of the sun safe knowledge is far from enough", "school did not offer courses in this field". Including parents, teachers and students, almost all people want to learn more sun safe knowledge, and hope that can through a variety of convenient ways, such as internet, television, newspaper and lectures, nearly half of them did it like these before. Some parents and teachers agreed with help children to learn sun safe knowledge through peer education.

Attitude of sun safe and sun protection

Attitude towards sun protection: students, parents, teachers and school doctors all expressed that it was necessary for students to learn how to receive adequate sunlight and how to protect themselves from overexposure to the sunlight. About the sun safe knowledge, nearly 1/3 of students and individual teachers hold a great interest, only a very few (about 1/10) students showed have no interest, and there were 1/2 of students are willing to talk about sun safe with classmates; 3/5 of students admitted to worry about if they will be suntan or heatstroke after overexposure to the sunlight.

Behavior of sun safe and sun protection

Students admitted when they exposure to the sun were generally in the shopping, playing basketball, swimming and other outdoor activities, rather than gone out to bask in the sun deliberately. Most of students said that they did not take the sun protective measures, such as "marked with the parasol" and "wear a hat"; When student was asked whether he had been sunburned, just individual student an-

swer in "desquamate during swimming", school doctors said that they have not meet a student who got sunburned; Investigators also found that the school has the place to keeps the rain in bad weather and the sunlight in good. PE teachers said, "In the summer and autumn of physical education curriculum, school switch classes to avoid strong ultraviolet period is very difficult".

Sun safe environment of school

Studies have shown that organizational and social environments supportive of sun safety are key to sun safety behaviors of the staff and to reducing sunburns(26), the environment of school is also the key to sun safety behaviors of the students and to reducing sunburns. We were very satisfied with the sun safe environment of intervention school, teaching building have curtain, adequate lighting, good day lighting and ventilated, which can avoid hot sun overexposure, on the roadside, there are a lot of trees which can help students better to exposure to the sunlight and sun protection. The only shortcoming is the publicity column or blackboard newspaper without any sun safe knowledge.

Evaluation of peer education model used in children's education of sun knowledge and behavior

In intervention school, students and teachers all gave a higher evaluation to peer education, but there were certain deficiencies.

Teachers thought this model was feasible, because it can let student understand knowledge more easily. Peer-educator should be excellent organizer and the teacher gave peer educators some advices: special publicity in the class meeting and class activity time. Teachers thought that compare with the traditional teacher education, peer education can promote students to set an example for others, and the recipient is more likely to accept. The advantages of traditional education are the impartation of knowledge is more comprehensive, accurate and systematic. So a teacher put forward: "For general health education knowledge, it can be achieve better result through peer education, but for specialized knowledge, it should be taught by teachers".

Peer education model used in children's education of sun knowledge and behavior is to be successful. They knew more sun safe knowledge through it, some students put forward: "I didn't like exposure to the sun, but I like it after I know its benefits", "I didn't know when the best time to exposure to the sun is, but I know it now". They also said that they love more for peer education, because the education process was easy, activities were very interesting and learning knowledge was not easy to forget.

Discussion

The importance of sun safe education for children

According to the baseline survey, students' understanding of sun safe was far from enough, and there was no specialized course for them. Teachers and parents also lacked a comprehensive system understanding of sun safe knowledge. Childhood is a critical period to set up a correct sun safe attitude, to form a good habit, to promote growth and development, and to prevent calcium deficiency, rickets and osteoporosis in adulthood. Epidemiological evidence suggests that sunburn in childhood may be more harmful than later in life, increasing the risk of skin cancer (27), so society, schools and families all should take it seriously. Child is at risk of overexposure to harmful UV rays, both during and after the school day (28). Nearly all of recent approaches have focused on implementing interventions while children are in school or community settings (29). Previous studies proposed that at least some of the UVR-related diseases, it is likely that it is these years of carefree sun exposure that may contribute most to the development of diseases such as melanoma, basal-cell carcinoma and cataract in later life (1-2). Children receive ultraviolet time have some influence on the cataract, so suggest that childhood take some protective measures when exposure to sunlight (30), such as wear a shirt with sleeves, stay in the shade or under an umbrella, or wear a hat when outside on a sunny day. There have been

many studies that evidence the health hazards of sunlight exposure, but less study on Sun safe intervention model, especially in China.

The feasibility of peer education in children

Peer education has grown in popularity and practice in recent years in the field of health promotion. Currently peer education seems to be gaining popularity in relation to HIV prevention and sexual health promotion (23). It is an effective way to change people's behavior, especially the children's behavior, but this pattern application within the scope of children is less. On the one hand, this pattern can solve the problem of teaching staff shortages effectively, and improve the children's health quality and ability of self-education. On the other hand, through step-by-step guide by peers transfer effect, it makes the teaching scope and effect of work achieved higher geometric series (24). Beginning from an identification of 10 claims made for peer education, most theories have something to offer towards an explanation of why peer education might be effective, most theories are limited in scope and there is little empirical evidence in health promotion practice to support them. The authors conclude that: Peer education would seem to be a method in search of a theory rather than the application of theory to practice (23). We use this in children, firstly, taking into account that children are relatively active and more frequent exchanges between the partners. In addition, children are in the period of "follow the trend", demonstration effect of partner is very strong, young people may be more willing to listen to their peers than adults.

Other factors influencing the sun safe education for children

Some studies have provided evidence that parents can be viable change agents for child behaviors and parent-based approaches could reduce risky behaviors that lead to skin cancer (31, 32). Some research shows that peers and social standards are important determinants of behavior (33, 34). So in the follow-up study, we should takes into intervention both social standards, as well as parents and teachers, popularize their sun safe knowledge, strengthen social propaganda and create a good social environment in the prevention education, to facilitate the work of peer education and improve the children's cognition and behavior of the sun safe.

Limitations

There are several limitations to this study worthy of further discussion. First, the low follow-up rates in intervention group may affect the generalizability of the results. Effective rate of each survey questionnaire is not the same, because there maybe some of the reasons in this survey: 1) The integrity of each student to complete the questionnaire is inconsistent; and 2) There is the phenomenon of students do not go to school, and the number of people in the absence of the different survey time may be different. In addition, only short-term effects of the peer-education intervention were evaluated. Third, although the study was designed as a pilot, there were both measured and unmeasured differences between the control and intervention groups that could introduce bias. For example, differences in baseline routine parents' education between two groups could impact on the result of evaluation.

Recommendations

Firstly, we would like to suggest that the government should issue policy to encourage schools to carry out the relevant health education courses including sun safe education. Secondly, schools, not only primary school, but also middle school, can try to carry out peer education on sun safe for the health of the children. Thirdly, future researcher would attempt to expand its application areas. Furthermore, in the follow-up study, social standards should be taken into intervention, as well as parents and teachers.

Conclusions

Peer education program is somewhat effective in some dimensions for improving children's understanding of sun safe knowledge and behavior, which gives the suggestions for government and schools to strengthen the sun safe education more efficiently.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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