

PHASE I EXAMPLE:

ABSTRACT

Skin cancer is epidemic and prevention must start in childhood to reduce lifetime ultraviolet radiation exposure and severe sunburns. Partners for Health Systems, Inc. (PHS) will initiate the production of an interactive multimedia (CD-ROM) version of the new *Sunny Days, Healthy Ways* (SDHW) elementary school sun safety curriculum and assess students' and teachers' reactions to it in two Colorado public elementary schools in the Weld County School District (Greeley and Evans, CO). Multimedia are increasingly attractive to health educators, teachers, students, and parents. The target population for this Phase I project is students enrolled in grades K and 2. To build upon ongoing development of grade 4 CD-ROM programs (CRFA study) and grade K and 2 prototypes (SBIR #1R43CA76755), the design and production of the multimedia SDHW will include the preparation of concept plans and prototype CD-ROM activities for grades K and 2. Personal interviews with 24 students and 8 teachers will provide descriptive data. The authoring of the CD-ROM multimedia prototypes will be performed under contract by the AMC Cancer Research Center's Health Communications Core.

Key Words: Skin Cancer, Prevention, Children, CD-ROM Programs, Interactive Multimedia, Middle School Curriculum

Commercial Application:

Computer use in education is increasing rapidly. The CDC is planning to issue national skin cancer prevention guidelines for inclusion K-12 comprehensive health education. All U.S. schools will be encouraged to incorporate sun safety in their curriculum. Thus, the sun safety CD-ROM curriculum has potential commercial application in public and private elementary schools, preschools, public libraries, as well as the home market, over the Internet, and for worksite wellness and managed care prevention programs.

BIOGRAPHICAL SKETCHES

_____, M.A., Principal Investigator

Education

Michigan State University, E. Lansing, Michigan,	B.A. 1983	Communication
Texas Tech University, Lubbock, Texas,	M.A. 1985	Speech Communication

Professional Background

1997- : *Director of Technology Transfer, Partners for Health Systems, Inc., Denver, CO (Product Design, Protection, and Commercialization)*

1988- : *Vice President, Communication and Opinion Resources, Inc., Tucson, AZ (Communication, Market & Media Research)*

1993-97: *Principal Research Specialist, Cancer Prevention and Control Program, Arizona Cancer Center, University of Arizona (Grant Administration & Implementation)*

1991-93: *Senior Research Specialist, Cancer Prevention and Control Program, Arizona Cancer Center, University of Arizona (Grant Administration & Implementation)*

1989-91: *Director of Communication and Education, Arizona Cancer Center, University of Arizona, Tucson, AZ (Health Education Development)*

- 1986-89: Coordinator, Colon Cancer Prevention Project, Arizona Cancer Center, University of Arizona, Tucson, AZ (Project Management)
- 1985-86: Health Education and Promotion Coordinator, City of Lubbock Health Department, Lubbock, TX (Community Health Education)
- 1984-85: Graduate Teaching Assistant, Dept. of Speech Communication, Texas Tech University, Lubbock, TX (Undergraduate Teaching)
- 1983-84: Public Affairs Producer, WFSL-TV 47, Lansing, MI (TV Production)

Honors and Awards

- Outstanding Achievement Award, American Cancer Society, 1991-92
- Excellence-in-Teaching Award, International Communication Association, May 1985

Skin Cancer Prevention Publications

Buller, D.B., Buller, M.K. (1991). Primary prevention of skin cancer. In Loescher, L. (Ed). Seminars in Oncology Nursing, 7, 53-63.

Buller, M.K., Buller, D.B., Loescher, L. (1993). Evaluation of a middle-school curriculum for improving skin cancer prevention. Published abstract from the annual meeting of the American Society of Preventive Oncology.

Alberts, D.S., Buller, M.K., Rosenbaum, E., Dollinger, M., Newell, G. (1995). Risk Assessment, Cancer Screening and Prevention. In M. Dollinger and E. Rosenbaum (eds.) Everyone's Guide To Cancer Therapy: How Cancer Is Diagnosed, Treated And Managed Day To Day (2nd edition). Kansas City, MO: Somerville House Books.

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Buller, D., Buller, M.K., Beach, B., Ertl, G. (1996). Sunny Days, Healthy Ways: Evaluation of a skin cancer prevention curriculum for elementary school-aged children. Journal of the American Academy of Dermatology, 35, 911-922.

Buller, M.K. (1996, August). Colorimeter can detect incipient skin cancers. Photonics Spectra, 96-97.

Buller, D., Burgoon, M., Hall, J., Aickin, M., Levine, N., Taylor, A., Emerson, J., Buller, M., Bowen, S., Alberts, D. (1996). A family intervention to protect children from ultraviolet radiation. Abstract 136, World Conference for Cancer Organisations, Melbourne, Australia.

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Buller, M.K., Buller, D., Goldberg, G. (1997). Sun Smart Day: A Skin Cancer Prevention Program for Children. Pediatric Dermatology. 14, 257-263.

, Ph.D., Collaborator/Contractor

Education

Michigan State University, E. Lansing, MI	Ph.D.	1984	Communication
Auburn University, Auburn, AL	M.A.	1980	Speech Communication
West Virginia University, Morgantown, WV	B.A.	1979	Chemistry

Professional Experience

- 1997- : **Senior Scientist, Center for Behavioral Studies, AMC Cancer Research Center, Denver, CO (Cancer Research) and Director, Communication Core, AMC Cancer Research Center, Denver, CO (Media Production and Evaluation)**
- 1988- : President, Communication and Opinion Resources, Inc., Tucson, AZ (Communication, Market, & Media Research)
- 1996- : Professor, Department of Communication, University of Arizona (Teaching & Research)
- 1992- : Professor, Arizona Prevention Center, University of Arizona (Health Behavior Research)
- 1991- : Director, Behavioral Sciences Program, Arizona Cancer Center, University of Arizona (Cancer Prevention Behavioral Research)
- 1990-96: Associate Professor, Department of Communication, University of Arizona (Teaching & Research)
- 1986-90: Assistant Professor, Department of Communication, University of Arizona (Teaching & Research)
- 1981-87: Senior Analyst & Project Manager, Burgoon Co., Inc., Tucson, AZ (Survey Research Management & Analysis)
- 1984-86: Assistant Professor, Department of Speech Communication, Texas Tech U. (Teaching & Research)
- 1985-86: Associate Director, Institute for Communication Research, Texas Tech U. (Research)
- 1984: Research Consultant, PERT Survey Research, Bloomfield, CT (Survey Research Analysis)

Selected Other Professional Activities

- 1994- : Chair, Publications Committee, 5 A Day Community Trials (NCI)
- 1995-97: Graduate Council, Graduate College, University of Arizona
- 1996-97: Technical Advisor, U.S. Centers for Disease Control and Prevention
- 1996- : Consultant, David Kahn Melanoma Foundation, West Palm Beach Florida
- 1997- : Member, External Advisory Board, Children's Sun Protection Campaign, Stratospheric Protection, EPA

Selected Publications

- Buller, D.B. & Buller, M.K. (1991). Primary prevention: Approaches to communicating prevention behaviors. Seminars in Oncology Nursing, 7, 53-63.
- Buller, D.B. & Street, R.L., Jr. (1991). The role of communication in patients' evaluations of health care and compliance decisions. Southern Communication Journal, 56, 230-237.
- Buller, D.B. & Street, R.L., Jr. (1992). Nonverbal communication in physician-patient interactions. In R. Feldman (Ed.), Application of Nonverbal Behavior Theory and Research. Lawrence Erlbaum: Hillsdale, NJ.
- Buller, D.B. & Street, R.L., Jr. (1992). Physician-patient relationships. In R.S. Feldman (Ed.), Application of nonverbal behavioral theory and research. Hillsdale, NJ: Lawrence Erlbaum.
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Buller, D.B., Borland, R., Burgoon, M. (in press). Impact of behavioral intention on effectiveness of message features: Evidence from the Family Sun Safety Project. Human Communication Research.

Ph.D., Consultant

Education

University of Arizona, Tucson, Arizona	B.A.	1972	Portuguese Language
Ohio State University, Columbus, Ohio	M.A.	1977	Educational Media
University of Arizona, Tucson, Arizona	Ph.D.	1992	Communication

Professional Background

1990- : *Associate Director, Biomedical Communications, Arizona Health Sciences Center*
Administrative responsibility for television production, instructional design, and engineering. Production responsibilities include coordination and development of video teleconferencing, programming multimedia application, videodisc production and pre-mastering, and digital signal processing. Beta software testing for national software development companies, i.e., IBM, Asymetrix, and Institute for Academic Technology. Write and produce instructional media programs including slide/tape, videotape, multimedia applications, teleconferences and presentation graphics packages incorporating audio, video and animation.

1986-90: Chief, Instructional Materials Development, Biomedical Communications, AHSC Supervision of instructional media specialists. Production of instructional media programs.

1983-86: Media Specialist III, Biomedical Communications, Arizona Health Sciences Center
 Production of instructional media programs.

1979-86: Media Specialist II, Biomedical Communications, Arizona Health Sciences Center
 Production of instructional media programs.

1977-85: Media Specialist I, Biomedical Communications, Arizona Health Sciences Center

Media and Other Awards

First Place - "University Medical Center Nursing: A Commitment to Excellence." 1987 Sigma Theta Tau International Honor Society of Nursing.

First Place - "Practical Spanish for Health-care Providers." 1985 Arizona Public Health Association.

First Place - "Alcohol and the Workplace." 1984 Health Sciences Communication Association.

First Place - "Parents Who Have Lost Children." 1981 American Journal of Nursing.

1993 Vernon and Virginia Furrow Awards: Innovation in Medical Education Grants Computer-assisted Instructions in Clinical Reasoning and Problem-Solving with Simulated Patients. April 1993.

1993 Billy Joe Varney Award of Excellence - Award of service to university, state and community.

Premier staff excellence award at The University of Arizona.

Publications and Papers

Hall, J.R. (1993). Linguistic markers of association as persuasive devices in mediated appeals. Ann Arbor: University Microfilms.

Burgoon, M., Hall, J., & Pfau, M. (1991). A test of the "messages-as-fixed effect fallacy" argument: Empirical and theoretical implications of design choices. Communication Quarterly, 39, 18-34.

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Computer Applications

- Hall, J.R. (1996). Human Growth and Well-being HIV/AIDS multimedia curriculum for grades 3-8. Tucson, AZ: University of Arizona.
- Hall, J.R. (1993). DiscLog. Videodisc database tool for multimedia production. Tucson, AZ: University of Arizona College of Medicine.
- Hall, J.R. (1992). Surveyor. Computer application for administering videodisc treatments and conducting related surveys. Tucson, AZ: University of Arizona College of Medicine.

REVISION INTRODUCTION

This proposal responds to the National Cancer Institute's (NCI) program on Interactive Media Technologies in Cancer Prevention in its Division of Cancer Prevention and Control in the categories of Innovative Alternative Teaching Methods, Internet/World Wide Web Applications, and Cancer Prevention Systems for the Public. It is a revision of an earlier proposal (1 R43 CA76755-01) submitted in April, 1997. **Changes and additions to the previous proposal are indicated by boldface type.** Reviewers' recommendations have been addressed to strengthen the original proposal in the following ways:

Structural Changes or Additions

- < The applicant organization has been changed from Communication and Opinion Resources, Inc. of Tucson, Arizona to Partners for Health Systems, Inc. (PHS) of Denver, Colorado.
- < Dr. David Buller has been changed from a co-investigator to a primary subcontractor through AMC Cancer Research Center (AMC) and its Communications Core, the multimedia production group for the proposed project.
- < Dr. John Hall has been changed from a primary subcontractor through The Arizona Health Sciences Center's Biomedical Communications Program to a consultant.

Changes or Additions to the Significance Section

- < A clearer description of the CD-ROM product has been provided, which includes more information on how the content will be translated from the written *SDHW* curriculum.
- < A stronger rationale for the use of CD-ROM with children in schools has been included.
- < The discussion of the theoretical basis for the *SDHW* curriculum has been expanded to further specify the psychosocial variables that mediate the sun safety outcome in this age group, the perceived barriers to performing sun safety behaviors, the positive and negative expectancies associated with sun safety behaviors, and the sun safety skills targeted by the curriculum. Research is reviewed that shows that the CD-ROM programs can help change these mediators effectively.
- < The proposal addressed how the CD-ROM intervention will be designed to affect the behaviors of children's parents.
- < The commercial opportunities for this product are described in detail including how the CD-ROM programs will satisfy anticipated recommendations from CDC for sun safety education, the lack of direct competitors, the estimated size of the market, and preliminary plans for marketing the product in Phase III.

Changes or Additions to the Research Design and Methods

- < The participation of the Weld County School District #6 (Greeley and Evans, Colorado) has been secured.
- < PHS will use AMC's Institutional Review Board for approval of all procedures involving human subjects.
- < Phase I and Phase II objectives have been clarified and expanded.

- < The focus of the research design has been enlarged from CD-ROM concept plans and focus groups to include production of prototype CD-ROM activities and personal interviews with students and teachers after they have had an opportunity to use the prototypes.
- < A timetable of Phase I activities has been added.
- < Examples of questions for the school computer technology assessments, student interviews, and teacher interviews are now included.
- < An on-line assessment of student learning will be programmed into the CD-ROM prototypes.
- < Criteria that would indicate Phase I success are provided.

RESEARCH PLAN

A. SPECIFIC AIMS

The specific aim of this Phase I project is to establish the technical merit and feasibility of producing sun safety CD-ROM programs for elementary schools to integrate into their health education to meet the CDC's 1998 national skin cancer prevention guidelines for K-12 comprehensive health education. Specific objectives are to:

PHASE I OBJECTIVES

1	Produce two prototype CD-ROM programs for children in Grades K and 2 based upon one unit (e.g., cover-up clothing) from the <i>Sunny Days, Healthy Ways (SDHW)</i> sun safety curriculum.	2	Evaluate the capability of Grade K and 2 students to use the prototype sun safety CD-ROM programs, and of teachers to integrate them into their school health education.	3	Evaluate grade K and 2 students' and teachers' satisfaction with and acceptance of the prototype <i>SDHW</i> sun safety CD-ROM programs.
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B. SIGNIFICANCE

Skin Cancer is Epidemic

In 1997, over 900,000 cases of nonmelanoma skin cancer (NMSC) (up 100,000 cases from 1996) and 40,300 cases of melanoma will be diagnosed resulting in 7,300 deaths (2). Melanoma incidence is increasing at 4% annually (2). Skin cancer is very high in the Southwest, due to low latitudes, abundant sunlight, lack of cloud cover, and high altitudes that increase ultraviolet radiation (UVR; 33, Harris, personal communication, 1997) and outdoor lifestyles that increase personal UVR exposure. UVR exposure is the most preventable risk factor for skin cancer (19). Development of NMSC and possibly melanoma skin cancer is positively related to total lifetime UVR exposure (4,18,26,38,43). Intermittent severe exposure (blistering sunburns) before age 20 may increase melanoma formation and possibly the incidence of NMSC (20,23,27,31,44). People can substantially reduce UVR exposure by limiting time in the sun and using shade, protective clothing, and sunscreens; however, people inconsistently and infrequently take these precautions (10,11).

Childhood Sun Safety is Essential

Children must learn to practice sun safety (21,31). The majority of lifetime sun exposure occurs (18,26,38,43) and severe sunburns are relatively common before age 20 (8,20,23,27,35,44). Children are inadequately protected (7,10,11,37). Instilling solar protection in children should produce lifelong

protection (14,21,41). Schools are the most efficacious setting for delivering this sun safety training. Nearly all children under age 15 regularly attend school (9,14,21). Schools are a credible community channel (11), are responsible for children's well-being, and consider health education an appropriate mission. Controlled educational environments facilitate program implementation and repeated presentations (32,45). Despite these advantages, sun safety curricula have only recently been developed for U.S. preschools and elementary schools (see Relevant Experience; 9,12,14,24). Other community channels will be less effective than schools at teaching children sun safety. Physicians have limited contact with children (especially those without insurance or on Medicaid); most contacts are for acute care (well-child checkups do not occur after age 7); managed care systems limit time with each patient. Community organizations attract a very selective population (athletic, gregarious, religious, or affluent children), may not see health education as their mission, and do not have a central administration to facilitate implementation. Mass media have high costs, are hard to sustain, and expose children to messages inadvertently in environments not conducive to learning and persuasion.

The Sunny Days, Healthy Ways Skin Cancer Prevention Curriculum

The *Sunny Days, Healthy Ways* sun safety curriculum (*SDHW*) was developed by a project team led by Ms. Mary Buller and Dr. David Buller. It is the only sun safety curriculum available in the U.S. that is integrated across all elementary school grades, fulfills state and national comprehensive health education standards, and has been systematically evaluated through progressive revisions. Other elementary school skin cancer prevention programs have been developed, including ones in New Hampshire and Texas. However, upon review these programs are less comprehensive and/or age-appropriate than *SDHW*. They do not serve as many grade levels or have separate components for each individual K-5 grade level. The *SDHW* creators, including Ms. Buller and Dr. Buller, hold the curriculum's copyright. It will be transferred to PHS for commercialization and administered by the Department of Technology Transfer (M. Buller, Director).

The *SDHW* was developed following principles of Social Cognitive Theory (SCT; 5,6). According to SCT, sun safety behavior by children is determined by a reciprocal relationship between personal and environmental factors. The *SDHW* produces sun safety by teaching requisite skills through demonstration and mental and physical rehearsal (e.g., selecting a proper type of hat and other protective clothing, identifying and using shade in outdoor environments, requesting sunscreen and other protective articles from adults). It also creates positive outcome expectations (e.g., avoidance of sunburn, protection of skin) and attempts to reduce barriers to sun safety (e.g., negative outcome expectations like sunscreens are messy, hats are unattractive, pants are too warm). Self-efficacy expectations are improved by teaching children that they are responsible for keeping their own skin healthy and demonstrating ways of doing so. The *SDHW* addresses these psychosocial variables at age-appropriate levels. For the earliest grades, the *SDHW* primarily demonstrates and rehearses three simple skills (and improves self-efficacy expectations for them)--selecting and using protective clothing, finding and using shade, and asking adults for sunscreen. It also nurtures simple positive outcome expectations like being safe in the sun and addresses simple barriers such as sunscreen is messy. In later grades, the *SDHW* teaches more complex skills such as identifying the proper SPF and applying sunscreen themselves and augments outcome expectations by teaching the scientific basis of skin functions and sun damage and introducing the concept of chronic disease, such as cancer. Suntanning also is addressed, and older children's increasing self-determination is integrated into self-efficacy expectations by teaching simple decision-making skills such as goal-setting and monitoring.

The most vital environmental factor for children at this age is the behavior of adult caregivers (e.g., parents, teachers). The *SDHW* assumes that adults influence children's sun safety more in younger grades than in older grades. Thus, in early grades, children are taught

skills for requesting sun safety from adults. For older children, especially those approaching adolescence, self-responsibility is taught. Also, children at all grades are encouraged to discuss sun safety skills and goals with their parents to help reduce common barriers for parents--conflict with children over sunscreen and protective clothing, perceptions that life is too busy for sun safety, and beliefs that sunscreen is too messy and expensive and protective clothing are too warm to use daily (10).

Evaluations of the *SDHW* showed that it teaches children at all ages relevant sun safety skills (using protective clothing, shade, and sunscreen), provides older children with the scientific basis for positive outcome expectations (avoidance of sunburn, healthier skin), reduces perceived barriers to sun safety (sunscreens are messy, suntan is desirable), increases sun safety intentions and actual sun safety, and reduces UVR exposure. The *SDHW* also provoked parent-child sun safety discussions (see Relevant Experience; 9,12-14, 53). It is anticipated that the proposed interactive multimedia (CD-ROM) version of the *SDHW* will be equally successful at teaching these skills to children, improving positive outcome expectations, reducing barriers, and increasing actual sun safety.

Computer Use in Education is Increasing

President Clinton has made increasing the use of computers in the classroom a national priority. Mr. Clinton has recently described technology as “an engine of our economic growth and has fundamentally changed the ways we learn, how we do business, and the skills students in America need to flourish in the world of work” (47). Children today must master computer skills to be prepared for a lifetime of computer use. President Clinton has challenged states, communities, business, families and teachers to ensure that by the year 2000 every classroom in America is connected to the Internet with high-quality computers, creative software, and well-trained teachers. Technology also can enrich education. He said that “children with access to computers and trained teachers can learn faster and learn better. In some cases, scores on standardized tests of basic skills for children taught with computers rise by 10 to 15 percent compared to the scores of those taught using conventional instruction” (47).

The CD-ROM programs proposed here respond to the President’s national goals and to recent trends in American education. A national survey (48) found that use of computers and telecommunications by students at school is increasing rapidly (from 29% in 1984 to 59% in 1993). Public school access to the Internet also is increasing rapidly (46). On average, 55% of schools have videodisc players, 74% have cable TV, 28% have satellite access, and 70% have Internet connections (49). On average, schools have one CD-ROM multimedia computer for every 21 students (49). In Colorado, the ratio is 20:1 (49). Teachers are using computers for instruction. In a 1997 survey (51), 20% of teachers in all public schools regularly used computers for teaching; 16% for professional growth; and 15% for curriculum development. Fifty-four percent of public school teachers give ‘using computers for classroom instruction’ as the #1 or #2 activity that they use computers for at school.

Educational CD-ROM programs also can be accessed at home. Students’ use of home computers rose from 12% to 28% (1984 to 1993) (48). Access to home computers is even higher than use, indicating the potential for growth. In 1993, an average of 33% of homes with children aged 3 to 17 had home computers (50). Parents, educators, and students believe computer skills are necessary for future success (40). One recent study showed even higher penetration rates. Most (78%) parents participating in the Family Sun Safety Project (D. Buller, P.I.) had access to a computer in 1996, and a large number of these computers had a CD-ROM drive (71%) and/or were connected to the Internet/World Wide Web (43%). With substantial and rising computer access, use and need, the market for quality educational software will be significant.

National Skin Cancer Prevention Guidelines for K-12 Comprehensive School Health Education

In 1998, the National Centers for Disease Control and Prevention (CDC) is planning to issue national skin cancer prevention guidelines for inclusion in CDC's recommendations for K-12 comprehensive health education issued by the Division of Adolescent Health. All U.S. schools will be encouraged to incorporate sun safety in their curriculum. The skin cancer prevention guidelines were developed by investigators at the University of Alabama, Birmingham. Under an individual professional agreement with the CDC, Dr. David Buller provided technical assistance to the Division of Cancer Prevention and Control on the skin cancer prevention guidelines.

The current *SDHW* classroom curriculum will be uniquely poised to fill a void. It will be marketed to meet the needs of schools that adopt the national skin cancer prevention guidelines and require evaluated, comprehensive curricula to do so. Already, the authors have been contacted by school districts in West Palm Beach, FL, Greeley, CO, Pittsburgh, PA, and the State of New York.

The *SDHW* CD-ROM programs also will have commercial application since, like the classroom curriculum, they will meet the CDC guidelines for school skin cancer prevention education. This will give the *SDHW* CD-ROM programs a competitive advantage. In addition, the CD-ROM curricula (fully developed and evaluated in Phase II) will be comprehensive, creative, proven effective at increasing student learning, and well liked by teachers. These CD-ROM programs also will be unique because they will have the companion *SDHW*.

Commercial Opportunities. The *SDHW* CD-ROM programs could be marketed independent of the *SDHW* curriculum as well. Potential markets include public, private, charter and alternative schools (U.S. and other English-speaking countries), preschools, homes, public libraries, dermatologist offices, and state departments of health, hospital health educators, managed care corporations. Currently, there are no competitors, although one or two competitors may be developed with the advent of the CDC school recommendations.

The size of the public elementary school market alone is vast and growing. A preliminary market was estimated based on 1990 Census data (EE) which showed that there were 32,007,392 children between the ages of 5 and 13 (68.89% of the school age population) in the U.S. Of these children, 28,012,869 were enrolled in public elementary schools (87.52% of the elementary school population). Applying these percentages to the number of K-12 public schools in the nation (81,608), we estimated that there were 56,220 public elementary schools. Based on these figures, we estimated that there were 498 students per elementary school in the U.S. The 1997 Technology Survey (49) found that there was one multimedia computer for every 21 students in U.S. public schools. Therefore, we estimate that there are 24 multimedia computers per public elementary school.

At a minimum, we estimate the market for the six Phase II CD-ROM programs (see Phase II Objectives on page 19) to be 337,320 units (i.e., CD-ROMs), assuming that each of the 56,220 schools purchase 1 set of K-5 *SDHW* CD-ROM programs. At a maximum, our market may be as large as 8,095,680 units, assuming that each school purchases a set of K-5 *SDHW* CD-ROM programs for each of its multimedia computers. We consider these figures to be conservative because elementary schools typically have enrollments smaller than 498 students per school. Also, this estimate does not include non-regular public schools (e.g., charter and alternative) or private schools which would increase the market by 14 percent. Since 65 percent of public schools in the U.S. have a local-area network (49), site licensing would be another way to market the CD-ROM programs.

Currently, PHS is involved in discussions with Media Seven Productions, Inc. (Catherine Newman, President) concerning the marketing and distribution of the proposed CD-ROM product. Media Seven Productions, a subsidiary of Westmark Publishing International, is a full service interactive multimedia development and marketing firm with success in niche markets. Dr. David Buller and Ms. Mary Buller are also talking with Blue Cross and Blue Shield of Colorado concerning the use of the *SDHW* sun safety educational materials with their

subscribers. PHS also could promote the sun safety CD-ROM programs through the AMC World Wide Web page, a catalogue of cancer prevention and control materials, the AMC quarterly newsletter and Annual Report, AMC educational events that it organizes around the country (e.g., *The Day of Caring*), and national clearinghouses of health education materials (e.g., NCI, CDC, ACS). The *SDHW* CD-ROM programs could be introduced to school administrators through a direct mail campaign and exhibits at educational association conferences and curricula trade shows. Currently, the authors are involved in discussions with the Kendall-Hunt Publishing Company. They are reviewing the *SDHW* curriculum for publication. Kendall-Hunt publishes the popular *Science for Life and Living* curricula series. They would be asked to distribute the proposed sun safety CD-ROM programs along with the *SDHW* curriculum.

Teaching Sun Safety with Interactive Multimedia

The *SDHW* relies upon traditional classroom teaching methods (i.e., activities, exercises, and lectures led by teachers). In recent field tests, teachers requested information to create computer-based activities for the *SDHW*, so website addresses for organizations such as NOAA/U.S. Weather Service and EPA/UV Index were included. This proposal will go far beyond these simple computer exercises to make the entire curriculum available in an interactive multimedia format that will be available on CD-ROM, and eventually, in the Internet environment. **"Interactive multimedia programs" denotes two types of computer-based applications: CD-ROM-based and Internet-based. CD-ROM programs have become commonplace in the home and in schools. CD-ROM multimedia programs incorporate a variety of media, including sound, graphics, animation, digital video, and text, to create a free-standing, computer-based learning experience. Effective learning programs incorporate visual engagement where students can click on different objects on the screen and have the computer display animations or simulations -- transporting the student to different worlds and world views. At the same time, effective learning programs contain valuable content to make the engagement meaningful. Simply creating simulations does nothing for the student unless the animation is demonstrating an educational objective that is difficult to demonstrate or describe orally or in print.**

An example of a relevant sun safety activity would be the exploration of fabric construction with a "spectroscope" -- an imaginary machine into which students could place fabric samples and have it pop up with its analysis of the fabric's sun safety factor. By receiving points for good performance throughout these learning games, students can become involved in a competitive learning game, a common device used with almost every well-designed computer-based instructional program.

Internet-based (on-line) programs translate these engaging activities and rich content to a web-based environment that can be disseminated worldwide. While the instructional design would be similar (engaging formats, incorporation of graphics, audio, and video), the bandwidth requirements of the Internet impose significant constraints on the technologies which can be effectively employed. However, with creative use of streaming technologies such as Realaudio and Realvideo, much of the excitement and engaging attributes of CD-ROM based instructional programs can be preserved. We are not committing to Internet-based (on-line) programs in this proposal. We will develop the computer-based CD-ROM format. However, we will use authoring tools (e.g., Director, Toolbook) which can allow the CD-ROM to be "taken to the web" (for expanding markets) using plug-in technologies and/or html/JAVA solutions.

Interactive multimedia CD-ROM programs are an increasingly attractive educational technology because the programs overcome many uncontrolled variables found in the traditional classroom setting. They provide consistent, reliable information presentation that is thoughtfully designed, based on well-researched content, and grounded in solid instructional design and behavioral principles and do not fatigue with student interaction as the school day progresses. Well-produced multimedia programs can promote greater receptivity, comprehension, and integration of information than traditional classroom

instruction (3,28,29,36). The use of CD-ROM technology can increase students' sense of their own capabilities, increase motivation, and boost self-esteem. Students can learn at their own pace and practice as much needed. CD-ROM programs can cater information to very discrete target populations, demand continual involvement of students (promoting sustained attention and better comprehension [28]), and challenge and empower students to make decisions, solve problems, resist peer pressure (e.g., to sunbathe), and practice new behaviors. Programs can provide personally consequential feedback to the user (34), link messages to tangential data banks to provide more detailed explanations students find interesting or difficult, and increase self-awareness. These attributes make attitudes more salient, accessible (30), and increase knowledge-consistent behavior, self-efficacy expectations, and confidence (15,16,41,42).

Interactive multimedia should facilitate the acquisition and application of sun safety skills by using attractive, similar peer models and "teachers" to repeatedly demonstrate skills in vivid and fast-paced sequences depicted in contexts relevant to children within a still-novel multimedia environment. This should promote student attention, skill acquisition, and rehearsal, goals-setting and monitoring, and the formation of positive outcome and self-efficacy expectations, crucial aspects of behavior acquisition as outlined in SCT.

Implementation of complex interactive multimedia systems is neither trivial nor easier than traditional, well-designed curricula. However, once created, programs are enduring, engage students with age-specific visuals and audio not just text display, encourage shy students by creating a nonthreatening, self-paced, private learning environment, improve students' abilities to retrieve complex, rich information matched to their level of understanding, and automate feedback on student performance. Free-standing programs liberate teachers to concentrate on more abstract, individualized, and advanced concepts and instruction in the classroom. When linked to Internet sites (such as the EPA, NOAA, ACS, NCI), the CD-ROM programs can make sun safety instruction available beyond traditional school walls.

The market for these educational CD-ROM programs reaches beyond the traditional school environment. Distributed on CD-ROM or placed on web sites, these programs become accessible to the home market for parents who expand education beyond normal school hours or who are home schooling their children. They can be incorporated by remote schools that depend on distance education. Finally, they can be distributed by health care and managed care organizations to their patients and members and by employers to their workers as part of wellness and prevention programs.

C. RELEVANT EXPERIENCE

_____, MA, Principal Investigator, Partners for Health Systems, Inc.

The project will be directed by Ms. _____, Director of Technology Transfer, _____, Inc. (1.0 FTE) and the primary author of *SDHW*. PHS, a small for-profit corporation in _____, _____, was incorporated in 1994. It provides management and administrative services to the _____ Cancer Research Center (_____) and the _____ Medical Center (_____ holding company), other small businesses, and non-profit research organizations. PHS has 55 employees in accounting, human resources, support services, facilities management, information technology, and technology transfer. PHS Technology Transfer develops and markets _____ and _____ innovations. PHS is led by Mr. _____, President and a Board of Directors.

Ms. _____ has extensive skills and experiences from previous research grants that will insure the success of the proposed research. Until October 1997, she was a Principal Research Specialist in the Behavioral Sciences Section at the Arizona Cancer Center (ACC). Ms. _____ was principal investigator on a Worksite Cancer Control Planning Grant from the national American Cancer Society (ACS) and principal investigator of a Sun Smart Day grant from the _____ Foundation. She was principal investigator on the first evaluation of the *SDHW* funded by the _____ Research

Commission (_____) and the ACC and co-investigator on the second evaluation of the *SDHW* funded by ADCRC (____). Ms. _____ was co-investigator and project director of the _____ Cancer Prevention Project and the _____ (NCI, _____, PI). In the Behavioral Sciences Section, she was the senior project leader on the 5 A Day: Healthier Eating for the Overlooked Worker Project (NCI, _____, PI) and the grant administrator on the Family Sun Safety Project (NCI, _____, PI). She supervised the design of a program of direct-mail messages for parents on sun safety and the development of 5 a Day nutrition education printed materials for a multicultural, low literate, and Spanish literate employee population. Ms. _____ was Director of the Communications and Education Department in the _____ and project coordinator on the Wheat Bran Fiber Trial (NCI, _____, PI). She was a member of the Mission 2000 _____ Cancer Prevention Committee at the _____ Division and received the _____ Division's 1992 Outstanding Achievement Award.

Ms. _____ is also Vice President of Communication and Opinion Resources, Inc. (COR), an Arizona corporation. In 1996, COR performed an evaluation of a nutrition education interactive multimedia program, *Body Fun with Dr. Helga Health'nstein*, for the Cancer Research Foundation of America, Inc. to identify program revisions and marketing strategies. This field experiment (N=388 students in grades 3-7 in one elementary and two middle schools) evaluated student learning and reactions to production features and components in the program. Student were observed as they interacted with the computer program. Procedures for free play and directed use of the program were developed for implementing the CD-ROM program at the schools. Ms. _____ worked with computer teachers and technicians to loading, run, and troubleshoot computer programs on Macintosh and IBM-PC systems, and to schedule and coordinate student computer sessions. Student tests contained items assessing learning and evaluations of program features on likability, ease of use, usefulness and credibility of information, and operational speed. Twenty computer, physical education, and other teachers and librarians reviewed the multimedia program and completed written evaluations.

While at the University of _____ Cancer Center, Ms. _____ was primary author and editor of the *Sunny Days, Health Ways Sun Safety Curriculum (SDHW)*. Several staff, school administrators, teachers, community dermatologists, health communication experts, and curriculum consultants contributed to its development. *SDHW* was originally designed for children in grades 4-6. Through a series of field tests and revisions, the *SDHW* curriculum now teaches sun safety skills with health, science, mathematics, society and culture, and language arts activities for grades K-5. This interdisciplinary approach is consistent with recent national science education reforms (see e.g., 1) and allows *SDHW* to be implemented without reducing mandated instruction in these areas. By linking *SDHW* to science, it is more attractive to schools. It is consistent with the Healthy People 2000 national objectives and the CDC's K-12 comprehensive health education guidelines, including the anticipated skin cancer prevention guidelines, so it can be added to comprehensive health education curricula. Its format follows the Madeline Hunter model (22) of the essentials of effective instruction, an instructional model adopted by many U.S. school districts.

The K-1 component is comprised of interactive exercises, activities, games, storybooks, and poems in four 60-minute units promoting use of shade, protective clothing, and sunscreen. The 2-3 component introduces some didactic instruction along with interactive activities in four units on the sun, human skin, sun safety strategies, and skills for putting sun safety into action. The 4-5 component incorporates science experiments and computer-based activities along with lectures, and classroom activities. Activity sheets are included for all grades. All grade-level components can be taught by the classroom teacher.

A cast of characters called the 'Sun Safety Squad' (Willie Widebrim, Ella Umbrella, Susan Sunscreen, and Sherman Shadetree) are incorporated into activities to increase student interest and involvement.

*

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In 1997, the *SDHW* curriculum underwent a final revision to (a) incorporate teacher and student feedback from the final classroom implementation and (b) meet some formatting suggestions of a national science curriculum publisher. The _____ Publishing Company, Inc. of _____, Iowa is currently evaluating the *SDHW* curriculum for national publication. The CD-ROM programs could be added to the contract.

_____, Ph.D., Primary Collaborator., _____ Cancer Research Center
Dr. _____, Senior Scientist at the _____ Cancer Research Center, Director of the _____ Communications Core (described below), and a co-author of *SDHW* will supervise the *SDHW* CD-ROM authoring and assist with the preliminary evaluation of the CD-ROM programs (Phase I).

_____ Cancer Research Center (_____) is a not-for-profit research institute dedicated entirely to the prevention and control of cancer. In 1995, the American Medical Center was incorporated as a holding company for _____, _____, and the _____ Cancer Research Foundation. Currently, _____ has 88 scientists and staff working in the areas of biostatistics, behavioral science, community studies, and laboratory science. _____ is funded by profits from PHS, federal and private grants, and contributions. _____ was first incorporated in 1904 as the _____ Relief Society - a tuberculosis treatment facility. With the control of tuberculosis, _____ shifted its mission to cancer treatment in the 1950s. In 1989, _____ refocused its mission exclusively to cancer prevention and control research. _____ will contract with the _____ Communications Core to author the CD-ROM concept plans and computer programs based on *SDHW*.

Dr. _____ has extensive skills and experiences from previous community trials which will insure the success of the proposed research. Until September 1997, Dr. _____ was the Director of the Behavioral Sciences Section at the _____ Cancer Center, an NCI-designated comprehensive cancer center at the University of _____ Health Sciences Center in _____, _____. Dr. _____ is principal investigator on four research grants supported by the National Cancer Institute (NCI), testing theory-based communication strategies to improve cancer prevention (i.e., sun safety, smoking cessation, and diet) (see Biosketches). He is the principal investigator on the new NCI-funded Arresting Smoking Uptake with Interactive Multimedia Project. A series of multimedia programs will be created to deliver smoking cessation and prevention counseling to children in grades 6-9, tailored to their prior experiences with tobacco. These programs will be disseminated to schools over the World Wide Web. In 1998, Dr. _____ will receive funds from NCI to create grades 6-8 components for the *SDHW* curriculum. His work also has been funded by the National Centers for Disease Control and Prevention, ADCRC, the Cancer Research Foundation of America, the Robert Wood Johnson Foundation, and the EPA. He has been a technical consultant on skin cancer prevention and health communication to the Division of Cancer Prevention and Control at the CDC. He is a co-investigator on an evaluation of a community-based tobacco prevention program for the Robert Wood Johnson Foundation. Dr. _____ is President of Communication and Opinion Resources, Inc. (COR). For COR, he has provided technical assistance on media planning for health campaigns and recently re-viewed the 1997 national media plan for the NCI's 5 a Day for Better Health Program under a contract with Tascon, Inc.

While at the University of _____, Dr. _____ conducted a survey of 205 parents' sun safety behavior with their children. The survey of 205 parents with children under age 13 in _____, _____ (_____, PI; 11). It showed inconsistent solar protection of their children (24% use sunscreen, 50% have children avoid the sun, and 62% use protective clothing only some of the time or less), an over-reliance on sunscreens (76% use it most of the time), and under-reliance on protective clothing (39%) and strategies that limit time in the sun to protect children (50%). Parents, though, considered schools to be a credible source of sun safety information in terms of accuracy (2.82), comprehensibility (3.17), utility (2.92; scale range=1-4). Hence, a series of parent sun safety messages

based on *SDHW* were formatively evaluated in the Family Sun Safety Project (NCI, _____, PI) along with the *SDHW* curriculum and as a program in pediatric practices. In 1995, 841 parents from the seven elementary schools and a large pediatric practice received the messages by mail; language intensity and logical argument style were manipulated in key messages. As hypothesized, parents receiving messages with higher language intensity as opposed to lower intensity reported a greater increase in solar protection and self-efficacy expectations and reduction in barriers from pretest to posttest; the greatest improvements occurred with messages that contained higher language intensity and a deductive logical style (Table 4; 10). In 1996, parents from six elementary schools and six pediatric practices (N=837) received the high language intensity, deductive messages by mail that included a credibility manipulation and in 1997 a controlled trial of overall campaign effectiveness was conducted.

At the ACC, Dr. _____ led the evaluation of the *SDHW* curriculum. The original *SDHW* component for grades 4-6 was tested for classroom feasibility in 1991 in two elementary schools (N=139 students; one intervention; one control) in the Mesa (AZ) Public School District (_____, PI; 14). Teachers implementing the curriculum received two hours of training from _____ staff and were interviewed following implementation. A pretest and two posttests of students showed that the curriculum substantially increased their knowledge of the sun, skin damage and cancer, and sun safety. Intervention students also held more favorable attitudes toward sun safety and some solar protection behaviors were higher 8 weeks after the curriculum than in control students. A one-day sun safety lecture derived from the *SDHW* curriculum improved fourth graders' knowledge and attitudes, as did a sun safety health fair (13).

A revised grades 4-6 *SDHW* curriculum was evaluated with funds from the ADCRC (_____, PI; 9). Four elementary schools in the _____ Unified School District participated in 1992-93; 12 classes were assigned to the intervention group and 12 classes to the control group, in a modified Solomon Four Group design (N=431 students). Compared to controls, students receiving the intervention showed large increases in sun safety knowledge. Attitudes toward sun safety improved and those toward tanning were less favorable. Intervention students reported more sun safety behavior and their skin showed less darkening from pretest to posttest (as measured by colorimeter), indicating less UVR exposure. However, students in grade 6 reacted less favorably attitudinally and behaviorally than in grades 4-5.

The expanded *SDHW* with K-1, 2-3, and 4-5 components was tested for classroom feasibility in 1994-95 in seven schools in four _____ school districts, and revised based on teacher feedback. It was evaluated for effects on students in 1995-96, with 407 students from six schools in these districts. Students in all grades showed greater knowledge of sun safety behaviors when exposed to the curriculum than control students. Grade 2-3 students had the greatest reduction in UVR exposure (colorimeter measure), while grade 4-5 students reported the most solar protection (12).

Currently, Dr. _____ is Principal Investigator of a project funded by the Cancer Research Foundation of America (CRFA) to produce a four-

unit CD-ROM program for the grade 4 *SDHW*. The effectiveness of the CD-ROM program will be tested in eight classes using a 2 X 2 factorial, pretest-posttest design (CD-ROM only, curriculum only, CD-ROM + curriculum, control) in _____, _____. This grade 4 CD-ROM program will demonstrate specific principles in the grade 4 component but will NOT translate the full K-5 curriculum to CD-ROM as proposed for Phase II. The grade 4 CD-ROM program will provide invaluable initial experience in creating sun safety CD-ROM programs. Data collection will be conducted with a course and student management program constructed within the CD-ROM program, which will administer a test to each student. The test will contain true/false items to test learning taken from the pretest used in the *SDHW* evaluations. The program also will question children about their attitudes toward the CD-ROM programs in terms of favorability, ease of use, information utility, credibility, and comprehensibility. This management application will track student progress through the module (bookmarking) and will score tests of CD-ROM content (including number correct, number of attempts, and time needed) so that students receive differential feedback dependent upon their learning. Student

reactions to the CD-ROM program (from interviews) will be summarized by descriptive statistics. This same management program will be used to evaluate learning in Phase II of this Phase I study.

Additional Relevant Experience with Research Procedures and Project Management

Teacher Training	We have trained 202 teachers in methods of implementing the <i>SDHW</i> . Standardized training protocol includes introduction to skin cancer and sun safety, description of implementation and data collection procedures, and review of curriculum and is completed in two hours after school.
Interviewing Procedures	Interviewing procedures were used in the 5 a Day Project. Training consists of reviewing the purpose and predetermined questions, instruction in methods of non-directive probing, and practice and feedback on mock discussions. Open-ended questions and neutral probing stimulate discussion. Responses are content analyzed by research assistants trained in interpretive data analysis (17,39). Staff independently record themes and issues in the discussions to develop categories for open-coding responses and to create procedures for unitizing statements. Staff code statements from one of the interviews to estimate their intercoder reliability. Retraining is provided until intercoder reliability exceeds 0.70. Statements from interviewees are coded and content analysis provides summary statistics (frequencies, proportions) for each category.
Informed Consent Procedures	We have developed procedures for obtaining active voluntary informed consent that insured sufficient sample sizes and participation rates in previous <i>SDHW</i> evaluations. <i>SDHW</i> is designated by school districts as part of their approved curriculum. So, (a) the curriculum is taught to all students, (b) informed consent is required only for data collection; (c) public distinctions between students who are and are not consented are avoided; and (d) teachers do not have to separate consented and non-consented children. Teachers give consent during orientations at school. Active parental consent is obtained by mailing a consent packet to parents, containing (a) letter from the school principal endorsing the project, (b) informed consent letter from the PI describing the project, (c) consent form on which parents indicate whether they give consent for their child, and provide their telephone number and name of a contact person to help the staff track students, and (d) postage-paid return-addressed envelope addressed to project staff. To improve participation, teachers may distribute flyers to parents; articles may be included in school newsletters; presentations may be made to parent-faculty groups; and reminder postcards may be mailed to parents. Student assent is obtained by distributing an informed assent statement, reading it to students orally at the beginning of the session, and directing students to indicate on the form whether they assent to participate in the project, sign the assent form, and return it to project staff. Teacher and parent consent and student assent is entirely voluntary; all are required for student inclusion in a study.
Recruitment Skills and Participation Rates	We have enrolled 2,449 students in 24 schools in previous evaluations of <i>SDHW</i> . All five school districts contacted have agreed to participate in a trial. Of 31 elementary schools approached to participate in the <i>SDHW</i> evaluations, 24 participated; non-participating schools cited too many other required special projects or new construction as reasons for declining. Participation rates by parents and children varied by school (39%-78%), based mainly on the culture of parental participation and staff enthusiasm. Higher participation could be achieved with passive informed consent, but it is not permissible under DHHS regulations.

Data Management Procedures	We have trained over 50 individuals in data collection, entry, coding, and/or management of behavioral data. Data collection training consisting of description of questionnaires and interviewing technique (wording conventions, skip patterns, non-directive probing, active listening, recording answers, managing time and inter-personal relationships, confidentiality), along with demonstrations, practice, and videotaping with feedback. Coding procedures and customized data entry computer programs are available. Data quality is controlled by range and consistency checks, an edit request system for making corrections, and a random audit of forms.
Spanish Translation	We have extensive experience translating health education materials, consent forms, and data collection forms into Spanish using a centering and translation-backtranslation method for the 5 a Day Project (_____, P.I.).
Timeline Adherence	It is crucial to stay on schedule when working with schools. We have maintained the original study timelines in all of the previous curriculum evaluation trials. Teacher training, curricula implementation, and data collection have occurred within four weeks of the original timelines.

D. RESEARCH DESIGN AND METHODS

Target Population

The target population for this Phase I project is students enrolled in grades Kindergarten (K) and 2 in _____ County (CO) School District #6. The field test will be conducted in public schools in _____, because the high elevation and increased skin cancer rates in the region make a sun safety curriculum relevant and attractive to schools. All students enrolled at the time of the consenting will be eligible to participate in the CD-ROM activity evaluation. Should Phase II be funded, the target population will be children in grades K-5. The primary target of the *SDHW* CD-ROM curriculum is students of white, non-Hispanic ethnicity, the group at substantially higher risk for developing skin cancer than other ethnic groups with darker skin complexions, whose natural melanin provides a measure of protection against UVR skin damage. However, all enrolled students, regardless of ethnicity, will be eligible to participate. Schools may request that materials be available in Spanish for Spanish-speaking students. Although such a request has not occurred in previous *SDHW* evaluations, the project will use translation methods from previous studies (see Relevant Experience), if needed.

Participating School District and Research Approval. The _____ County School District No. 6 (Greeley and Evans, _____) (_____) has agreed to participate in this project (see letter of support). Two elementary schools from the district will be recruited. _____ students and teachers have not been exposed to the *SDHW*. At the time of funding, two inclusion criteria will be applied to select elementary schools: they must contain grades K-5 only (this will likely eliminate a few schools that include grade 6), and possess adequate computer equipment (i.e., Pentium computers with CD-ROM) in sufficient numbers to run the prototype programs. _____ requires internal review of research proposals. In our experience, this process takes three months to complete. Ms. _____ already has initiated this review process with _____ in order to ensure formal approval by the time of funding. No problems are anticipated. Each school will receive a Sun-Safe School Guide for participating.

Informed Consent Forms and Procedures. In past *SDHW* evaluations, school districts also have required that school district personnel review informed consent forms and procedures prior to granting formal approval for the evaluation. Thus, Ms. _____ will create the consent forms and procedures for the field test prior to Phase I as part of the school district research approval process. These forms and procedures will be similar to those used in the previous evaluations of the *SDHW* (see Relevant Experience), with modifications to reflect the fact that the evaluation is being conducted by PHS, that the *SDHW* curriculum activities are being delivered on CD-ROM, and that data collection will be conducted on-line by a computer management program that accompanies

the CD-ROM programs and through personal interviews with students and teachers after they interact with the CD-ROM programs. Project-specific procedures will be developed to obtain active voluntary informed consent from teachers and parents, and active voluntary informed assent from students based on procedures employed in previous *SDHW* evaluations (see Relevant Experience). **All informed consent and assent forms and procedures will be approved by the ___ Institutional Review Board (Ms. _____, IRB Coordinator) and will conform to DHHS regulations.** (See Section E).

Teacher consent will be obtained at school; parent consent will be obtained by mail. Parents will receive an introductory letter from PHS describing the study, a form to indicate whether they consent for their child to participate in the CD-ROM interaction and interview (including a signature), and a postage-paid envelope to return the form to PHS. The CD-ROM will be designated by the school district as part of their approved curriculum, so consent/assent will be obtained for data collection only. Prior to interaction with the CD-ROM program, project staff will describe the study orally to each student by reading a prepared description and each student will indicate by saying yes or no whether he/she assents to participate. Parent consent and student assent will be required for a student to participate. Based on our prior experiences in Arizona school districts, we expect these procedures to yield nearly 100% teacher consent, 60% parent consent, and at least 75% student assent (see Relevant Experience for past participation rates).

Phase I Study

Phase I Objectives. The 12-month CRFA study (_____, P.I.; see Relevant Experience) is developing and evaluating the effectiveness of a full-length CD-ROM sun safety program for students in grade 4. It includes four activities which address the four units of the *SDHW* curriculum. In this 6-month Phase I study, we will build upon that work and, specifically, aim to:

PHASE I OBJECTIVES

<p>1 Produce two prototype CD-ROM programs for children in Grades K and 2 based upon one unit (e.g., cover-up clothing) from the <i>Sunny Days, Healthy Ways (SDHW)</i> sun safety curriculum.</p>	<p>2 Evaluate the capability of grade K and 2 students to use the prototype sun safety CD-ROM programs, and of teachers to integrate them into their school health education.</p>	<p>3 Evaluate grade K and 2 students' and teachers' satisfaction with and acceptance of the prototype <i>SDHW</i> sun safety CD-ROM programs.</p>
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Phase I school implementation and data management will be conducted by PHS (Ms. _____ and a Research Assistant and Secretary hired for the project) (see Phase I Activities Timetable below). Phase I CD-ROM development will be conducted by the AMC Communications Core, a team of instructional specialists experienced in multimedia and Internet-based education materials. Core staff possess the multimedia production skills needed for this project, including instructional design, storyboarding, graphic design, and multimedia development (including competencies in digital signal processing for audio and video, as well as multimedia authoring tools for Macintosh and Windows-based platforms that allow for media display and automated data collection).

Phase II Objectives. Upon successful completion of the Phase I objectives (see Indicators of Success on page 23), the specific aims of the future Phase II project would be to:

PHASE II OBJECTIVES

1	Produce a six full CD-ROM programs for children in grades K through 5 based upon all the units (i.e., sun, shade, cover-up clothing, sunscreen) from the <i>Sunny Days, Healthy Ways (SDHW)</i> sun safety curriculum.	2	Evaluate the effectiveness and acceptance of the CD-ROM sun safety programs by elementary school teachers and students in one or more states at increased risk for sun exposure and skin cancer.	3	Develop a Teacher Technical Guide on how to use the <i>SDHW</i> CD-ROM programs in school health education.
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Phase I Work Plan Activities and Timetable. The feasibility of an elementary school sun safety curriculum has already been established in previous projects evaluating the *SDHW* curriculum. Consequently, in Phase I, we will complete the timetable of activities to produce two prototype *SDHW* CD-ROM activities for grades K and 2.

Phase I Activities Timetable

Phase I Activities	Who will Complete	Phase I Study Month					
		July 1998	Aug 1998	Sep 1998	Oct 1998	Nov 1998	Dec 1998
Develop CD-ROM concept plans	Com Core						
Design school technology survey	M. _____						
Write July monthly report	M. _____						
Produce CD-ROM activities	Com Core						
Design interview questions	M. _____						
Conduct & analyze school tech surveys	Res Asst						
Write August monthly report	M. _____						
Recruit and consent 8 teachers and 24 students (grades K and 2)	M. _____ Res Asst						
Write September monthly report	M. _____						
Organize CD-ROM use sessions	M. _____						
Conduct individual interviews with teachers & students after CD-ROM use	M. _____ Res Asst						

Write October monthly report	M. _____ —						
Compile and analyze teacher and student interview data	M. _____ Res Asst						
Summarize students' computer responses	D. _____ —						
Write November monthly report	M. _____						
Refine CD-ROM concept plans	Com Core						
Prepare Technical Guide outline	Res Asst						
Review completion of Phase I objectives	M. _____ —						
Write final Phase I report	M. _____						

School Computer Technology Assessment

Early in Phase I, Ms. _____ and a Research Assistant under her supervision hired for the project, will conduct an on-site assessment of computer technology at each of the District #6 elementary schools that meet the eligibility criteria. The assessment will consist of a face-to-face interview with the school principal and teacher/librarian supervising computer technology and a visual inspection of the school computer equipment/labs. Ms. _____ will determine from this inspection whether each school meets computer technology requirements. If more than two schools meet the technology requirements, then two schools will be randomly selected from the eligible number. This inspection will also provide information to the AMC Communications Core that will be used to select authoring software that will insure that the CD-ROM programs will run on the school's computer technology. **Examples of computer technology questions are:**

Do your students have access to computers at school? How many? What platforms do you support? What is the typical configuration of the school computers (screen size, color depth, memory, CD-ROM)?
Do you have Internet connections for the computers students use at school? How many?
Do the teachers use computers in their lesson plans? How? Do they use CD-ROMs and/or the Internet?
What kind of computer training have the teachers had? What kind of training do they need, if any?
What are your school's technology goals or plans for the near future?
What kind of a budget does your school have for computer equipment and programs?

Concept Plans and CD-ROM Production

During the first month of Phase I, Ms. _____, Dr. _____, and the _____ Communication Core will develop concept plans for the *SDHW* CD-ROM programs. These plans will describe the content, scripts, graphics, format, and layout of two age- and developmentally-appropriate multimedia curriculum activities. Dr. _____'s Communications Core will produce the CD-ROM programs from the concept plans during August and September, 1998. Activities will be created for grades K and 2 to supplement the grade 4 CD-ROM program produced in the CRFA study. In

the development of the original *SDHW*, we determined that children's cognitive abilities and understanding of science and health principles became increasingly sophisticated and that these grade level divisions made the most instructional sense (see Relevant Experience).

With technical consultation from Dr. _____ and content consultation from Ms. _____, the _____ Communications Core will author the CD-ROM programs on the Windows 3.1/Win95 platform using Asymetrix Multimedia Toolbook CBT Version, a suite of multimedia authoring tools. Experience and skills of this staff include: (a) Script writing and storyboarding for multimedia productions; (b) Recording, editing, post-production of high-quality narration, sound effects and music (8- and 16-bit audio); (c) Production and post production of high quality video (3/4" SP format within an A-B roll production facility); (d) Digital capture and compression of video for computer display employing all popular codes; (e) High quality graphic design and palette management to ensure faithful display of photorealistic images; (f) Database interface design using multimedia front ends (Paradox and Dbase III); (g) Extensive programming experience to ensure in-depth error trapping and user feedback; (h) Human-machine interface design to ensure cognitive consistency and ergonomic efficiency; (i) API hooks so that Web browsers can be configured to download and automatically execute finished titles via the Web which allow central updating of titles for wide distribution, if desired; (j) Tested setup programs to make installation easy for the end user; (k) Thorough understanding and experience creating CD-ROM masters; all titles can be mastered in-house; (l) Creation of direct calls to URL's on the network so that Web browsers can be automatically executed and search for a World Wide Web location to present to the user, which allows users to be directed to interesting Web sites of relevance for additional information; (m) Packaging of finished titles for distribution.

Instructional Goals and Content. Due to the time constraints of the Phase I funding period, we will produce one 20- minute CD-ROM prototype for each of the two grade levels (K and 2). The Phase I CD-ROM prototypes will be developed to meet the instructional goals of the ultimate Phase II K-5 CD-ROM programs. The instructional goals and content of all *SDHW* CD-ROM programs will parallel those of the original *SDHW* curriculum. Following principles of Social Cognitive Theory (SCT), the goals are to promote behaviors by students that reduce sun exposure by (a) improving self-efficacy and outcome expectations related to sun safety, (b) changing attitudes to favor sun safety, and (c) increasing sun safety skills. The CD-ROM activities will aim to produce one of three preventive behaviors: (a) limiting time in the sun and avoiding sun exposure during daily hours of peak UVR, (b) wearing protective clothing (e.g., long-sleeved shirts, long pants, shoes, sunglasses, hats), and (c) applying sunscreen lotion and lip balm with an SPF of 15+.

The Phase I *SDHW* CD-ROM prototypes, and subsequent K-5 CD-ROM programs (Phase II) will integrate into comprehensive health education and/or science curricula by presenting information that increases students' understanding of the scientific principles behind health concepts related to skin cancer prevention. Content of the lessons will become increasingly sophisticated from grades K through 5, reflecting age and developmental changes in children. For example, in grade K, simple sun safety skills will be demonstrated and practiced, and in grade 2 these skills will be taught along with basic scientific principles related to the function of human skin. In grade 4 (CRFA project), these skills, along with increasingly sophisticated information on science, health, and disease, are presented (see Relevant Experience). Like the original *SDHW*, the Phase I CD-ROM prototype activities will incorporate skills in the areas of health, science, mathematics, society and culture, and language arts, link sun safety behavior to science, be consistent with the Healthy People 2000 national health objectives and CDC's national guidelines for K-12 comprehensive health education, and be structured around the Madeline Hunter model (22) of the essentials of effective instruction. This will insure that the *SDHW* CD-ROM programs will integrate with existing school curricula. Such integration is crucial when recruiting schools to participate in the Phase II evaluation and for adoption by schools during Phase III commercialization.

Instructional Format of *SDHW* CD-ROM Programs. The Phase I CD-ROM activities will use child and/or adult instructors (as determined from the formative evaluation and focus groups from the current CRFA study) to deliver the curriculum concepts and include demonstrations of the behavioral, scientific,

and health/life skills in realistic settings with child role models (again selected based on formative evaluation and focus groups from the current CRFA study). The plans will integrate digital video, voice-over narration, music, graphics and animation to form age-appropriate activities. Activities may include simulations, decision-making role plays, informational news briefs, and/or brief documentary videos. Students can practice sun safety behavioral skills in the CD-ROM activities. The activities will provide opportunities for students to express knowledge and attitudes by responding to questions about sun safety.

Computer-Based Knowledge, Attitude, and Behavior Testing. The CD-ROM programs will be designed to record students' responses/choices in the interactive activity to provide a measure of learning. Students' attitudes and behaviors related to sun safety also will be measured. A sum of student scores (number of correct and incorrect responses/choices) will be computed to identify any features of the prototype CD-ROM activities which are either too easy or too difficult for the children at each grade level. Dr. Buller will perform these summary statistics. More sophisticated statistical analyses are unwarranted due to the extremely small sample of students.

Refinement of Concept Plans for Phase II. Based on what we learn from an analysis of the on-line testing and personal interviews (see below), the Communications Core will refine the Phase I CD-ROM concept plans in readiness for the full Phase II evaluation of all *SDHW* CD-ROM units in a grades K-5 sample.

Technical Guide. Based on Phase I experience, an outline of a Teacher Technical Guide will be created in Phase I. The complete Technical Guide, which will be developed in Phase II, will instruct teachers on the use of the CD-ROM programs. It will describe how to run the programs on PC and Macintosh systems, handle common technical difficulties, follow curriculum implementation schedule, and plans for using the multimedia programs both in free play and directed use formats. Similar plans were used in the *Body Fun* CD-ROM evaluation (see Relevant Experience).

CD-ROM Interaction and Follow-up Interviews with Students and Teachers

Eight consenting teachers (4 from each grade) and 24 consented students (12 from each grade) will be asked to interact individually with the prototype CD-ROM program for their grade level for at least 20 minutes in the school computer facilities. The Principal Investigator and project Research Assistant will be available for technical troubleshooting and assistance. At this young age, there is unlikely to be many sex differences in sun safety knowledge, attitudes, and practices of the students, yet every attempt will be made to balance the ratio of boys and girls in the student sample. Personal interviews will be conducted with the teachers and students to gather as much information about their experience interacting with the CD-ROM activities as possible. The small samples have been planned in order to obtain in-depth responses from students and teachers. There is insufficient time to conduct extensive interviews with larger samples.

The CD-ROM interaction and interviews will be conducted in October at school during regular school hours by Ms. _____ or the Research Assistant immediately after each person has interacted with the CD-ROM activity for their grade level. An AMC Communications Core Multimedia Development Specialist may attend the interviews, which are expected to take approximately 30 minutes. Teacher interviews will be conducted in private. Student interviews will be conducted in relative privacy in the presence of a teacher or other designated school representative. Interviewers will take extensive notes during the interviews. The interviews will be content-analyzed as described in the Relevant Experience section. Most questions will be open-ended to probe a wide range of use, preference, satisfaction, and acceptance. This formative evaluation in grades K and 2 will enhance the effectiveness of the full Phase II multimedia curriculum by identifying student preferences for and difficulties with features of instruction and computer programs. At the conclusion of the interviews, participating children and their parents and participating teachers will receive information on how to adequately

protect themselves from the sun to lower their exposure to ultraviolet radiation and ultimately lower their risk of developing melanoma and non-melanoma skin cancers.

Student Interviews. Because young children have limited reading and questionnaire skills, and may be too reticent or swayed by a focus group setting, a personal interview will be conducted with each student. Each student will be interviewed as he or she finishes with the CD-ROM activity. This will be time-efficient and allow us to obtain students' immediate feedback before they forget something or have had a chance to talk with others and possibly alter their initial opinions. The interviews will provide information on computer skills, experience with and preferences for educational computer software, learning that has occurred, and reactions to the CD-ROM activities' content, characters, graphics, sounds, and pace. At the conclusion of the interviews, children will receive a small gift for participating such as a water bottle or baseball cap. Ms. _____ will construct the questions to be used for the student interviews. Questions will be modeled after the student evaluation instrument used in the Body Fun evaluation (see Relevant Experience). Examples of student interview questions are:

Do you like to use computers? How often do you use a computer? What do you use it for?
What are some of your favorite CD-ROM programs? What do you like about them?
Did you like the *SDHW* CD-ROM activity? What did you like/not like about it?
Was the program too fast or too slow for you? What did you learn from the CD-ROM activity?
What did you think about the sounds and music made by the program?
What did you like/not like about the animated characters, pictures and colors used in the CD-ROM?
Was the program too easy or hard to use? Why? Would you play it again? Why?
Do you have a computer at home? Can it play CD-ROM programs?

Teacher Interviews. Interviews with teachers will provide an understanding of their experiences with and preferences for instructional interactive multimedia software and their satisfaction with the prototype *SDHW* CD-ROM activities. Each teacher will receive \$20 and for interacting with the CD-ROM activity and participating in the interview. Ms. _____ will construct the questions to be used for the teacher interviews. Questions will be modeled after the teacher evaluation instrument used in the Body Fun evaluation (see Relevant Experience). Examples of teacher interview questions are:

Do you think the *SDHW* CD-ROM is an effective health education tool? Why or why not?
Did the activities reflect real life situations? Were the activities believable and convincing?
Can the CD-ROM program help develop concepts that are difficult to get across in other ways?
How?
How did you like/dislike the visuals, sounds, animated characters, script, and pace of the program?
Could you assess student learning using the CD-ROM program? How?
How can this activity help strengthen other learning skills? Which ones?

Potential Difficulties, Limitations, and/or Alternatives

It is anticipated that CD-ROM will be the most viable technology over the next few years for computer-based instruction in schools. However, research shows that two other alternative technologies for delivering these types of programs exist in schools. One is videodisc players which are present in 55% of public schools in the U.S. (49), and the other is the on-line Internet/World Wide Web mechanism to which 70% of U.S. public schools have access (49). These two alternative technologies will be explored in interviews with teachers to determine whether they should also be used for delivering the sun safety information in addition to or instead of CD-ROM.

Indicators of Phase I Success

In order to proceed to Phase II, we would expect to document the following information from schools and responses from students and teachers as indicators of Phase I success:

- < Schools have sufficient technology to run the sun safety CD-ROM programs.
- < Teachers believed skin cancer prevention to be an important health or science topic to address.
- < The CD-ROM programs were easily installed and ran on school computers with minimal problems.
- < SDHW curriculum content was easily translatable into CD-ROM computer-based activities.
- < Students were able to navigate through all features of the CD-ROM prototypes in the 20-minute session.
- < Students scored over 80% correct on items assessing learning of the sun safety content.
- < Students liked the features and content of the sun safety CD-ROM prototype programs.
- < Teachers could easily integrate the CD-ROM activities into their health and/or science lesson plans.
- < Teachers found the CD-ROM programs to be an effective health education tool.
- < Teachers believed the CD-ROM programs could help them teach difficult or complex concepts.
- < Teachers felt that they could assess student learning using the CD-ROM prototypes.

HUMAN SUBJECTS

Selection Criteria

Students. Students enrolled in grades K and 2 in the fall semester of the 1998-99 academic year at two public elementary schools randomly selected from the _____ County School District No. 6. Anticipated number: 24 students. Anticipated age range: 5-8 years. Anticipated health status: good health. There are no criteria for inclusion or exclusion of any sub-population of students.

Teachers. Teachers instructing science, health and/or computer classes in grades K and 2 in the fall semester of the 1998-99 academic year at two public elementary schools randomly selected from the Weld County School District No. 6. A monetary incentive of \$20 will be paid to each participating teacher. Anticipated number: 8 teachers. Anticipated age range: 22-70 years. Anticipated health status: good health. There are no criteria for inclusion or exclusion of any sub-population of teachers.

Source of Research Materials

Data (reactions to the CD-ROM programs) in the form of handwritten notes will be collected from students and teachers through personal interviews with study investigators or staff. The CD-ROM programs will record students' responses/choices in the interactive activity to provide a measure of learning. A sum of student scores (number of correct and incorrect

responses/choices) will be computed from the CD-ROM computer files. All data will be obtained specifically for research purposes.

Recruitment and Consent Procedures

- a. Identification of eligible students will be made by PHS staff working with district and school administrators.
- b. PHS staff will contact administrator(s) of schools and school districts and make an oral presentation to the administrator(s) describing the purpose of the study, recruitment of students and teachers, research procedures, selection criteria, risks, and benefits of study. We will distribute written descriptions to school administrator(s).
- c. PHS staff will make an oral in person presentation to teachers at schools selected for recruitment of students. PHS staff will describe the project research procedures, selection criteria, risks, and benefits, and distribute written descriptions to teachers.
- d. Active, voluntary parental informed consent will be obtained for each participating student. Parents will be mailed a consent packet by PHS. The school may provide parent addresses to PHS or it may affix mailing labels to packets prepared by PHS to protect parents' confidentiality. Packets will contain (a) letter of introduction from the school principal endorsing the project, (b) informed consent letter from the PI at PHS, Ms. _____, describing the project, (c) informed consent form on which parents indicate whether they give consent for their child and sign the form, and (d) postage-paid return-addressed envelope addressed to PHS. To improve participation, teachers will distribute flyers; school newsletters will contain articles; and reminder postcards will be mailed to parents. All consent forms will conform to DHHS regulations on the protection of human subjects and be approved by _____ Institutional Review Board.
- e. Student assent will be obtained by reading an informed assent statement to all students. Students will be asked to indicate whether they assent to participate in the project. Children in grades K and 2 will indicate orally to PHS staff who will record their yes or no response. Responses will be recorded by study staff. Student assent statement will conform to DHHS regulations on the protection of human subjects and be approved by _____ IRB. Only students for whom PHS receives both parental consent and student assent will participate in the project.

Participating teachers will be contacted by PHS staff by telephone or in person and invited to participate. PHS staff will describe the purpose, procedures, risks, and benefits of the CD-ROM interaction and interview to teachers. Teachers will read and sign a consent form when they arrive at the CD-ROM interaction/interview session.

Potential risks

Potential risks posed by the proposed research are minimal and mainly psychological and social. Participating students may be embarrassed or feel uncomfortable reporting their computer skills, use of and experience with educational computer software, and their sources of health information. They may desire to please the research staff and or be reticent to give their opinions to a stranger. Focus groups or telephone interviews are alternative methods of data collection. However, focus groups may tend to sway students responses away from their true opinions and the participants may be afraid that the other students will react unfavorably to their answers. Telephone interviews would be very time consuming and possibly impossible with the very young children in grades K and 2. Also, face-to-face interviews in the home would be highly intrusive and probably unacceptable to parents.

Procedures for Protecting Against or Minimizing Potential Risks

To protect the privacy and confidentiality of student and teacher responses to the interviews, they will be conducted by the Principal Investigator or trained Research Assistant from PHS. Teacher interviews will be conducted in private. Student interviews will be conducted in relative privacy in the presence of a teacher or other designated school representative. All notes, coding sheets, and

computer data files will be secured and stored at the PHS offices in _____, __, with access limited to investigators and staff.

Reasonable Risks to Subjects

The minimal risks posed by this project are reasonable because the students will provide a great deal of information to investigators and project staff that will result in a curriculum that improves sun safety of children. At the conclusion of the interviews, participating children and their parents and participating teachers will receive information on how to adequately protect themselves from the sun to lower their exposure to ultraviolet radiation and ultimately lower their risk of developing melanoma and nonmelanoma skin cancers.

The project will yield an understanding of how to design successful school-based CD-ROM curricula to increase sun safety among adolescents enrolled in grades K-5. This project will produce interactive multimedia activities that integrates with an existing, successful sun safety curriculum for elementary school students to provide another means of performing sun safety instruction. Also, the CD-ROM programs will conform to current health and science education standards, including anticipated national guidelines on skin cancer prevention for schools from the CDC. The curriculum will be compatible with existing health education and science curricula in grades K-5 in the United States.

VERTEBRATE ANIMALS

Not applicable.

CONSULTANTS

_____, *Ph.D.*, Associate Director, Biomedical Communications, _____ Health Sciences Center, University of _____, _____ will serve as a consultant to this project for instructional design multimedia development, and software beta testing (see biosketch and letter of commitment). Dr. _____ leads the Interactive Multimedia Design (IMD) Team in Biomedical Communications. He has eight years of experience creating and evaluating interactive multimedia instructional computer programs. In the Human Growth and Well-being Project (NICHD), Dr. _____ supervised the development of an HIV/AIDS prevention curriculum for grades 3-8 delivered on 36 interactive multimedia instructional programs to a multicultural student population in Arizona and New Mexico. He currently is directing the development of the *SDHW* grade 4 CD-ROM programs in the project funded by the _____ Research Foundation of America (_____, P.I.). Dr. _____ provides consultation on effective multimedia development and beta testing to _____ Corporation (Toolbook), _____, _____, _____ Canada, and the Institute for Academic Technology. He is an _____ Advisory Board member.

CONTRACTUAL ARRANGEMENTS

A contract will be drawn between _____ and _____ to cover costs incurred by the _____ Communication Core in preparing concept plans and CD-ROM programs. This will include storyboards, content, scripts, graphics, format, and layout. A fee of \$23,000 has been negotiated with _____ (see budget pages) and _____ and _____ are prepared to establish in writing the required contractual agreement when this application is funded. Ms. _____ will administer the contract for _____ and Dr. _____, Deputy Director, _____, will administer the contract for _____. See attached letter confirming _____'s intent to enter into such a contract.

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