

RESEARCH BRIEF

Does Knowledge Influence Melanoma-Prone Behavior? Awareness, Exposure, and Sun Protection Among Five Social Groups

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Purpose/Objectives: To examine melanoma-related knowledge, sun exposure, and sun protection to determine whether increased awareness is associated with a reduction in risk.

Design: Quantitative/empiricist study conducted by purpose-designed mailed questionnaire.

Participants: Consultant oncologists at one teaching hospital in London, England; specialist registrars (oncologists in training) contacted through a London-based educational group; oncology-trained nursing staff from oncology departments at two London teaching hospitals; medical students; general (nononcology) nurses; and members of the lay public from one London teaching hospital.

Setting: Two teaching hospitals in London, both registered cancer centers that possess specialist departments of oncology and are staffed by clinical and medical oncologists.

Methods: Anonymous, self-completion, mailed questionnaire.

Research Variables: Sun exposure; use of sun protection and avoidance; knowledge of the biologic effects of sun exposure, moles, and malignant melanoma; melanoma-prone behavior.

Findings: No significant differences were found in sun exposure or melanoma-prone behavior across the five groups studied. No correlation existed between knowledge and melanoma-prone behavior. Differences in knowledge and protection scores were demonstrated across all groups and were statistically significant, but they did not translate into changes in exposure or behavior scores.

Conclusions: Public health policy that seeks to reduce the incidence of melanoma is based on the false premise that increasing awareness of melanoma risk will reduce melanoma-prone behavior. Increasing awareness of the risks of sun exposure may improve the use of sun protection, but it does not reduce melanoma-prone behavior, even among specialist healthcare professionals.

Implications for Nursing: This study provides a new epidemiologic tool for nurses working in the specialty.

Key Points . . .

- Knowledge of the potential harm of sun exposure does not translate into reduced sun exposure.
- Improved knowledge of the risks of sun exposure is associated with improved sun protection, but the extent of sun exposure still means no improvement in melanoma-prone behavior.
- The assumption by government and public health bodies that improving awareness of the risks of sun exposure will reduce the incidence of malignant melanoma probably is incorrect.

that increased awareness will lead to a change in behavior and reduce the incidence of malignant melanoma. Evidence exists, however, that increased knowledge does not lead to a change in sun-seeking behavior. If this is so, then this entire segment of public health policy is predicated on a false assumption.

The objective of this research was to study healthcare professionals (including specialists in oncology and general RNs without specialist oncology training), medical students, and lay people for differences in sunbathing, use of sun beds and sunscreen, and concern about and knowledge of risk factors for malignant melanoma. The study further aimed to examine differences in these variables between those reporting high-risk melanoma-prone behavior and those reporting low-risk behavior.

Background

Early studies examining psychosocial factors in sunbathing and sunscreen use in the United States reported that sun

The role of sun exposure in the pathogenesis of malignant melanoma is accepted. A change in sun-seeking behavior is, therefore, a key objective of the United Kingdom government's cancer-reduction strategy. Stated aims include increased awareness by individuals of their skin cancer risk factors and changes in behavior by those at high risk to use sun protection and limit their sun exposure and that of their children (Anonymous, 1998). The implication is

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exposure was predicted by variables such as skin cancer knowledge (increased knowledge predicted decreased exposure) and social networks (health club membership, regular exercise, and having sun-seeking friends all increased exposure) (Keesling & Friedman, 1987). Sunscreen use was shown to be related positively to skin cancer knowledge. A similar study of 1,600 Australians reported that more than 75% of individuals exposed themselves during the hottest hours of the day and less than 25% reported sunscreen use (Hill et al., 1992).

"Behavior" defines that which people do or refrain from doing, consciously or unconsciously, voluntarily or involuntarily, and "health behavior" involves actions taken by people who believe they are healthy to remain free of disease (Fernsler & Miller, 1993). According to this definition, health behavior is confined to preventive actions. Health behavior is determined by many factors, but this study was concerned only with psychological factors that determine a particular area of health behavior.

Behavior to prevent sun exposure includes wearing protective clothing and avoiding intense sunlight. Examining skin and seeking treatment for suspicious lesions also are important, with early identification offering at least a 95% chance of preventing the spread of malignant melanoma (Goldsmith, 1987). Research into skin protective and sun exposure behavior is limited to an assessment of skin protective intentions while in the sun and an examination of demographic factors (Rhodes, 1995).

Prevention and control programs have been successful in increasing knowledge and awareness of skin cancer, but major changes in attitude and behavior have not occurred (Robinson, Rademaker, Sylvester, & Cook, 1997). This may be because of a lack of perceived personal susceptibility. Some have suggested that a better approach may be to emphasize the short-term consequences of painful sunburns caused by inadequate sun protection. This could increase the perceived personal relevance of the message and foster behavioral change (Cody & Lee, 1990).

Health behavior is influenced by many interacting factors. Many theories and models have been developed to identify and describe the interaction of these variables and to predict health behavior, although no human behavior is totally predictable. The Theory of Planned Behavior (Ajzen, 1988) has been shown to be useful for practical predictive interpretation of intention and behavior (Sutton, 1997), and it provides a template for the study of high-risk behavior in the sun and the use of sun beds. The theory incorporates perceived control over a given behavior, attitude toward the behavior, and subjective ideas about the behavior into a framework of predictors.

Factors that influence perceived behavioral control may be internal (e.g., information, skills, urges, compulsions) and external (e.g., rules). These factors may impinge on an individual's control over health behavior: An individual may intend to cover his or her skin when exposed to the sun but may know from past experiences that he or she is unlikely to execute the intentions. Empirical studies testing the Theory of Planned Behavior generally support the central premise that, unless a given behavior is under the individual's complete volitional control, its predictions are superior to those based on the Theory of Reasoned Action (Sutton, 1997).

A gap exists between knowing about melanoma and actually converting this knowledge into preventive behavior. Individual health behavior is a concern of healthcare professionals, many of whom are in an ideal position to promote healthy practices to the public and bridge this gap. This requires that healthcare professionals possess knowledge of the risk factors associated with the development of malignant melanoma and factors affecting health behaviors (Cohen & Frank-Stromborg, 1993).

Trained oncologists and oncology nurses possess both theoretical knowledge and practical experience of malignant melanoma, and they should be well informed about all aspects of the disease. Both groups are in an ideal position to help in the primary prevention and are familiar with the warning signs of malignant melanoma. The sun-seeking behavior of these highly trained individuals has not been studied previously.

The purpose of this study was to reach a better understanding of the relationship among knowledge and sun- and sunbed-related behavior and skin protection among oncologists and oncology nurses, comparing this with the knowledge and behavior of nononcology trained nurses, medical students, and lay people. Medical students and lay people have been used in similar studies (Bourke, Healsmith, & Graham-Brown, 1995; Campbell & Birdsell, 1994; Douglass, McGee, & Williams, 1997; Jerkegren, Sandrieser, Brandberg, & Rosdahl, 1999); therefore, results from this study can be compared to the previous findings.

Methods

The current study was conducted by anonymous, self-completed, postal questionnaires distributed to 336 participants in five groups.

- Oncologists: consultants or specialist registrars in medical or clinical oncology working at cancer centers within teaching hospitals in London, England
- Oncology nurses: RNs holding an English Nursing Board (ENB) certificate in oncology (or equivalent) and working at one of two London cancer centers
- General nurses: RNs not holding an ENB certificate (or equivalent) in oncology and not working in a cancer specialty, all drawn from one London teaching hospital
- Medical students: fourth- and fifth-year medical students in training at St. George's Hospital Medical School in London
- Lay public: members of the general public older than 18 with no cancer diagnosis, contacted in person in the waiting areas of St. George's Hospital

Oncologists were used to provide a reference population with a high knowledge of risk factors for melanoma and protective behavior. They are exposed to patients suffering from malignant melanoma, and this may influence their personal sun-protection and sun-seeking behavior. Oncologists have not been featured as a study population in previous studies.

Oncology nurses have been considered so well informed of the harmful effects of ultraviolet (UV) radiation that further information may not alter risk behavior among them.

General nurses were chosen because their overall knowledge of melanoma and its risk factors was believed to be less than that of oncology nurses, providing a useful comparison population. No previous similar research using this population was identified.

Medical students long have been considered an appropriate population for the study of sun-related behavior. Young adults (aged 30 and younger) are more likely to report a higher incidence of sun exposure (Johnson & Lookingbill, 1984). College students generally have more discretionary time than the adult population during daylight hours, which could be spent in the sun. Medical students receive both theoretical and practical teaching on malignant melanoma during their training, and they should be well informed about all aspects of the disease. Previous research using student populations has shown consistently that a high level of knowledge of risk does not lead to sun-protective behavior (Boldeman, Jansson, Nilsson, & Ullen, 1997; Jerkegren et al., 1999). The researchers of the current study believed that examining only medical students would be an interesting point of comparison with the previous research.

Lay people were chosen as a “nonhealthcare professional group.” The researchers assumed that their knowledge scores would be the lowest of the five populations studied, again providing a reference group for comparison with the healthcare workers.

Ethical approval was obtained from all relevant authorities. The purpose-designed questionnaire consisted of four sections comprising

- Seven questions on demographic characteristics
- Nine questions adapted from Jerkegren et al. (1999) capturing the individual’s sun-related behavior and titled “Exposure” (maximum score = 28, higher score indicating greater exposure)
- Five questions about “Protection” covering respondents’ use of sunscreen, wearing of hats, covering of arms and legs, and avoidance of strong sunlight, as used by Campbell and Birdsell (1994) (maximum score = 15, higher score indicating greater protection)
- Eighteen questions focusing on “Knowledge” about moles, malignant melanoma, and the biologic effects of the sun (maximum score = 18, higher score indicating greater knowledge).

The questionnaire was designed with the specific research questions in mind.

Demographic characteristics included sex, age, skin color, and personal or family history of skin cancer. Personal and environmental characteristics can be linked to behavioral and attitudinal patterns (Knapp, 1998), and these data may thus contribute to the interpretation of study findings.

Questions on exposure were adapted from those used by Jerkegren et al. (1999) in their study of Swedish university students. These questions were assessed by items validated in a previous study (Boldeman et al., 1997). An example is “Do you consider yourself a sun seeker?” Answers were scored on a scale of 0–4, with higher scores indicating more sun exposure. The maximum exposure score was 28.

The questions in section 3, titled “Protection,” previously were used in the study by Campbell and Birdsell (1994) of Canadian adults. Their findings were similar to those of other studies, indicating a degree of reliability and validity. Respondents were assessed for their use of four sun-protection behaviors: using sunscreen, wearing a hat, covering arms and legs with light clothing, and avoiding strong sunlight. Each was scored on a four-point Likert scale, ranging from 3 (usually used) to 0 (never used). A fifth question concerned per-

ceived skin reaction in the sun. A maximum protection score of 15 indicated the highest level of protection.

The final section of the questionnaire consisted of 18 questions detailing an individual’s knowledge about moles, melanoma, and the biologic effects of the sun. Each question had three response categories: “yes,” “no,” and “don’t know.” A correct answer resulted in one point so that the maximum score was 18. This is the least validated component of the questionnaire, having been constructed specifically for this study. A first step in questionnaire development toward ensuring the validity of the knowledge component was to base questions on concepts derived from the relevant literature (Watson, 1999). The United Kingdom Skin Cancer Prevention Party, a health promotion group, publishes a prevention summary for the public that includes advice on how people can protect themselves and their children in the sun and when the sun should be avoided. The Health Education Authority (HEA) publishes fact sheets for the public concerning sun protection (HEA, 1998a, 1998b, 1998c). The knowledge questions were derived from these sources. Two oncologists with specialist interest in melanoma, one who is the second author of this article, examined the questionnaire to determine that it had content and face validity. The knowledge questions are considered reliable and can be verified empirically through the published sources mentioned earlier.

The anticipated response rate from those who received the questionnaire through the mail was 65%, based on response rates in similar studies (Campbell & Birdsell, 1994; Stott, 1999). This was believed to be an appropriate method of distribution for subjects living throughout London. Polit and Hungler (1999) suggested that an adequate response rate with a mailed questionnaire should be 60% or more; however, a 30% response rate is not unusual. A response rate of about 90% was anticipated from the medical students, who were addressed collectively by the principal researcher and to whom questionnaires were distributed prior to lectures. Previous studies (Douglass et al., 1997; Jerkegren et al., 1999; Vail-Smith & Felts, 1993) have indicated high responses from similar populations. Eighty questionnaires were distributed to the lay groups with an expected response rate of less than 50%.

Results

The overall response rate was 55% (183 replies) comprising 45% of oncologists (27 replies), 59% of oncology nurses (27), 64% of general nurses (45), 41% of medical students (33), and 64% of lay people (51) canvassed. Demographics are summarized in Table 1 with results of inquiries regarding skin type, sunbathing, and sunscreen use.

Data were captured in spreadsheet format before being transferred to the SPSS® statistics package (SPSS Inc., Chicago, IL) for descriptive analysis. The mean scores for each population group in each of the three variables (exposure, protection, and knowledge) were calculated (see Table 2). A “Behavior” score was calculated by subtracting the percentage exposure score from the percentage protection score—a lower score indicating worse melanoma-prone behavior. Analysis of variance (ANOVA) with post hoc comparison (Scheffe’s Test) was used to examine differences among the five populations, between sexes, and

Table 1. Demographic Data on Five Patient Groups Together With Results of Skin Type and Sunscreen Inquiries

Variable	Oncologists n (%)	Oncology Nurses n (%)	General Nurses n (%)	Medical Students n (%)	Lay Public n (%)
Respondents					
Male	11 (41)	4 (15)	4 (9)	12 (36)	17 (33)
Female	16 (59)	23 (85)	41 (91)	21 (64)	34 (67)
Age group (years)					
18–30	10 (37)	8 (30)	19 (42)	32 (97)	16 (31)
31–45	16 (59)	19 (70)	17 (38)	1 (3)	10 (20)
46–60	1 (4)	–	9 (20)	–	10 (20)
Older than 60	–	–	–	–	15 (29)
Skin type					
White	20 (74)	25 (93)	39 (87)	23 (70)	49 (96)
Indian	4 (15)	–	–	3 (9)	–
Chinese	1 (4)	–	–	2 (6)	–
Afro-Caribbean	1 (4)	1 (4)	3 (7)	2 (6)	1 (2)
Mediterranean	1 (4)	1 (4)	3 (7)	3 (9)	1 (2)
Sunscreen use					
Usually	19 (70)	19 (70)	25 (56)	15 (46)	23 (45)
Sometimes	4 (15)	5 (19)	10 (22)	5 (15)	9 (18)
Rarely	2 (7)	3 (11)	5 (11)	7 (21)	5 (10)
Never	2 (7)	–	5 (11)	6 (18)	14 (28)
How often do you sunbathe with the intention of getting a tan?					
Never	11 (41)	4 (15)	9 (20)	11 (33)	9 (18)
Rarely	6 (22)	11 (41)	14 (31)	5 (15)	22 (43)
Occasionally	7 (26)	9 (33)	18 (40)	9 (28)	11 (22)
Quite often	3 (11)	2 (7)	3 (7)	7 (21)	6 (12)
Very often	–	1 (4)	1 (2)	1 (3)	3 (6)

Note. Because of rounding, percentages may not total 100.

among age groups (Scheffe, 1959). Pearson's correlation coefficient was calculated to assess any correlation between knowledge and behavior.

Exposure

General nurses had the highest mean exposure score (9.02), and respondents aged 18–30 closely followed ($\bar{X} = 8.95$). No significant difference was found in exposure scores across the five populations, among age groups, or between sexes. Incidence of having been sunburned as a child ranged from 63% of oncologists to 39% of medical students. This may reflect a difference in generational behavior influenced by health promotion campaigns. Use of sun beds was generally low among all respondents. Only 41% of oncology nurses reported never

having used a sun bed in a lifetime, compared to 78% of oncologists.

Protection

Mean scores indicated that people older than 60, men, and lay people used the least protection, and oncology nurses had the highest score ($\bar{X} = 9.89$).

Significant difference was found in protection scores among groups and ages. Oncology nurses scored significantly higher than lay people ($p < 0.012$), indicating greater measures of skin protection taken. Those aged 18–30 scored significantly higher than those who were older than 60 ($p < 0.044$), as did those aged 31–45 ($p < 0.003$). People older than 60 were represented only in the lay population.

Table 2. Mean Scores for Each of the Five Groups Questioned

Variable	Oncologists	Oncology Nurses	General Nurses	Medical Students	Lay Public
Exposure (possible maximum = 28)	7.93	8.85	9.02	8.55	8.08
Protection (possible maximum = 15)	9.19	9.89	8.80	7.97	7.55
Knowledge (possible maximum = 18)	15.15	13.93	12.02	13.39	11.63
Behavior ^a	32.39%	34.31%	26.44%	22.32%	21.47%

^a Behavior score was derived for individual respondents as $(P/15 - E/28) \times 100\%$; lower scores indicate higher risk behavior.

Sunscreen was the protective method used most by all groups. Oncology nurses were the sole group to report that they all used sunscreen. Lay people were least likely to wear a hat (39%), and oncology nurses were most likely to do so (30%). Wearing light clothing was the least popular protective measure. Avoidance of the sun between midday and 2 pm was the second most popular measure taken by all groups to protect their skin from UV rays. Medical students were least likely to adopt this method of skin protection.

More than 50% of all respondents reported that their skin was “sometimes red, always tans.” Lay people were most likely to report that their skin always tans and never gets red (18%).

Knowledge

ANOVA demonstrated significant differences in knowledge scores among groups ($p < 0.001$) and ages ($p < 0.05$). Post hoc testing showed that oncologists scored significantly higher than nurses ($p < 0.001$) and lay people ($p < 0.001$) and oncology nurses scored significantly higher than lay people ($p < 0.013$). Those older than 60 scored significantly lower than those aged 18–30 ($p < 0.001$), 31–45 ($p < 0.001$), and 46–60 ($p < 0.041$). Questions tapping knowledge of signs that may be linked with a suspected malignant melanoma had a higher percentage of correct responses than those questioning risk behavior.

Behavior

Oncology nurses reported the lowest risk (least melanoma-prone) behavior and lay people the highest. Respondents older than 60 scored the lowest, indicating a high level of melanoma-prone behavior. None of these differences in behavior scores among groups or ages or between sexes was statistically significant.

Discussion

Early studies examining psychosocial factors in sunbathing and sunscreen use in the United States reported that subjects' sun exposure was predicted by a variety of variables, including skin cancer knowledge. Keesling and Friedman (1987) showed sunscreen use to be positively related to skin cancer knowledge. Subsequent studies, however, have shown that regular use of sunscreen is low (only 7%–30% of sun seekers) and inadequate (Banks, Silverman, Schwartz, & Tunnessen, 1992; Leary & Jones, 1993). Prevention and control programs have been successful in increasing knowledge and awareness of skin cancer, but major changes in attitude and behavior have not occurred (Robinson et al., 1997).

The authors sought to identify any correlation between knowledge and sun protection, sun exposure, or melanoma-prone behavior. A questionnaire was designed comprising elements of validated instruments used by previous researchers and some unvalidated questions regarding respondents' knowledge of the relationship between sun exposure and malignant melanoma. Two of the variables (knowledge and behavior) are unvalidated measurements, although the knowledge questions were derived from published sources. Further useful experience would be derived from a larger study.

The study has several other limitations and potential sources of bias. No correction was made for nonresponse bias, and no effort was made to follow up with nonresponders or to define their characteristics. Nonresponders may practice the most high-risk (melanoma-prone) behavior. The lay group was the only population whose response was greater than anticipated. This may relate to individuals receiving the questionnaire by hand rather than mail; however, self-selection of those responding to any survey is a source of bias. Reasons for attending the hospital may have influenced their participation in the study, and they may not be representative of the lay population as a whole. Similarly, medical students may not be a representative sample of students in the United Kingdom with regard to knowledge of risk factors for melanoma and subsequent behavior.

An important weakness is the lack of an objective, valid, or reliable measure of UV radiation exposure or protection. The reliance on self-reporting represents a significant shortcoming, including recall bias (inability to remember or objectively assess the severity and duration of sunburn). A study of the reliability of sunburn history showed that data on sunburns must be interpreted with caution (Berwick & Chen, 1995). Responses to questions regarding intention to tan may be influenced by whether respondents tanned or not.

The Theory of Planned Behavior (Ajzen, 1988) was used to underpin this study. The theory has been shown to be useful for predicting behavior from intention, including assessing reasons for sun exposure (Sutton, 1997). The current study did not explore individual reasons for intentional sun exposure, but previous studies have found that the most common reasons for sunbathing are achieving a suntan and relaxation (Hillhouse, Stair, & Alder, 1996; Robinson et al., 1997; Vail-Smith & Felts, 1993). Level of knowledge appeared to be relatively high in the current study, and one would therefore expect the belief about outcome to be “sunbathing is bad for my health.” Similarly, because attitude toward any given behavior is based on evaluation of the outcome of that behavior, the outcome of sun exposure should be evaluated as “If I don't sunbathe, I'm less likely to get malignant melanoma.” Application of the Theory of Planned Behavior to this setting (using imaginary quotations) is illustrated in Figure 1.

The Theory of Planned Behavior predicts that subjective behavior is determined by an individual's beliefs about the opinion of others and his or her motivation to comply with that opinion. If this were true, the authors would expect low-risk behavior to be much more prevalent where respondents have a relatively high knowledge of expert opinion of the risks of exposure to UV radiation. The results of the study, however, show no correlation between knowledge and behavior scores, and they are not, therefore, consistent with the predictions derived from this theory.

All groups in the study continued to expose themselves intentionally to undesirable amounts of UV radiation, despite their universally high awareness of risk factors for malignant melanoma. Intentional UV exposure through sunbathing and the use of sun beds is influenced more by perceived benefits, such as feeling attractive and healthy. Knowledge of risk factors for melanoma does not lead to sun-protective behavior. These findings are consistent with studies by Jerkegren et al. (1999), Stott (1999), and Martin (1995).

Attitudes regarding behavior are based on

- Beliefs about outcome
 - “Sun exposure is bad for my health.”
- Evaluations regarding outcome
 - “If I don’t expose myself in the sun, I am less likely to get melanoma.”

Subjective norm for behavior is based on

- Beliefs about the opinions of others
 - “My friends think that sunbathing is bad for you.”
- Motivation to comply with that opinion
 - “I want people to value me, so I will not get a suntan.”

Perceived behavioral control

- Taking account of past experience and anticipated obstacles
 - “I work outdoors.”

Figure 1. Application of the Theory of Planned Behavior to Typical (Imaginary) Responses to Questions About Behavior and Sun Exposure

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For more information . . .

- Sun Protection
www.sunprotection.org
- Parents’ Guide to Sun Protection for Children: The ABCs for FUN in the SUN
www.aad.org/pamphlets/ABCsFunSun.html

Links can be found at www.ons.org.