

# Cancer: Education and Primary Prevention Starts in Childhood and Adolescence

Nadja Seidel<sup>1\*#</sup>, Friederike Stoelzel<sup>1\*</sup>, Sandra Herrmann<sup>1</sup>, Cornelia Zimmermann<sup>2</sup>, Hendrik Berth<sup>3</sup>, Melanie Glausch<sup>1</sup>, Kristina Loewe<sup>1</sup>, Michael Baumann<sup>1</sup>, Gerhard Ehninger<sup>1</sup>

<sup>1</sup>University Cancer Center, University Hospital Carl Gustav Carus Dresden, Dresden, Germany

<sup>2</sup>Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus Dresden, Dresden, Germany

<sup>3</sup>Department of Medical Psychology, Medical Faculty of the Technical University Dresden, Dresden, Germany

Email: #nadja.seidel@uniklinikum-dresden.de

**How to cite this paper:** Seidel, N., Stoelzel, F., Herrmann, S., Zimmermann, C., Berth, H., Glausch, M., Loewe, K., Baumann, M. and Ehninger, G. (2016) Cancer: Education and Primary Prevention Starts in Childhood and Adolescence. *Journal of Cancer Therapy*, 7, 851-856.

<http://dx.doi.org/10.4236/jct.2016.712084>

**Received:** September 28, 2016

**Accepted:** November 1, 2016

**Published:** November 4, 2016

Copyright © 2016 by authors and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution-NonCommercial International License (CC BY-NC 4.0).

<http://creativecommons.org/licenses/by-nc/4.0/>



Open Access

---

## Abstract

At least one third of all newly diagnosed cancers could be prevented if lifestyle factors were changed. The University Cancer Center Dresden initiated two programs aiming at cancer awareness and intentions to engage in health-promoting behavior among children and adolescents. Study 1 examined sun protection knowledge of 80 preschool children in a non-randomized design and Study 2 inspected 235 7th grade students' knowledge of cancer and its behavioral risk-factors as well as intentions on health-promoting behavior using a randomized pre-post design on group-level. Study 1 showed significant improvement of sun protection knowledge in preschool children ( $p < 0.05$ ). Study 2 was effective in increasing knowledge about risk factors for cancer ( $p < 0.001$ ) and in increasing intentions to engage in health-promoting behavior ( $p < 0.001$ ). Communicating health-related behavior in preschools as well as school-based programs targeting multiple cancer-related risk factors are promising tools for primary prevention of cancer.

## Keywords

Cancer Prevention, Cancer Education, Health Behavior, School-Based Health Promotion, Literacy

---

## 1. Introduction

Cancer is the second most frequent cause of death in Germany and the overall incidence is rising. The spiraling costs of cancer treatment inflict a crushing burden on the economies of even the wealthiest countries [1]. Besides early detection and treatment,

\*Equal contributors.

an adequate legislation to reduce exposure and risk behaviors as well as health promotion are key measures to reduce the burden of cancer. At least one third of all newly diagnosed cancers could be prevented if behavioral factors such as smoking, limited physical activity, unbalanced diet, alcohol consumption and excessive exposure to sunlight were changed [1]. Considering children and youth being most susceptible to some external agents [2] as well as the accumulation of carcinogenic effects of risk behaviors over life time [3], starting education and primary prevention as early as possible is considered a cornerstone of cancer prevention.

The Prevention Center of the University Cancer Center Dresden thus initiated two programs, particularly aiming at cancer awareness and intentions to engage in health-promoting behavior among children and adolescents. The theater play “Clown Zitzewitz and Sun Protection” combines the education of preschool age children and their primary caregivers, using a method called “Theater in Health Education”. The “Be Smart Against Cancer”-program for 7th grade students targets multiple cancer-related risk factors for adult-onset cancer and encourages a healthy lifestyle.

## 2. Methods

Within two studies, 80 preschool children 3 to 6 years of age were examined using a nonrandomized (Study 1, [4]) and 235 7th grade students using a randomized (Study 2; [5]) pre-post design both including an intervention group and a control group based on group-level. Both study protocols were approved by the institutional review committee on the protection of human participants.

### 2.1. Study 1

Study 1 examined children’s sun protection knowledge, comparing an intervention group (IG) receiving cognitive-behavioral (preschool children watching a theater play) and environmental interventions (education of caregivers) to a control group (CG) solely receiving the environmental intervention using a photographic test (five items). Based on the Theory of Social Learning, the role models Clown Zitzewitz and his friend perform the desired sun protection measures in the theater play.

### 2.2. Study 2

Study 2 compared students receiving the “Be Smart Against Cancer”-curriculum to a wait-control group. The program is based on the Theory of Planned Behavior and includes the modules: “What is cancer?”, “Sun protection”, “Non smoking”, and “Physical activity, Healthy nutrition, and Limited alcohol consumption”. Knowledge of cancer and its behavioral risk factors (21 items), health-promoting intentions (6 items regarding physical activity, sun protection, smoking behavior, consumption of fruits/vegetables, sweets and alcohol), and reported risk behavior (6 items, *i.e.* no sports or physical activity in leisure times, no usage of sun lotion in the summer, any rate of smoking within the last three months, consumption of fruits/vegetables less than twice a week, daily consumption of sweets or soft drinks, any consumption of alcohol within the last

three months) were assessed at baseline and at the end of the one week program. A risk-score was created by summing up each risk behavior present. Detailed descriptions of both interventions have been reported [4] [5].

Within study 1, an analysis of covariance (ANCOVA) compared knowledge between IG and CG over all age groups, as well as for 3 to 4 and 5 to 6 year olds. Pretest measures served as covariates. To control for the influence of age on knowledge scores in the ANCOVA over all age groups, age was additionally included as a covariate. Within study 2, effects of the implemented curriculum regarding knowledge (pre-post difference) and intentions (pre-post difference) were tested using General linear mixed model (LMM) with experimental group (IG vs. CG) and risk-score (dichotomized into risk-score  $\leq 1$  vs. risk-score  $\geq 2$ ) as fixed effects, school as a random effect and pre-test scores as covariates. A mediation analysis (SOBEL, Version 3.6) to predict the intention to engage in protective behavior was applied with the experimental group as independent variable and knowledge as a mediator. Two-tailed tests were used and all statistics were performed using SPSS, Version 17.0 (SPSS Inc., Chicago, USA).

### 3. Results

#### 3.1. Study 1

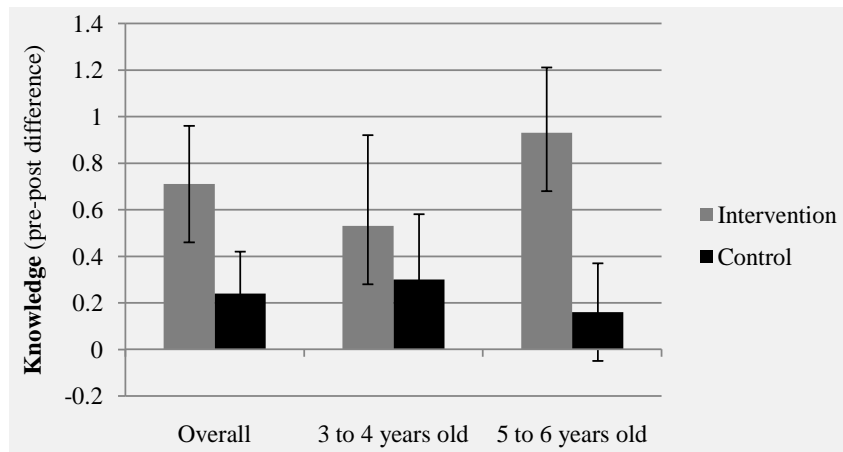
Study 1 showed that the theater play improved sun protection knowledge of preschool children ( $p < 0.05$   $\eta^2 = 0.06$ ,  $F(1.76) = 4.59$ ,  $n = 80$ ). Age specific analyses showed better results for children aged 5- to 6-year ( $p < 0.05$   $\eta^2 = 0.20$ ,  $F(1.31) = 7.62$ ,  $n = 34$ ) than for children aged 3- to 4-year ( $p = 0.17$   $\eta^2 = 0.04$ ,  $F(1.43) = 1.90$ ,  $n = 34$ ; **Figure 1**).

#### 3.2. Study 2

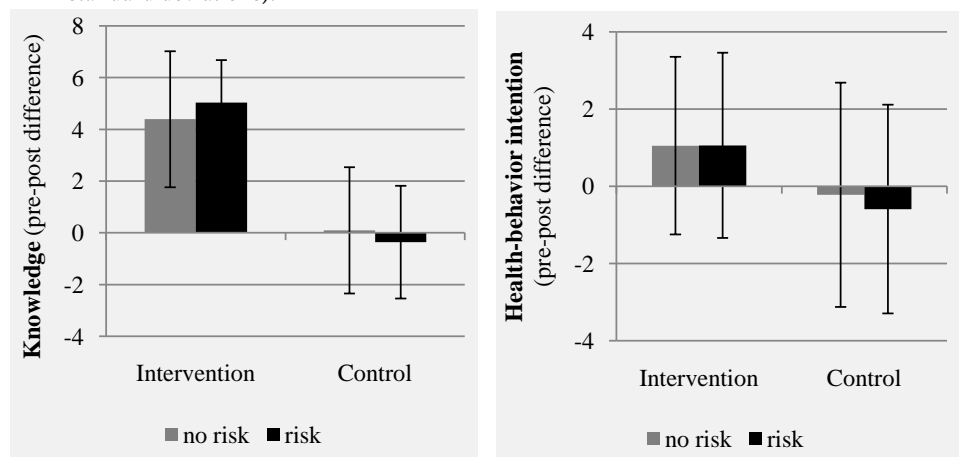
Within study 2, “Be Smart Against Cancer” was effective in increasing knowledge about cancer and risk factors for cancer ( $p < 0.001$ ,  $F(5,975) = 136.22$ ,  $n = 235$ ), as well as in increasing intentions to engage in health-promoting behavior ( $p < 0.001$ ,  $n = 235$ ,  $F(5,772) = 16.93$ ), independent of a student’s risk profile, *i.e.* the risk behavior (**Figure 2**). No mediating effect of knowledge of cancer on the intention has been found (b (YM.X), X = experimental group, M = pre-post difference of knowledge-score, Y = pre-post difference of intention-score,  $p = 0.48$ ).

### 4. Discussion

Both programs effectively raise cancer related knowledge. Study 1 shows a significant increase of knowledge on sun protection in preschool children that have seen the theater play. This is remarkable, since support for effectiveness of the “Theater in Health Education”-method in younger children has not been established yet [6] [7]. The benefit for 5- to 6-year old children was larger compared to younger children, indicating a possible age limit for the effectiveness of this method. The impact regarding knowledge of the “Be Smart Against Cancer”-curriculum in study 2 is comparable to other school-based programs aiming at improving health literacy [8]-[10]. Although health educa-



**Figure 1.** Study 1: Sun protection knowledge of preschool children (means and standard deviations).



**Figure 2.** Study 2: Knowledge about cancer/risk factors and intentions to engage in health-promoting behavior children (means and standard deviations).

tion has led to increased public awareness [11], the knowledge about some risk factors and their consequences has yet to be established among young adolescents. In addition to raising awareness, “Be Smart Against Cancer” also effectively boosted health-promoting intentions. Since knowledge did not mediate the effect on intention and further social-cognitive determinants have not been measured, the underlying process of intention building cannot be reconstructed precisely. Furthermore, the results indicate that the effectiveness of “Be Smart Against Cancer” is independent of a student’s risk profile. Therefore, it holds considerable promise as a broadly applicable program to raise cancer awareness and promote healthy behavior intentions.

According to recent research, good intentions cannot always be translated into corresponding actions, since various factors can be compromising. As described in the Health Action Process Approach-model, action planning, self-efficacy as well as situational determinants, e.g. barriers may play an important role [12]. Possibilities to foster self-efficacy and to overcome barriers in school settings are the initiation of class-level projects and the introduction of school policies. Several studies indicate the need for

comprehensive strategies for addressing problem behaviors using interventions in multiple settings [13]. Environmental interventions, e.g. adequate legislation and policies, are essential for health promotion. Especially young children depend heavily on their environment and benefit from programs combining environmental and behavioral interventions. Study 1 describes such an example that creates a supportive environment in preschools regarding appropriate sun protection measures and introduces an interactive theater play for the children. An important limitation of both studies concerns the use of nonrandomized groups respectively group-randomization, which bears a potential influence by confounding variables. Furthermore, both studies lack a follow-up, which limits the explanatory power. Since the main focus of the interventions is to promote awareness and intentions, a change of behavior over the long term was not evaluated.

The World Health Organization outlines that effective prevention measures are urgently needed to avert a cancer crisis, because the battle will not be won with treatment alone [1]. Using “Theater in Health Education” in preschools to communicate health-related behavior as well as school-based programs targeting multiple cancer-related risk factors are promising tools for cancer education and primary prevention of cancer in early life. While the role of health promotion in reducing cancer incidences is indisputable, research on the best dissemination and sustainability strategies of effective programs is a nascent field.

### **Acknowledgements**

Both studies were supported by Deutsche Krebshilfe (German Cancer Aid) in the Program for the “Development of Interdisciplinary Oncology Centers of Excellence in Germany”, reference number: 107759.

### **Addendum**

Both studies are part of the thesis by NS.

### **Conflict of Interest**

The authors declare that they have no conflict of interest.

### **Authors’ Contributions**

FS participated in the design and carried out both studies; NS participated in the design and carried out study 2. NS performed the statistical analyses and drafted the manuscript. SH, CZ, MG and KL participated in carrying out the study as well as the data analysis. FS, HB, MB and GE provided important advice in the design of the study and contributed to the manuscript revision. GE is head of both projects. All authors read and approved the final manuscript.

### **References**

- [1] Stewart, B.W. and Wild, C.P. (2014) World Cancer Report 2014. International Agency for

Research on Cancer, Lyon.

- [2] Paller, A.S., Hawk, J.L.M., Honig, P., Giam, Y.C., Hoath, S., Mack, M.C. and Stamatas, G.N. (2011) New Insights about Infant and Toddler Skin: Implications for Sun Protection. *Pediatrics*, **128**, 92-102. <http://dx.doi.org/10.1542/peds.2010-1079>
- [3] Wodarz, D. and Zauber, A.G. (2015) Cancer: Risk Factors and Random Chances. *Nature*, **517**, 563-564. <http://dx.doi.org/10.1038/517563a>
- [4] Seidel, N., Stoelzel, F., Garzarolli, M., Herrmann, S., Breitbart, E.W., Berth, H., Baumann, M. and Ehninger, G. (2013) Sun Protection Training Based on a Theater Play for Preschoolers: An Effective Method for Imparting Knowledge on Sun Protection. *Journal of Cancer Education*, **28**, 435-438. <http://dx.doi.org/10.1007/s13187-013-0483-z>
- [5] Stoelzel, F., Seidel, N., Uhmman, S., Baumann, M., Berth, H., Hoyer, J. and Ehninger, G. (2014) Be Smart against Cancer! A School-Based Program Covering Cancer-Related Risk Behavior. *BMC Public Health*, **14**, 392. <http://dx.doi.org/10.1186/1471-2458-14-392>
- [6] Loescher, L.J., Emerson, J., Taylor, A., Christensen, D.H. and McKinney, M. (1995) Educating Preschoolers about Sun Safety. *American Journal of Public Health*, **85**, 939-943. <http://dx.doi.org/10.2105/AJPH.85.7.939>
- [7] Buller, D., Taylor, A. and Buller, M. (2006) Evaluation of the Sunny Days, Healthy Ways Sun Safety Curriculum for Children in Kindergarten through Fifth Grade. *Pediatrics*, **23**, 321-330.
- [8] Schonfeld, D.J., Bases, H., Quackenbush, M., Mayne, S., Morra, M. and Cicchetti, D. (2001) Pilot-Testing a Cancer Education Curriculum for Grades K-6. *Journal of School Health*, **71**, 61-65. <http://dx.doi.org/10.1111/j.1746-1561.2001.tb06492.x>
- [9] Midford, R., Mitchell, J., Lester, L., Cahill, H., Foxcroft, D., Ramsden, R., Venning, L. and Pose, M. (2014) Preventing Alcohol Harm: Early Results from a Cluster Randomised, Controlled Trial in Victoria, Australia of Comprehensive Harm Minimisation School Drug Education. *International Journal of Drug Policy*, **25**, 142-150. <http://dx.doi.org/10.1016/j.drugpo.2013.05.012>
- [10] Strøm, H.K., Adolfsen, F., Handegård, B.H., Natvig, H., Eisemann, M., Martinussen, M. and Kuposov, R. (2015) Preventing Alcohol Use with a Universal School-Based Intervention: Results from an Effectiveness Study. *BMC Public Health*, **15**, 1-11. <http://dx.doi.org/10.1186/s12889-015-1704-7>
- [11] American Cancer Society, the American Diabetes Association, and the American Heart Association on Health Education (2008) Health Education in Schools— The Importance of Establishing Healthy Behaviors in Our Nation's Youth. *Health Education Journal*, **40**, 55-58.
- [12] Schwarzer, R. and Luszczynska, A. (2008) How to Overcome Health-Compromising Behaviors. *European Psychologist*, **13**, 141-151. <http://dx.doi.org/10.1027/1016-9040.13.2.141>
- [13] Saraf, D.S., Nongkynrih, B., Pandav, C.S., Gupta, S.K., Shah, B., Kapoor, S.K. and Krishnam, A. (2012) A Systematic Review of School-Based Interventions to Prevent Risk Factors Associated with Noncommunicable Diseases. *Asia Pacific Journal of Public Health*, **24**, 733-752. <http://dx.doi.org/10.1177/1010539512445053>



**Submit or recommend next manuscript to SCIRP and we will provide best service for you:**

Accepting pre-submission inquiries through Email, Facebook, LinkedIn, Twitter, etc.

A wide selection of journals (inclusive of 9 subjects, more than 200 journals)

Providing 24-hour high-quality service

User-friendly online submission system

Fair and swift peer-review system

Efficient typesetting and proofreading procedure

Display of the result of downloads and visits, as well as the number of cited articles

Maximum dissemination of your research work

Submit your manuscript at: <http://papersubmission.scirp.org/>

Or contact [jct@scirp.org](mailto:jct@scirp.org)