Characteristics of swimming pools with high rates of objectively measured sunscreen use

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Background: A combination of verbal reports, observations, and physical assessments can improve understanding of prevention programs.

Objective: Skin swabbing techniques were used to detect the presence of sunscreen as part of a sun protection measurement study at 16 swimming pools. Three pools demonstrated much higher sunscreen use (>95%) than the others (47.1%). This paper compares these three pools to the other 13 to examine whether they have common features and if different sources of data can help interpret the findings.

Methods: Data were collected from skin swabs detecting the presence of sunscreen; observations of participants; observations of pool environments; and surveys.

Results: Pool observations showed a higher use of shade structures, sun safety signs, and other supporting items at the three high—sunscreen use pools. These three pools had significantly more year-round and long-term employees than did the other 13 pools.

Limitations: Sunscreen characteristics could not be determined using the swabbing technique. Publicity about the study, or the weather, may have influenced behaviors at the pools.

Conclusions: Supportive environments were associated with consistent high levels of sunscreen use. This study also confirms the importance of using multiple data sources to interpret findings. (J Am Acad Dermatol 2009;60:684-8.)

Interventions to improve sun safety in communities include efforts to change individuals' sun safety practices and sun-safe environments and policies.[1] A major challenge in studying the effects of interventions to prevent skin cancer is the great reliance on individuals' verbal reports of both behavior and environments.[2] Ideally, research should use a combination of verbal reports, observations, and physical assessments to measure sun safety practices and environments, and this information should be triangulated to better describe the results of prevention programs.[2]

METHODS

Skin swabbing techniques were used to detect the presence of sunscreen on lifeguards, parents, and children as part of a measurement study to examine the validity of self-reported sun protection behaviors with objective measures at 16 swimming pools participating in the Pool Cool sun safety diffusion study. Three of the 16 pools demonstrated much higher sunscreen use than the others. This paper compares these three pools to the other 13 using multiple data sources to see if they have common features and to examine whether the different sources of data can help interpret these findings.

The 16 pools in this study were already participating in a nationwide diffusion trial of the Pool Cool sun safety program. Pool Cool is an educational and environmental intervention for swimming pools that was evaluated and found to have significant positive effects on sun protection behaviors, on sun safety environments,[3] and on

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reducing sunburns among lifeguards.[4] The program has been widely disseminated across the country and is being evaluated in a multiyear diffusion trial funded by the National Cancer Institute (CA92505-S1). Half the pools in the diffusion trial were randomly assigned to a "basic" condition, and half to an "enhanced" condition. The pools in the basic condition received a tool kit containing a leader's guide that describes how to implement the program, teaching materials (lesson cards, visual aids, activity materials, etc), a large dispenser of sunscreen, some incentives for lifeguards (lanyards, pens, etc), and an aluminium "sunscreen tips" display sign. Enhanced pool sites received the same information and materials as the basic sites plus additional sun safety resources, including Pool Cool incentive items (hats, ultraviolet light–sensitive stickers, water bottles, etc), additional sun safety signs, and possibly a shade structure. The enhanced pools were also given written guidance and technical assistance on how to make Pool Cool more effective and how to increase sustainability, and they participated in an incentive program that enabled their pools to earn prizes (extra Pool Cool items, sunscreen, etc) as incentives for high levels of participation in the program.

Four regions participated in the measurement study: Austin, Texas; Phoenix, Arizona; Omaha, Nebraska; and Portland, Oregon. Regions were stratified by latitude (north–south) and study arm (basic–enhanced), and each region had at least 6 Pool Cool study pools with a minimum of 15 lifeguards each and least 15 parent/child pairs with children 5 to 10 years of age taking swimming lessons at each pool.

Procedures

Recruitment targets for the measurement study were established based on statistical power calculations. The goal was to collect completed data for at least 10 parents, 10 children, and 10 lifeguards at each of the 16 pools in the study; or a total of 480 participants. All parents and their children were enrolled in the study in pairs. Each eligible parent/child pair consisted of one parent (or legal guardian) and his/her 5- to 10-year-old child enrolled in swimming lessons. Eligibility criteria for lifeguards were being employed at the pool and on site during the data collection period.

MEASURES

Sunscreen use

Objective measures of sunscreen use were collected through participant skin swabs completed on one weekday morning and one weekend morning, using previously tested procedures.[6-8] All participants (lifeguards, parents, and children) were swabbed four times, once each on the arm and leg on day 1 (weekday), and again on day 2 (weekend). Results were combined and recoded to create a variable for any sunscreen detection on day 1 (arm or leg) and a variable for any sunscreen detection on day 2 (arm or leg). Day 1 and day 2 results were then combined to create a third variable indicating any sunscreen detection over both days. The number of participants at each pool wearing sunscreen on either day was computed as a percentage of total study participants at the pool.

Observations of sun-safe behavior

Researchers observed what participants were wearing at the time of skin swabbing for the following categories: headgear, sunglasses, and upper body. The response options for each category were as follows: headgear—nothing, cap/visor, brimmed hat/legionnaire, other; sunglasses—yes or no ("yes" was noted even if sunglasses were on a participant's head or around his/her neck; "no" was marked if sunglasses were not visible at all); upper body (males)—nothing, tank top, short sleeves, long sleeves, other; upper body (females)—bikini top, one-piece, tank top/tankini, short sleeves, long sleeves, other.

Observations of sun-safe behavior were dichotomized (yes or no) for all three variables (hat, shirt, and sunglasses). "Hat use" was recoded to classify the use of any type of hat (yes = cap/visor, brimmed hat/legionnaire; no = nothing). Upper body clothing was recoded from six categories to identify the use of a "shirt with sleeves" (yes = short sleeves, long sleeves; no = nothing, bikini top, one-piece, tank top/tankini). The Statistical Package for Social Sciences (SPSS Inc, Chicago, IL) crosstabs procedure was used to compute χ^2 statistics for each sun-safe behavior (hats, shirts, and sunglasses) at each day of observation among the three high–sunscreen use pools, among participants (lifeguards, parents, and children), and between the three high–sunscreen use pools and the other 13 pools.

Interrater reliability was assessed by having two researchers independently observe and record participants' sun protection habits on separate forms. Reliability was calculated for day 2 (the weekend day) of data collection at the study sites in Austin and Phoenix. The following results were found for each category: headgear, n = 289, 97% agreement, κ = 0.87; sunglasses, n = 287, 97% agreement, κ = 0.86; and upper body, n = 291, 98% agreement, κ = 0.89.

Observations of pool environments and field notes

Systematic observations of pool environments were recorded at each of the 16 pools, including information about the availability of sunscreen, the number of shade structures, and the observable practices of the lifeguard staff. Research staff also kept freehand field notes to record information that described their field experience in more detail at each pool site.

Pool manager surveys

As part of the main Pool Cool diffusion study, and independent of the measurement validation study, surveys of pool managers were collected for each pool that provided descriptive information about the pool and its surrounding community and information about pool policies and programs.[5] Questions on the surveys asked about the description of the surrounding community (urban, suburban, and rural) and its population size (<49,000 to >1,000,000), the size of each pool's user population (weekly summer admissions), the number of staff, average length of staff employment, how often the pool sponsored special events, and whether their supervisory organizations supported their efforts. A series of questions asked about sun safety programs for lifeguards and educational activities in swim lessons, and whether the pool provides sunscreen and shade, posts sun-safety signs and ultraviolet light ratings, and provides special activities like skin cancer screenings for its patrons. Finally, pool managers were asked to rate the importance of various supporting factors for sun safety (risk management, community demand, and community relations) and potential obstacles (limited budget, lack of information, and facility design).

Data analysis

Descriptive statistics were computed from all 16 validation study pools for each of the data collection methods described above: skin swabbing, observations, field notes, and pool manager surveys. χ^2 tests were used for comparisons of observations of sun-safe behavior within the three high−sunscreen use pools and also between the three high−sunscreen use pools and the other 13 pools.

RESULTS

Participation

Nine hundred ninety three eligible participants (390 parent/child pairs = 780 + 213 lifeguards) were approached across the 16 pools. Of the 993 approached, 631 consented to participate (64%; 223 parent/child pairs + 185 lifeguards). The most common reasons given for declining to participate included: not willing or available to return for data collection and lack of interest. Of the 631 participants who agreed to participate, 564 or 89% completed the study (201 parent/child pairs + 162 lifeguards).

Sunscreen use

Sunscreen was detected on more than 95% of participants at three pool sites (n = 111)—two in Phoenix and one in Portland. The detection rates at these three pools were 97.6% (Phoenix, pool #1); 97.5% (Phoenix, pool #2); and 100% (Portland, pool #3). Sunscreen was only detected on 47.1% (N = 467) of participants at the other 13 pools in the measurement validation study. A summary of detection rates can be found in Table I.

Eight of the pools in the measurement study were from the enhanced (or intervention) arm, of the diffusion trial, and eight were from the basic (or control) arm. All three pools that demonstrated greater than 95% sunscreen use were from the enhanced (intervention) arm of the main Pool Cool diffusion study. A comparison of all participants (parents, children, and lifeguards) in both groups revealed that a significantly higher proportion of those in the enhanced group were detected wearing sunscreen compared to those in the basic group (73% vs. 42%; χ^2 (1 d.f.) = 59.15; $P < .0001$).

Observations of sun-safe behavior

Wearing shirts with sleeves (67%) was the most commonly observed sun-safe behavior among participants at the three high−sunscreen use pools. Participants were also observed wearing sunglasses (43%) and hats (10%). There were no statistically significant differences in observed sun-safe behavior among the three high−sunscreen use pools.

There were also no statistically significant differences in sun-safety behavior observations between the three high−sunscreen use pools and the other 13 pools with the exception of sunglasses. Participants at the three high−sunscreen use pools were almost twice as likely to be wearing sunglasses on either day of observation—45% compared to 24% on day 1 ($P <$ .001) and 41% compared to 23% on day 2 ($P < .001$).

Field notes

Characteristics of the high−sunscreen use pools were recorded in the field notes at all three pools. Free sunscreen was available for use by pool staff and patrons at each of these three pools and was conveniently located, highly visible, and easily accessible, usually near the entrance to the pool and/or the entrance to an office or break room. Shade was prevalent at these pools, with large umbrellas on the

Table I. Percentage of participants detected wearing sunscreen on days 1 or 2

Region	Pool(s)	Lifeguards % (n)	Parents % (n)	Children % (n)	Total % (n)
Phoenix, AZ (south; enhanced)	Pool 1	100 (11)	93.3 (15)	100 (15)	97.6 (41)
	Pool 2	100 (12)	100 (14)	92.9 (14)	97.5 (40)
Portland, OR (north; enhanced)	Pool 3	100 (14)	100 (15)	100 (15)	100 (44)
Remaining 13 pools		48.9 (139)	42.1 (164)	50.6 (164)	47.1 (467)

deck for patrons, umbrellas on the lifeguard stands, picnic tables located under awnings, and occasional trees or walls providing additional shade. Pool Cool sun safety signs were visibly displayed throughout the pool area (ranging from 1-5 signs). Lifeguards were observed wearing hats, shirts, wetsuits, sunglasses, and various Pool Cool incentive items (lanyards, hats, water bottles, etc). Lifeguards were also observed applying sunscreen at two of the three pools. Research staff reported that pool staff at these three pools were very familiar with the Pool Cool program, and that they were particularly enthusiastic about the validation measurement research and helpful in recruiting participants to be swabbed.

In contrast, shade was observed and described as being minimal at seven of the 13 other pools, five of the 13 did not have any sun safety signs posted around the pool premises, and lifeguards at five of the 13 pools were not observed wearing any of the Pool Cool incentive items (lanyards, hats, water bottles, etc).

Pool manager surveys

Self-reported surveys filled out by the pool managers also showed several common characteristics among the three high–sunscreen use pools. All three pools were large, each admitting more than 500 patrons per week during the summer, and each having between 40 and 80 staff members. Staff at each pool was mostly seasonal; however, the average length of employment was reported as 3 to 5 years for each pool, suggesting relatively high stability among the pool staff from summer to summer.

Policies and sun-safe behaviors at these pools showed similar common traits. All three pools reported that their pool sponsored special activities, such as water safety days, either occasionally or often, and that their supervisory organizations supported their efforts either mostly or completely. All three pools also provided sun safety programs for lifeguards and educational activities in swim lessons either often or usually/always, and each provided shade for their patrons and posted sun safety signs either often or usually/always. Two of the three pools also provided sunscreen for their patrons usually or always.

When asked how important various supporting factors were for choices or plans regarding sun safety at the pool, all three pools reported that health concerns, risk management, and community relations were very important, and community demand was either somewhat important or very important for each pool.

It is also worth noting that none of the three pools posted ultraviolet light ratings at their facility, and two of the three had no plans to conduct special activities, such as skin exams, at their facility. When asked about potential obstacles for choices or plans regarding sun safety, two of the three pools reported that having a limited budget was a very important obstacle for them, suggesting that while money is indeed perceived as an important factor, it is obviously not necessary in order to have a sun-safe pool environment.

There were no statistically significant differences found between the three high–sunscreen use pools and the other 13 pools with regard to pool/staff size, number of patrons, community type/size, or pool programs/policies. However, there were significant differences in staff employment (number of years and year-round vs. seasonal). The managers who filled out the surveys at the three high–sunscreen use pools averaged 6.67 years of employment at their respective pools compared to 1.67 years for the other 13 managers ($t = 4.57$, 13 d.f.; $P < .001$). Managers at the three high–sunscreen use pools were also more likely to report that some or most of their lifeguard staff were seasonal compared to managers at the other 13 pools, most of whom reported that all their staff were seasonal ($P = .04$).

CONCLUSION

The two most notable findings regarding the three high–sunscreen use pools suggest that continuity of staff employment (particularly managers) and level of participation in the Pool Cool program may be influencing the high use of sunscreen at these pools (either directly or indirectly). Each of the three high–sunscreen use pools had managers who had

been employed at the pool for at least 3 years and at least some staff who were not seasonal (ie, they were year-round employees), suggesting some consistency and continuity of pool programming, policies, and sun safety knowledge. The three high—sunscreen use pools were also from the enhanced arm of the Pool Cool diffusion study, and these pools used or displayed significantly more shade, sun safety signs, and other Pool Cool items (all of which were provided in greater quantities to the enhanced pools in the diffusion study) than the other 13 pools, suggesting that increased levels of participation in the Pool Cool program may also be a factor.

The strengths of this study lie in its use of multiple data sources for interpretation, both objective (skin swabbing, behavioral observations, and field notes) and self-reported (pool manager surveys). Any interpretation and possible explanation of the high—sunscreen use discovered at these three pools would have been difficult without the additional information provided by the field notes and pool manager surveys.

The swabbing technique used only indicated the presence or absence of sunscreen. It did not determine the sunscreen's sun protection factor or whether the sunscreen was applied or reapplied properly to all parts of exposed skin surface. Also, it is unknown exactly how much attention or publicity preceded the arrival of the Pool Cool staff at each pool, and therefore it is unknown to what extent their presence may have had on behavior at each facility. However, there is no reason to believe that these three pools were different from the others in this respect. Variations in weather on data collection days may have also influenced behavior, either at the three high—sunscreen use pools or at other 13 pools in the measurement validation study. However, there were other pools in each of the two regions of interest where data collection occurred on the same days.

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