Changing Patterns of Sun Protection Between the First and Second Summers for Very Young Children

Lori Steinberg Benjes, MD; Daniel R. Brooks, ScD, MPH; Zi Zhang, MB, MPH; Lisa Livstone, MPH; Linda Sayers, RN; Catherine Powers, EdD; Donald R. Miller, ScD; Timothy Heeren, PhD; Alan C. Geller, MPH, RN

Objectives: To determine if an intensive intervention directed to mothers of newborns would increase levels of sun protection practice and lower rates of sunburning for their children; and to examine changes in sun protection practices and burning rates experienced between the first and second summers of life.

Design: Randomized study.

Setting and Participants: Mothers of infants residing in the coastal town of Falmouth, Mass.

Intervention: Mothers were randomly selected to receive hospital education alone or hospital education plus tailored materials and telephone counseling.

Main Outcome Measures: Child’s sun protection practices and degree of skin damage at mean ages 6 and 18 months, as reported by the mother.

Results: Baseline surveys were completed by 108 mothers; 92 (85%) of the mothers completed posttests. There were few differences between intervention and control groups in use of sun protection for infants from the first summer (mean age, 6 months) to the second summer (mean age, 18 months). The child’s routine use of hats, shirts, and shade dropped substantially from the first to the second summer. Conversely, sunscreen use rose from 34% to 93% (P < .001) for both groups during the same period. During the first summer, 22% of children received a sunburn or tan compared with 54% during the second summer (P < .001).

Conclusions: Comprehensive sun protection begins to decline at a much earlier age than previously reported. Future studies should focus on parents’ beliefs about the need for, and practice of, vigilant sun protection as their children grow from infancy to toddlerhood.

Arch Dermatol. 2004;140:925-930

Many of the 1.3 million skin cancers diagnosed in the United States are caused by excessive and unprotected exposure to the sun.1 Painful sunburns during childhood are particularly important in the development of melanoma.2-4 Despite numerous federal recommendations for safe sun practices, at least two thirds of US children are not adequately protected from the sun.5-7 For these reasons, it has been suggested that sun protection habits should begin early in life and be taught as part of routine preventive health care.7-10

A community-wide skin cancer education campaign in the coastal town of Falmouth, Mass, (population, 30,000) resulted in a marked reduction in sunburns experienced by children aged 6 years or younger.11 A maternity nurse–led intervention for 187 postpartum mothers at a newborn nursery in Falmouth was one component of the effort.12 One year after this intervention, we contacted the same mothers in Falmouth and found that 90% recalled the informational program and equal numbers stated that receiving the educational materials in the newborn nursery was timely.12

Because the education in the newborn nursery was a generic, standardized introduction to sun protection during a hectic time for new mothers, we proposed a more personal, specific intervention that could reach mothers when they were more settled at home and better able to master a parenting skill.

We hypothesized that mothers randomized to individualized sun protection prevention strategies would demonstrate higher levels of sun protection practice and lower rates of sunburning for their child compared with those receiving only education in the newborn nursery. Furthermore, we were interested in examining changes in sun protection prac-
tices and burning rates experienced between the first and second summers of life for the combined cohort of intervention and control families. Information provided from this study could potentially expand research on the early acquisition of parents’ sun protection skills.

METHODS

DESIGN AND SETTING

In the 24 to 48 hours after delivery, maternity nurses at Faulmouth Hospital counseled mothers to provide as much shade as possible for their infants, avoid the sun during peak hours, and protect their children with sun hats, umbrellas, pants, long-sleeve shirts, and sunscreen after 6 months of age. After receiving the nurse-led education, mothers were asked by a maternity nurse to participate in a study testing the effectiveness of additional “booster” doses of sun protection education during the next 12 months. This study was approved by the Boston Medical Center Institutional Review Board.

PROCEDURES

Participating mothers of newborn children were recruited in the first 6 months of 1998, and they completed baseline surveys in September and October 1998. Surveys were conducted in the fall to maximize parental recall of sun protection practices and exposures during the most recent summer. Infants ranged in age from 3 to 9 months at the time their mothers completed the baseline survey. Families were randomized to intervention and control groups after completion of the baseline survey. Beginning in the spring of 1999, mothers in the intervention group received a telephone call of at least 15 minutes from one of us (L.S.B.) and two 4-page RayBuster newsletters. Highlights of the telephone call and materials included health benefits of sun protection, specific instructions for use of sunscreen and protective clothing, solutions to mothers’ specific difficulties with sun protection, and personalized sun protection suggestions from the study director. Materials were created based on needs identified in the baseline survey and were tested with 5 mothers of young children who were not involved in the study. Mothers in the control group were not provided any additional information beyond that provided by the maternity nurse.

In September and October 1999, 12 months after completion of the first survey, mothers in both groups completed follow-up surveys regarding experiences during the second summer after the birth of their child.

MEASURES AND SCALES

Primary Outcomes

The 2 key outcome measures were differences from one summer to the next in (1) mothers’ practice of a series of sun protection behaviors for their child (wearing a hat, wearing a long-sleeve shirt, staying in the shade, and using sunscreen) and (2) mothers’ reporting of their child’s sunburning and tanning. Use of protective clothing, shade, and sunscreen was reported as “always,” “often,” “sometimes,” “rarely,” or “never.” Sunburns were classified as “never,” “once and slight,” “once and mild,” “once and severe,” “twice,” or “more than twice.” Tanning was reported as “none,” “minimally and with difficulty,” “light brown,” “moderately brown,” or “dark brown or black.” Using a checklist with these same measures, a local pediatrician recorded tanning and sunburning of the skin for 31 children whose mothers completed the pretest survey.

Secondary Outcomes

Secondary outcomes included the program’s effect on mothers’ own protective behaviors for themselves and their knowledge and attitudes regarding protection for themselves and for their child. In the postintervention survey only, we also measured mothers’ vigilance in protecting their child from the sun, which included the following variables: type of hat worn, use of umbrella for stroller, reapplication of sunscreen, use of sunscreen before going outside, body sites of sunscreen application, volume of sunscreen used, and possession of sunscreen in the diaper bag or car. Responses were summarized in a vigilance scale, and mothers scoring below and above the median scale score were categorized into sporadic and routine users of sun protection, respectively.

COVARIATES

Additional questions on each survey addressed mothers’ and their child’s sensitivity to the sun, mean hours per week spent outdoors by children during the past summer, and mothers’ knowledge about skin cancer risk, attitudes regarding skin coloring, degree of confidence in protecting their child from the sun, and self-perceived ease of applying sunscreen to their child.

STATISTICAL ANALYSIS

We created dichotomous categories for each of the primary outcome measures. Sun protection practices were classified as routine if they were practiced “always” or “often”; all other responses were classified as sporadic. Sunburning and tanning were classified as any vs none. We also created a measure of skin damage, classified as any report of either sunburn or tan vs neither sunburn nor tan.

Within each study group, change in outcome over time was described as the difference in percentage from baseline to follow-up. We measured the effect of the intervention by comparing the intervention and control groups on this change in percentage. We then calculated a z statistic to test the difference between the intervention and control groups by subtracting the change in percent in the control group from the change in percent in the intervention group, and dividing this difference by its standard error, based on the standard errors of the 2 paired differences in proportions13:

\[ z = \frac{[P_{I,2} - P_{C,2} - (P_{I,1} - P_{C,1})]}{\sqrt{SE(P_{I,1} - P_{C,1})^2 + SE(P_{I,2} - P_{C,2})^2}}, \]

where \( P_{I,1} \) and \( P_{C,1} \) refer to the proportion with the outcome at follow-up in the intervention and control group, respectively; \( P_{I,2} \) and \( P_{C,2} \) refer to the proportion with the outcome at baseline in the intervention and control group; \( \sqrt{SE(P_{I,1} - P_{C,1})^2 + SE(P_{I,2} - P_{C,2})^2} \), the standard error of the difference in paired proportions in the intervention group and control groups.

We also evaluated changes from the first to second summers in sun protection practices and sunburning, tanning, and skin damage among the combined intervention and control groups. We combined the 2 groups because any between-group differences were modest compared with differences between the 2 periods. We used McNemar test for paired proportions to determine the \( P \) value for the difference between baseline and follow-up for each outcome measure.

RESULTS

One hundred sixteen mothers were approached and asked to participate in the study. Baseline surveys were completed by 108 mothers; 45 (83%) of 54 intervention mothers and 47 (87%) of 54 control mothers completed fol-
Analyses in this study are limited to the 92 mothers (85%) who completed both surveys.

**BASELINE DESCRIPTION OF COHORT**

The age distribution of the 92 mothers was 17 to 24 years (15% [14/92]), 25 to 34 years (59% [54/92]), and 35 to 45 years (26% [24/92]) (Table 1). Sixty-seven percent [61/91] had some education beyond high school. Seventy-eight percent [72/92] of mothers had fair or very fair skin. Thirty percent [28/92] of mothers received a sunburn during the summer before the baseline survey. Most mothers (83%) believed that a child was most attractive if his or her skin stayed its natural skin color, although only 5% of mothers considered natural color to be attractive for themselves. Almost all respondents (96%) recollected receiving sun protection materials at the hospital, and 91% had read the materials. The mean age of children was 6 months (range, 3-9 months) at baseline and 18 months (range, 15-21 months) at follow-up. Eighty-one percent of children had fair or very fair skin. Differences between intervention and control groups were generally modest.

**COMPARISONS BETWEEN STUDY GROUPS**

Fourty-six percent of intervention mothers improved their knowledge scores compared with 35% of control mothers ($P = .22$). There were no differences in the perception of attractiveness for the child or for the mother or in the difficulty in protecting oneself from the sun (data not shown).

There were few differences between intervention and control groups in percentage change in use of sun protection from the first to the second summer (Table 2). Routine use of hats, shirts, and shade dropped from the first to the second summer in both groups. The percentage who stayed in the shade experienced the largest drop but was consistent in the 2 groups (33% decrease in the intervention group and 26% decrease in the control group, $P = .58$). Conversely, sunscreen use rose 62% in the intervention group and 56% among controls ($P = .60$).

The proportion of mothers reporting child sunburning increased from 7% to 14% in the intervention group compared with 7% to 28% in the control group ($P = .10$). We calculated the sample size necessary to detect a true difference of this magnitude with 80% power; we found that it would have been necessary to have 130 participants in each of the 2 groups. Rates of tanning increased from 14% to 45% in the intervention group compared with 17% to 37% in the control group. Consequently, the increase in skin damage (tanning plus burning) was substantial in the intervention and control groups (32% and 43% increase, respectively; $P = .37$). In the examination of children at age 6 months, 1 of 31 children showed effects of tanning.

There were no overall differences between the 2 groups in sun protection practices of the mothers. Routine sunscreen use among intervention mothers increased 11% compared with 3% among control mothers. There were no differences between the 2 groups in mothers' reporting of personal sunburns or tanned skin (data not shown).

**POOLED ANALYSIS OF CHANGES IN SUN PROTECTION AND SKIN DAMAGE**

Sunscreen use increased, use of other forms of sun protection declined, and children’s skin damage increased between the first and second summers (Table 3). Between the first and second summers, 64 (70%) of the 92 mothers reduced their use of protective clothing and shading for their child, 17 (19%) maintained the same use, and 11 (12%) increased their use. Of the 64 mothers decreasing their use of protective clothing and shading for their child between the first and second summers, 67% increased the amount of sunscreen that they used for their child. By age 18 months, 93% of mothers routinely used sunscreen, despite the fact that mothers were 10% more likely to report difficulties with sunscreen application in the second summer. Among the 51 mothers whose child spent all of the time in shade during the first summer, 14% continued to report always keeping their child in the shade for the second summer, but shade use declined to often (38%), sometimes (38%), rarely (6%), and never (4%) for the remainder.

There were substantial changes in skin damage between the first and second summers (Table 3). During the first summer, 78% of children neither sunburned nor tanned compared with only 46% during the second summer who stayed in the shade experienced the largest dropudy protection materials at the hospital, and 91% had read the materials. The mean age of children was 6 months (range, 3-9 months) at baseline and 18 months (range, 15-21 months) at follow-up. Eighty-one percent of children had fair or very fair skin. Differences between intervention and control groups were generally modest.

**Table 1. Baseline Demographics and Practices of 92 Mothers**

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Intervenion Group (n = 45)</th>
<th>Control Group (n = 47)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s age, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-24</td>
<td>7 (16)</td>
<td>7 (15)</td>
<td>14 (15)</td>
</tr>
<tr>
<td>25-54</td>
<td>28 (62)</td>
<td>26 (55)</td>
<td>54 (59)</td>
</tr>
<tr>
<td>35-45</td>
<td>10 (22)</td>
<td>14 (30)</td>
<td>24 (26)</td>
</tr>
<tr>
<td>Mother’s education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ High school</td>
<td>13 (30)</td>
<td>17 (36)</td>
<td>30 (33)</td>
</tr>
<tr>
<td>Some college</td>
<td>17 (39)</td>
<td>10 (21)</td>
<td>27 (30)</td>
</tr>
<tr>
<td>≥ College graduate</td>
<td>14 (32)</td>
<td>20 (43)</td>
<td>34 (37)</td>
</tr>
<tr>
<td>Have other children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26 (58)</td>
<td>30 (64)</td>
<td>56 (61)</td>
</tr>
<tr>
<td>No</td>
<td>19 (42)</td>
<td>17 (36)</td>
<td>36 (39)</td>
</tr>
<tr>
<td>Mother’s skin color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very fair</td>
<td>3 (7)</td>
<td>8 (17)</td>
<td>11 (12)</td>
</tr>
<tr>
<td>Fair</td>
<td>32 (71)</td>
<td>29 (62)</td>
<td>61 (66)</td>
</tr>
<tr>
<td>Brown</td>
<td>10 (22)</td>
<td>10 (21)</td>
<td>20 (22)</td>
</tr>
<tr>
<td>Child’s sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>29 (64)</td>
<td>25 (53)</td>
<td>54 (59)</td>
</tr>
<tr>
<td>Female</td>
<td>16 (36)</td>
<td>22 (47)</td>
<td>38 (41)</td>
</tr>
<tr>
<td>Mother’s response to sun exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn readily</td>
<td>24 (53)</td>
<td>26 (55)</td>
<td>50 (54)</td>
</tr>
<tr>
<td>Burn minimally</td>
<td>14 (31)</td>
<td>14 (30)</td>
<td>28 (30)</td>
</tr>
<tr>
<td>Barely</td>
<td>2 (4)</td>
<td>6 (13)</td>
<td>8 (9)</td>
</tr>
<tr>
<td>Not burn at all</td>
<td>5 (11)</td>
<td>1 (2)</td>
<td>6 (7)</td>
</tr>
</tbody>
</table>

*Data are given as number (percentage). Totals vary because of missing data.

Vigilant sun protection, measured only at follow-up, was 82% in the intervention group compared with 61% in the control group ($P = .02$). There was no association between mothers’ vigilance and their child’s skin damage.

Sunscreen use increased, use of other forms of sun protection declined, and children’s skin damage increased between the first and second summers (Table 3). Between the first and second summers, 64 (70%) of the 92 mothers reduced their use of protective clothing and shading for their child, 17 (19%) maintained the same use, and 11 (12%) increased their use. Of the 64 mothers decreasing their use of protective clothing and shading for their child between the first and second summers, 67% increased the amount of sunscreen that they used for their child. By age 18 months, 93% of mothers routinely used sunscreen, despite the fact that mothers were 10% more likely to report difficulties with sunscreen application in the second summer. Among the 51 mothers whose child spent all of the time in shade during the first summer, 14% continued to report always keeping their child in the shade for the second summer, but shade use declined to often (38%), sometimes (38%), rarely (6%), and never (4%) for the remainder.

There were substantial changes in skin damage between the first and second summers (Table 3). During the first summer, 78% of children neither sunburned nor tanned compared with only 46% during the second sun-
mer (\(P<.001\)). In the first summer, no child received a sunburn and a tan; 7 children both sunburned and tanned in the second summer. We found no differences in routine use of sun protection between children who did not tan or burn at all during the second summer (46%) vs those who either burned or tanned (54%) (data not shown).

Although skin damage increased, the number of hours of reported sun exposure did not increase from baseline to follow-up. Overall, 76% of children spent more than 5 hours per week outdoors during their first summer compared with 73% during their second summer.

The experiences and findings from this study bring to light a critical period when comprehensive sun protection starts to wane and skin damage in very young children begins to increase. Positive associations between intervention group participation and reduced sunburning appear to provide enough evidence to warrant a new trial with a larger sample size and other settings. Future studies should focus on parents’ beliefs about the need for, and practice of, vigilant sun protection as their child grows from infancy to toddlerhood.

Our data suggest that children in the intervention group experienced less increase in rates of sunburns, but it appears that this was partly offset by greater increases in tanning rates. We can only speculate that intervention mothers became more aware of the effects of burning but did not vigilantly protect their child to prevent tanning. This finding raises a question as to whether only complete avoidance of the sun during peak hours or the most vigilant practice of sun protection can prevent tanning in very young children. Nonetheless, coupled with reduced sunburning, higher vigilance scores in the intervention group suggest possible effects from the intervention. However, we could not account for changes in parental vigilance because these questions were only asked of mothers at posttests.

The overall analysis of the 92 families’ experiences in the first and second summers revealed 2 major findings. First, skin damage rates increased from 22% in the first summer for 6-month-olds to 54% in the second summer for 18-month-olds (\(P<.001\)), despite more than 90% of mothers reporting that they routinely used sunscreen in the second summer. Second, it appears that lack of full protection in the child’s second summer rather than increased sun exposure resulted in more sunburning and tanning; that is, use of hats, long-sleeve shirts, and shade dropped substantially for children between ages 6 months to 18 months in both study groups, despite efforts that consistently publicized total and comprehensive sun protection. Sunscreen use nearly tripled between the first and second summer, while protective clothing use dropped by 15% and shade use declined by more than a third. The shift to sunscreen use may be linked to the mothers’ difficulties in keeping hats and shirts on their child and the unavailability of fully shaded playgrounds and pool sites once their toddlers are mobile and more independent minded. Alternatively, sunscreen use may have increased as mothers became less concerned about its safety with young children during the second summer, or because of the mothers’ perception that sunscreen alone is adequate sun protection, to the exclusion of other sun protection measures. Interestingly, the use of sunscreen increased, despite mothers’ reporting greater difficulties in sunscreen application when their child was 1 year older.

The effects of the intervention are likely limited because of earlier community-wide education efforts directed toward intervention and control mothers.11 Before the present study, Falmouth residents received an intensive sun protection campaign, enhanced by mandatory, individualized maternity nurse counseling on sun protection at the newborn nursery.12 These activities would have already encouraged child sun protection practices by new mothers in Falmouth, and identifying an additional effect of the mothers’ intervention would have required a far larger sample size or perhaps a more intensive intervention.

In the present study, one half of the mothers received booster education, including personalized mailings and telephone calls to reinforce the earlier sun protection messages. Mothers were encouraged to model, teach, and reinforce various sun protection strategies for their child beginning at a very early age. We anticipated that unprotected sun exposure would carry with it the negative consequences of a painful sunburn and that mothers would wish to avoid sunburn for their child and themselves.

Our intervention (customized materials and telephone counseling) was grounded in the following 4 major approaches that effect individual change:

The empirical-rational strategy assumes that individuals are rational and therefore uses the dissemina-

### Table 2. Changes in Types of Sun Protection Used by Mothers for Their Children During Mean Ages 6 to 18 Months

<table>
<thead>
<tr>
<th></th>
<th>Intervention Group (n = 45)</th>
<th>Control Group (n = 47)</th>
<th>(P) Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Posttest</td>
<td>Change</td>
</tr>
<tr>
<td>Wear hat‡</td>
<td>73</td>
<td>64</td>
<td>-9</td>
</tr>
<tr>
<td>Wear shirt‡</td>
<td>73</td>
<td>62</td>
<td>-11</td>
</tr>
<tr>
<td>Stay in shade‡</td>
<td>89</td>
<td>56</td>
<td>-33</td>
</tr>
<tr>
<td>Any skin damage</td>
<td>36</td>
<td>58</td>
<td>22</td>
</tr>
<tr>
<td>Any burn</td>
<td>7</td>
<td>14</td>
<td>7</td>
</tr>
</tbody>
</table>

*Data are given as percentage.
†Test for percentage change in intervention group minus change in control group.
‡Always or often.
tion of information to increase their knowledge about a behavior and its consequences.14

The Health Belief Model focuses on how the individual reacts to this information and states that people will adopt a healthier behavior if (1) they believe they are susceptible to the problem, (2) the problem they are trying to avoid is serious, and (3) the action they take will reduce the negative outcome.15

Social Learning Theory,16 a precursor of the widely applied Social Cognitive Model,17 illustrates how children may learn behavior from their parents. In addition to their own direct experience, children may learn what behaviors are appropriate by observing how people around them behave and whether this behavior is rewarded.

These theories were based on the following tenets: (1) behavior is learned through interaction with and observation of our environment and (2) behavior is altered by the expected reward or punishment received. Individuals may learn vicariously from "models," particularly those with whom they identify.16,17 Parents influence their child's health beliefs and behaviors directly by taking care of them and providing access to medical care, and indirectly through their parenting behaviors and by modeling what may be positive or negative health behaviors.18

The Transtheoretical Model of Behavior Change19 embodies the idea that each individual is at a different stage of readiness to adopt a particular change in behavior and that health messages should be tailored according to the "stage of change." For example, for a mother who believed that a tan was a sign of healthy skin, we might have begun the intervention with a discussion about the damaging effects of UV light, rather than a discussion of the use of a chemical sunscreen vs physical sunblock, which might be reserved for the mother aware of the effect of suntanning and already using sunscreen routinely. Baseline survey questions assessed each mother's stage of readiness19 to adopt sun protection skills for her child. The results were used to tailor the intervention to the appropriate stage for each individual.

We anticipated that combining education in the newborn nursery with follow-up telephone counseling and tailored newsletters would be a novel avenue by which to educate mothers of newborns on sun protection. Mothers are more receptive to educational counseling during this early part of their child's lives, and this increased receptivity may be a portal through which health providers can educate mothers on how to protect their child from excessive sun exposure.20,21 Delivery of motivational strategies in the context of telephone counseling has been used with success for smoking cessation, breast cancer screening, and compliance with colposcopy after cervical cancer screening.22,23 The advantage of the newsletters was that mothers could read selective portions according to their stage of change.

Individualized telephone counseling affords the mother of a newborn the opportunity to ask questions about the care of her infant. It serves to reinforce and expand on education that takes place in the newborn nursery, thereby strengthening the initial message. The telephone intervention was designed to focus the mother on the process of thinking about or practicing sun protection skills for her child, depending on where the mother was in the process of acquiring sun protection skills. The study was also set against the backdrop of increasing local and national attention to comprehensive sun protection programs such as the American Cancer Society's Slip, Slop, Slap messages and the Centers for Disease Control and Prevention's Choose Your Cover campaign, which affected the mothers' stage of change, as measured in the baseline surveys.

Our finding that a high level of parental sunburning is associated with a child's sunburning is in agreement with previous findings in older children.11 Sunburning rates and sun protection use by families of very young children vary by location of study. Rates for children in this study are similar to those found for young children in a large US study.24 An Australian study25 found that a third of 6-month-olds had experienced a sunburn and 15% had experienced painful sunburn. In another Australian cohort of women and infants, 93% of children were shaded usually or always and 64% had sunscreen applied.26 A mother's own sun protection methods predicted the method of sun protection that she would most likely use for her child. A study27 in Europe found routine use of protective clothing dropped by more than 50% from age 1 to 6 years; the present study would indicate that substantial declines in sun protection occur in the first 2 years.

All measures used in this analysis were obtained from self-reported surveys of parents and are thus subject to well-known limitations.13 Although objective physical examination data (documentation of visible sunburn or suntan, tan lines, lentigines, and nevi) were meticulously collected by one of the Falmouth Hospital pediatricians to corroborate mothers' self-reports, these data were only collected in one third of subjects. Unfortunately, there was no more objective means available for measuring sun exposure, suntanning, other skin damage, or sun protection practices. Exposure to the intervention might have influenced parents at follow-up to give the right answers to questions, but higher rates of skin damage than one would have expected slightly mitigate this concern. Questions using the stages of change model have been reliably tested in other sun protection investigations,28 but another study29 found lower stability for stages of

Table 3. Change in Types of Sun Protection and Skin Damage for Children During Mean Ages 6 to 18 Months*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pooled Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>Sun protection</td>
<td></td>
</tr>
<tr>
<td>Wear hat</td>
<td>79</td>
</tr>
<tr>
<td>Wear shirt</td>
<td>77</td>
</tr>
<tr>
<td>Stay in shade</td>
<td>86</td>
</tr>
<tr>
<td>Apply sunscreen</td>
<td>34</td>
</tr>
<tr>
<td>Skin damage</td>
<td></td>
</tr>
<tr>
<td>Never burned, never tanned</td>
<td>78</td>
</tr>
<tr>
<td>Never burned, ever tanned</td>
<td>15</td>
</tr>
<tr>
<td>Ever burned, ever tanned</td>
<td>0</td>
</tr>
<tr>
<td>Ever burned, never tanned</td>
<td>7</td>
</tr>
</tbody>
</table>

*Data are given as percentages. †McNemar test.

©2004 American Medical Association. All rights reserved.
change related to sunlight exposure. Further research needs to be conducted regarding their use with mothers of young children, as recent findings in the exercise and dietary fields have shown certain limitations.

There is much debate as to whether sunscreen should only be used to complement protective clothing and shading or as an equally essential component of a safe sun strategy. Ultimately, we are most interested in learning what types of sun protection are necessary to prevent sun damage, such as sunburning and tanning. To date, there have been no trials comparing the ability of sunscreen alone vs other types of sun protection to reduce sun damage. Moreover, randomized studies of various behavioral interventions (directed to the individual, family, community, or some combination thereof) would make an invaluable contribution to this emerging field.

Earlier findings have suggested that ages 9 to 12 are critical years when children begin to show independence from their parents regarding sun protection and, concomitantly, sun protection rates begin to drop. Although this study is limited by small numbers, it suggests that comprehensive sun protection begins to decline and skin damage increases at a much earlier age. The reasons for this decline are manifold but may include the child’s earliest signs of independence, different parental perceptions about their child’s susceptibility to sunburning, or an increase in the proportion of parents who believe that sunscreen is the strongly preferred method for sun protection (perhaps coupled with less than fully effective use). If these findings of sun protection and skin damage changes between infancy and toddlerhood were to be borne out in larger studies, it would suggest that efforts to promote a safe sun strategy embracing multiple methods of sun protection, most notably shading, must be carefully reevaluated, focusing on the parents and caregivers of very young children. Sun protection habits must be taught as part of routine preventive health care and in school settings, but bolstered again in preadolescent and adolescent years, when such habits are known to deteriorate.

Accepted for publication November 25, 2003.

We thank Richard Adams, MD, for his contributions to the data collection process.

Correspondence: Alan C. Geller, MPH, RN, Department of Dermatology, School of Medicine, Boston University, Doctor’s Office Building 801A, 720 Harrison Ave, Boston, MA 02118 (ageller@bu.edu).

REFERENCES