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Melanoma Risk Estimation Based on Objective Measures as a Complement to Self-Assessment

ADAM CARLSSON and MAGNUS FALK

Department of Health, Medicine and Caring Sciences Linköping University, Linköping, Sweden

Abstract. *Background/Aim: A variety of self-tests addressing individual skin cancer risk are available online. These are generally based on self-estimated measures, such as self-rated skin sensitivity to sun exposure, affecting its reliability. The aim of this study was to investigate whether the addition of objective variables, by means of ultraviolet (UV) sensitivity phototesting and nevi count, could be of contributory value for the composition of a comprehensive risk score for skin cancer, and whether the use of such a score could contribute to change of behavior in the sun after assessment of individual risk. Patients and Methods: A sample of 70 voluntary participants, all university students, were recruited for the study. The participants rated their sun exposure habits by filling out the Sun Exposure and Protection Index (SEPI) questionnaire, and their skin UV-sensitivity was decided both by self-estimation, using Fitzpatricks's skin type scale, and objectively, by the performance of a UV-sensitivity phototest. Finally, the number of pigmented nevi on the lower arm was counted both by the participants themselves and by a trained observer. A cumulated skin cancer risk score was calculated on the basis on these three variables (sun habits, UV-sensitivity and nevi count), and the outcome compared whether based on the participants' self-assessments or on the objective assessment. The individual risk score, based on objective measures, along with a tailored sun protection advice, was communicated to the participants, and after three weeks they once again filled-out the SEPI part addressing propensity to increase sun protection. Results: The results showed good correlation between the self-assessed and trained observer performed nevi count, but poor agreement between self-estimated and objectively measured skin UV-sensitivity. For the cumulative risk score, the self-performed score was on average slightly lower than its reference, but no systematic difference could be observed. At follow-up, high-risk individuals showed a significant decrease in total SEPI score ($p<0.05$). Conclusion: Objective assessment of nevi count and skin UV-sensitivity might be of significant value when estimating individual skin cancer risk, in order to communicate tailored sun protection advice.*

The incidence of skin cancer has been continuingly increasing over many years. This is true both for malignant melanoma as well as for basal cell carcinoma and squamous cell carcinoma (1, 2). The single most predisposing factor for developing skin cancer is exposure to ultraviolet (UV) radiation from the sun or from other artificial sources such as tanning beds (1, 3), which in turn is enhanced in the presence of other predisposing factors, including family history of the disease, high numbers of melanocytic nevi, presence of dysplastic nevi, fair skin, blue or green eyes, and red or blond hair (3). Whereas these predisposing factors cannot be altered, behavior in the sun certainly can, being the major target for primary prevention efforts. The challenge in this respect is for relevant healthcare providers to properly communicate measures of prevention and motivate people as to why it is important, and how to override possible obstacles to appropriate sun protection (4, 5). An important aspect in this regard is to identify and direct preventative action to those who need it the most, *i.e.* individuals with certain genotypic/phenotypic predispositions and/or a risky behavior, which is a key element of what is often described as tailored advice (6).

To date, a variety of self-tests addressing the possibility to obtain a personal risk score expressing the likelihood of developing different forms of skin cancer (within a given time interval) are available online (7-11). Although ambitious and to some extent probably fairly reliable, they all have the disadvantage that they rely on subjective, self-reported measurements, which in general include variables such as Fitzpatrick's classification of tendency to burn and tan (12), as well as some kind of counting procedure of number of pigmented nevi on a given body site. It is a

Correspondence to: Magnus Falk, Linköping University, Department of Health, Medicine and Caring Sciences, 581 83 Linköping, Sweden. Tel: +46 708106176, Fax: +46 13288909, e-mail: magnus.falk@liu.se

Key Words: Malignant melanoma, tailored advice, questionnaire, sun habits, ultraviolet radiation.

Table I. *Algorithm for calculating skin cancer risk level based on Sun exposure habits based on sun exposure and protection index (SEPI), Skin UV-sensitivity by phototest and Nevi count.*

Risk factor variable	Risk level			
	Low=1 point	Intermediate=2 points	High=3 points	Weight
Sun exposure habits (Total score on SEPI part 1)	0-13	14-19	>19	×1.5
Skin UV-sensitivity (Number of phototest erythemas)	0-2	3-4	>4	×2
Nevi count (Number of nevi on forearm)	0-7	8-15	>15	×3

common and well-known phenomenon that people tend to underestimate their sensitivity to UV radiation (13-15), with the possible outcome of not protecting themselves sufficiently. Although widely accepted, several studies have reported that there is a poor correlation between Fitzpatrick's classification and actual UV-sensitivity assessed by objective measures, such as by phototesting (14-18). If possible to create a risk score to a lesser degree dependent on subjective measurements, it would probably benefit the prerequisites to succeed with preventive efforts, or at least, to direct these efforts to the individuals in most adequate need of them.

The aim of this study was to investigate whether the addition of objective variables, by means of UV-sensitivity phototesting and nevi count, could be of contributory value for the composition of a comprehensive risk score for skin cancer. The study also sought to investigate whether the use of such a score could contribute to change of behavior in the sun after assessment of individual risk.

Patients and Methods

Study population. Participants were recruited in a population of university students in Linköping during the spring of 2018. Four selected University classes at the Medical Faculty at Linköping University were given a short oral presentation of the study and could thereafter, if interested to participate, schedule an appointment to receive phototesting and inclusion in the study. At this appointment they were also given a more detailed, written study information about the study before deciding whether to participate. In addition to this recruitment procedure, students from any classes were also recruited at a small booth that was set up at two public places at the Medical Faculty, and were there given the same oral study information and possibility to schedule an appointment for further information. As inclusion criteria, participants had to be aged 18 years or older and registered as students at the Linköping University. Known abnormal photosensitivity, intake of any photosensitizing drugs or previous sunbathing abroad or in a tanning bed during the last four weeks were exclusion criteria. Ethical approval for the study was obtained from the Regional Ethical Review Board in Linköping before study onset, and all participants gave there signed informed consent before taking part in the study.

Data collection and skin cancer risk categorization. Data collection aiming to resemble information for categorization of skin cancer risk profile consisted of three elements: (i) Sun exposure behaviour, (ii) skin UV-sensitivity and (iii) nevi count. Whereas sun exposure behaviour was based solely on self-reported measures, by means of the participants filling-out the validated SEPI (Sun Exposure and Protection Index) questionnaire (19), skin UV-sensitivity was assessed both by use of self-estimation of tendency to burn and tan according to Fitzpatrick's classification (12) and by objective UV-sensitivity measurement by phototesting. Similarly, nevi count was decided both by the participant's themselves counting the number of pigmented nevi on their lower arm, and by control counting performed by a trained observer (one of the authors, A.C.). Each of the three risk elements were categorized into three risk levels (Table I), in the cases of skin UV-sensitivity and nevi count based on the objective assessments (phototest result and number of nevi counted by the trained observer). The individual contribution of melanoma risk between these three elements have in previous studies been considered a factor of approximately times 1.5-2 for high UV exposure, a factor of times 2 for skin UV-sensitivity, and a factor of times 3-5 for high nevi count (for each element in relation to not having any of the risk factors) (11, 20), which was used to calculate a combined risk score on the basis of these, with a possible maximum score of 19.5 points. More thorough description of the assessment of each element is described under the following subheadings. The individual skin cancer risk level (based on the objective assessment) was communicated to the participants by regular mail, together with a tailored sun protection advice based on their scoring results.

Sun exposure and protection. The SEPI questionnaire comprises two parts (19). Part 1 addresses the individual behavior in the sun and holds eight questions, each with five possible answer alternatives scored from 0-4 points, thus with a maximum total score of 32 points. A higher total score corresponds to a less protective and – with regard to skin cancer – riskier behavior in the sun. Part 2 measures the propensity to increase sun protection, and contains five questions, also on a 0-4 point scale, *i.e.* with maximum 20 points in total. In this case, a higher total score corresponds to a low of propensity to take greater precautions in the sun. Consequently, a high score in both parts of the questionnaire indicates that the respondent has a high exposure to UV radiation, and at the same time a low propensity to take precautions in order to reduce this exposure. At inclusion, the participants filled in both part 1 and 2 of the SEPI. After approximately three weeks, and after they had been presented with their comprehensive individual skin cancer risk

Table II. *Study population characteristics at baseline, displayed for responders versus non-responders.*

	Responders n (%)	Non responders n (%)	*p*-Value Chi^2-test
Gender			0.79
Men	21 (43%)	10 (48%)	
Women	28 (57%)	12 (52%)	
	n	n	Mann-Whitney *U*-test
Age			0.81
Mean	24	23.5	
Median	23	24	
SEPI 1 total score			0.15
Mean	16.0	17.6	
Median	16	18	
SEPI 2 total score			**<0.05**
Mean	9.4	11.6	
Median	9	12	
Nevi count (by objective assessment)			0.29
Mean	12.2	8.5	
Median	10	7	
UV-sensitivity, self-estimated (Fitzpatrick's classification, type 1-5)			
Median	3	3	0.20
UV-sensitivity, objective by phototest (number of phototest reactions)			
Median	4	4	0.25
Cumulated risk profile			0.12
Mean	12.5	11.4	
Median	12.5	11	

Bold value indicates statistical significance.

profile, they were asked to fill-out part 2 of the SEPI once again, and send it back in an enclosed prepaid envelope, in order to investigate any change in propensity to increase sun protection after the intervention.

Skin UV-sensitivity by self-estimation. Fitzpatrick's classification of skin type was used to estimate self-rated UV-sensitivity. The method is widely accepted and frequently used for the purpose (12). The six skin type categories, describing the ability to burn and tan, of which the participants chose the one closest to their own preferences, are as follows:

Skin type 1: always burns, never tans
Skin type 2: usually burns, tans minimally
Skin type 3: sometimes mild burn, tans uniformly
Skin type 4: rarely burns, always tans well
Skin type 5: moderately pigmented brown skin, very rarely burns, tans very easily
Skin type 6: deeply pigmented dark brown to black skin, never burns, tans very easily

Skin UV-sensitivity by phototesting. Objective measurement of individual skin UV-sensitivity was made by the performance of a UVB phototest (Dermalight 80 MED tester, A.L.T Lichtterapitechnik, Germany). The phototest device has six quadratic UV-light emitting fields, each 12×12 mm in size. The source of the broadband fluorescent UV light was a Philips PL 9W/12, and the differentiation of UV-dose in each field achieved by a metal grid of varying density. The test was applied on the inside of the upper arm of the participant, with an exposure time of 25s. This gave the separate UV doses 18, 35, 51, 63, 82 and 105 mJ/cm^2, respectively. The participants were instructed to read the phototest themselves after 24 hours, by counting the number of erythematous reactions from the test, and report their test result by responding to an e-mail received the following day. Besides functioning as a reminder to read the test, the e-mail also contained a repeated instruction how to perform the test reading. The instruction made clear that even a slightly visible erythema should be counted, an assessment that has in previous studies shown to be reliable (21, 22).

Nevi count. Each participant was then instructed to count the number of nevi on their lower arm, from the elbow and below, including the hand. They were advised not to let someone else help them to count. No information regarding what defines a nevi were given. The result was reported on a specified form. The trained observer the made a blinded control count on the same arm, without knowledge of the participant's own counting result.

Statistical analyses. Weighted Kappa analysis was used to analyse the agreement between self-estimated and phototest measured UV-sensitivity. In the analysis, matching of the six skin type levels according to Fitzpatrick (type 1-6, see above) was tested against the corresponding decreasing number of phototest reactions (5-0

reactions), in both cases thus reflecting a progression from high to low UV-sensitivity. Linear regression analysis was to investigate the correlation between the self-assessed nevi count and the blinded control count. Finally, a Bland-Altman plot was used to visualise the differences between the combined risk score based on subjective versus objective measures.

Results

Of approximately 300 individuals receiving the initial information, 70 agreed to participate. Of these, twenty-one did not respond to the follow-up questionnaire, leaving 48 responders to complete the full study (baseline + follow-up). Table II presents the demographic characteristics and baseline outcomes, displayed for responders and non-responders, respectively. Except for SEPI part 2 score, for which responders had a slightly but statistically significantly lower score (p=0.01) there were no significant differences between the two groups.

Agreement between self-estimated UV-sensitivity and phototest results. Agreement between the participants' self-estimated skin type according to Fitzpatrick and the result of the phototest was explored using weighted Kappa analysis. Results showed poor correlation between the two methods (weighted kappa value 0.05). No participants reported having Fitzpatrick's skin type 5 or higher, and no participants presented with more than five erythemas from the phototest.

Correlation between self-assessed nevi count and control count. Figure 1 shows a plot of the correlation between self-assessed nevi count, by means of number of nevi on the lower arm, and the corresponding control count performed by the trained observer. Linear regression analysis showed moderately strong correlation between the two assessment methods (R^2=0.62, p<0.001).

Comparison between skin cancer risk based on subjective versus objective measures. Figure 2 is a Bland-Altman plot showing the distribution of the difference in combined risk score, based on sun exposure habits (SEPI 1 score), UV-sensitivity and nevi count, according to whether self-performed by the participants or objectively (by phototest and control count of nevi). As can be seen in the plot, there was no systematic difference in direction of scoring outcome between the two methods, although the self-performed score was on average slightly lower than its reference.

Propensity to increase sun protection at follow-up. Table III presents the mean SEPI part 2 score at baseline and at follow-up (after the participants had been presented with their cumulated risk score). In the total population of participants responding to the follow-up questionnaire, a significant increase in propensity to seek the shade during midday was seen (p<0.01), but not for any of the other variables or for the total SEPI part 2 score. When analyzing the responders according to the combined risk score (based on the objective assessment), dichotomized by the median score (12.5 points), results show at follow-up that high-risk individuals had not only significantly increased their propensity to seek the shade (p<0.05), but also showed a significantly decrease in total SEPI part 2 score (p<0.05).

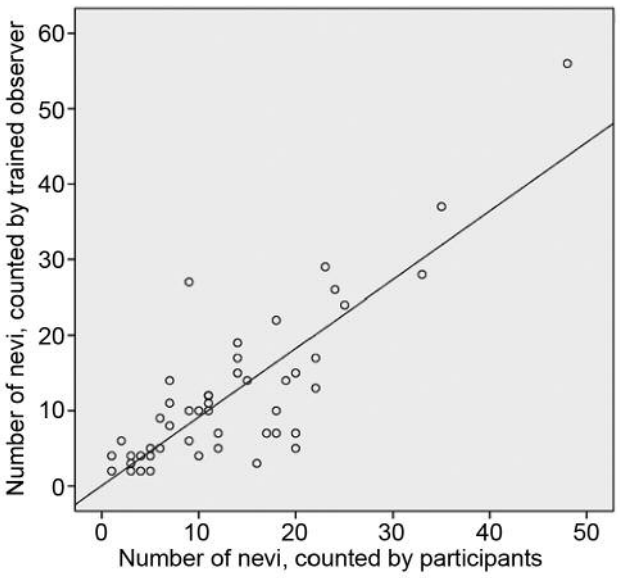

Figure 1. *Plot of the correlation between self-assessed nevi count, by means of counting the number of nevi on the lower arm, and the corresponding control count performed by the trained observer.*

Discussion

This study illustrates a model for skin cancer risk estimation based not solely on self-reported measures, but mainly on objective measures, by means of phototesting and nevi count, also illustrating that the outcome of such a procedure may differ from that based on subjective measures. The results give some indication that a risk score purely based on self-assessment may to some extent be misleading and risk to misdirect efforts of sun protective advice from individuals in particular need for it to others with a lesser need, and vice versa. A number of such self-report based risk calculation instruments are available on the internet, with the advantage of being easy available, but for patients attending relevant healthcare providers, *e.g.* primary care centers or dermatology clinics, more reliable instruments would be beneficial. The approach suggested in the present study provides some novel information in this direction.

The good correlation (R^2=0.62, *i.e.* slightly below 0.7 which is commonly defined as strong correlation) between

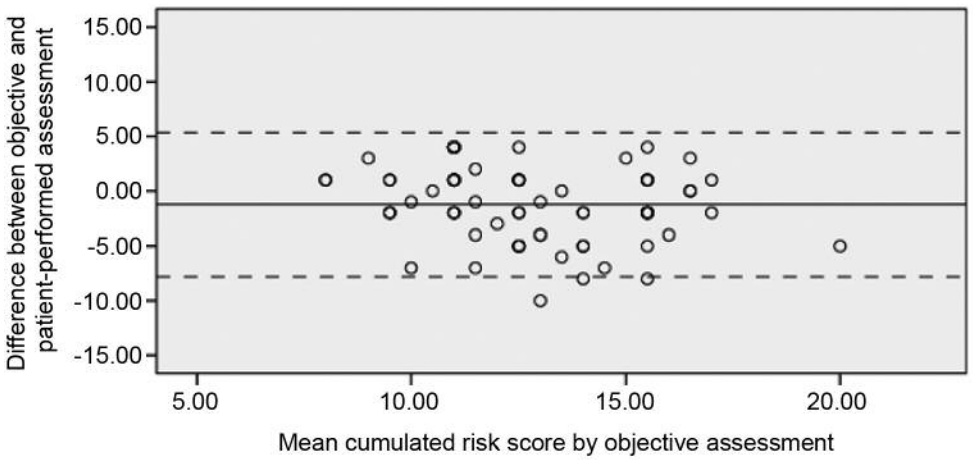

Figure 2. *Bland-Altman plot of the difference in cumulated risk score, according to whether it is based on solely patient-performed or objective assessment.*

Table III. *Propensity to increase sun protection, reflected in sun exposure and protection index (SEPI) part 2 total score at baseline and at follow-up. A high score reflects a low propensity to increase sun protection.*

	SEPI part 2 score (baseline)		SEPI part 2 score (follow-up)		*p*-Value (Wilcoxon signed rank test)
	Mean	Median	Mean	Median	
All responders (n=48)					
Giving up sunbathing	2.29	3	2.1	2	0.78
Use of sunscreen	0.63	0	0.67	0	0.75
Use of protective clothing	2.27	2	2.24	2	0.93
Use of protective headwear	2.27	3	2.12	2	0.39
Staying in the shade	2.02	2	1.59	1	**<0.01**
Sepi 2 total score	9.39	9	8.82	9	0.085
Responders with low cumulated risk score					
Giving up sunbathing	2.20	3	2.04	2	0.41
Use of sunscreen	0.64	0	0.76	0	0.41
Use of protective clothing	2.20	2	2.24	2	0.81
Use of protective headwear	2.24	2	2.32	3	0.59
Staying in the shade	1.96	2	1.64	1	0.087
Sepi 2 total score	9.24	9	9.08	10	0.82
Responders with low cumulated risk score					
Giving up sunbathing	2.38	3	2.17	2.5	0.27
Use of sunscreen	0.63	0	0.58	0	0.74
Use of protective clothing	2.33	3	2.25	2	0.77
Use of protective headwear	2.29	3	1.92	2	0.16
Staying in the shade	2.08	2	1.54	1.5	**<0.05**
Sepi 2 total score	9.54	10	8.54	9	**<0.05**

Bold values indicate statistical significance.

nevi count performed by the participants themselves and the trained observer indicates that self-reported nevi count is likely to be a sufficiently reliable measure, whereas self-reported skin UV-sensitivity, on the other hand, and in concordance with previous studies, appears to be considerably more arbitrary (15-18). Thus, risk calculation instruments based on the sum of several different measures, among which UV-sensitivity is usually one of these, would benefit in accuracy from the possible addition of objective quantification of UV-sensitivity, by use of phototesting, as an alternative to traditional classification of skin type according to Fitzpatrick, if available. Regarding nevi count,

one might speculate on whether the results might have been different if the study had been performed in a population of higher age, where for instance other nevi-like skin lesions such as seborrheic keratosis is very common, and for the individual person probably in many cases difficult to discriminate from melanocytic lesions, with a potential risk for considerable over-rating of nevi count. Thus, it is uncertain to which extent the study outcome is in this respect representable for a general population.

The comprehensive scoring model applied in this study was based on three risk factor aspects: Sun exposure habits, UV-sensitivity and nevi count. Other important variables frequently used when estimating skin cancer risk are pervious history of skin cancer, heredity for melanoma and phenotypical characteristics such as eye and hair colour, freckles and occupation (3). It is in this respect important to emphasize that the risk scoring model exemplified in this study is not a presentation of a complete and optimal instrument, but rather a way to illustrate how objective measures can be utilized to improve the accuracy of any instruments to estimate individual skin cancer risk.

It is interesting that the study participants reported a somewhat higher propensity to increase their sun protection after having received information about their individual skin cancer risk, although the change was only statistically significant for seeking the shade during midday. The possible effect of the intervention was more pronounced among individuals informed to be in the higher risk interval, which seems appropriate since they would also be the ones likely to benefit the most from increased sun protection. However, it is important to note that the study was not randomized, why it cannot be ascertained that increased readiness to protect more from the sun observed in the results was actually an effect of the intervention *per se* (*i.e.* the communicated tailored sun protection advice) or just a general effect of taking part in a study, although similar intervention effects from tailored advice have been shown also in a previous, in that case randomized, study among primary care patients (23).

This study would have benefitted from having a larger sample size. Unfortunately, within the available time frames for performing the study, we did not fully manage to recruit the desired number of participants. A contributory reason behind this is probably, to some extent, the time and effort required to take part, each participant needing to schedule an appointment to go through with the phototesting, a circumstance that may have prevented a few people from taking part in the study. Therefore, it would be desirable for the study to be reproduced in a larger population, if possible also in a broader age interval, and optimally, using a randomized intervention study design. Also, the somewhat lower SEPI part 2 score (meaning higher propensity to take on sun protective actions) observed for responders than for non-responders (Table II) might indicate a component of selection bias, possibly to some extent affecting the results, or how to interpret them.

In conclusion, objective assessment of nevi count and skin UV-sensitivity might have a place when estimating individual skin cancer risk, in order to appropriately communicate tailored sun protection advice.

Conflicts of Interest

The Authors have no conflicts of interest to report.

Authors' Contributions

Adam Carlsson: Project planning, data collection, statistical analyses, interpretation of results and manuscript writing. Magnus Falk: Project planning, statistical analyses, interpretation of results, manuscript writing and main project supervision.

References

1 Rastrelli M, Tropea S, Rossi CR, and Alaibac M: Melanoma: epidemiology, risk factors, pathogenesis, diagnosis and classification. In Vivo 28(6): 1005-1112, 2014. PMID: 25398793.

2 Che G, Huang B, Xie Z, Zhao J, Yan Y, Wu J, Sun H and Ma H*:* Trends in incidence and survival in patients with melanoma, 1974-2013. Am J Cancer Res *9(7)*: 1396-1414, 2019. PMID: 31392077.

3 Markovic SN, Erickson LA, Rao RD, Weenig RH, Pockaj BA, Bardia A, Vachon CM, Schild SE, McWilliams RR, Hand JL, Laman SD, Kottschade LA, Maples WJ, Pittelkow MR, Pulido JS, Cameron JD, Creagan ET and Melanoma Study Group of the Mayo Clinic Cancer Center: Malignant melanoma in the 21st Century, Part 1: Epidemiology, risk factors, screening, prevention, and diagnosis. Mayo Clin Proc *82(3)*: 364-380, 2007. PMID: 17352373. DOI: 10.4065/82.3.364

4 Henrikson NB, Morrison CC, Blasi PR, Nguyen M, Shibuya KC and Patnode CD: Behavioral Counseling for skin cancer prevention: A systematic evidence review for the U.S. preventive services task force. Agency for Healthcare Research and Quality (US); 2018. Report No.: 17-05234-EF-1.2018. PMID: 29697227.

5 Hedevik H, Guorgis G, Anderson CD and Falk M: Sustainable effect of individualised sun protection advice on sun protection behaviour: a 10-year follow-up of a randomised controlled study in primary care. BJGP Open *29(3)*: 3, 2019. PMID: 31344682. DOI: 10.3399/bjgpopen19X101653

6 Grossman DC, Curry SJ, Owens DK, Barry MJ, Caughey AB, Davidson KW, Doubeni CA, Epling JW Jr, Kemper AR, Krist AH, Kubik M, Landefeld S, Mangione CM, Silverstein M, Simon MA and Tseng CW: Behavioral counseling to prevent skin cancer. JAMA *319(11)*: 1134-1142, 2018. PMID: 29558558. DOI: 10.1001/jama.2018.1623

7 Olsen CM, Pandeya N, Thompson BS, Dusingize JC, Webb PM, Green AC, Neale RE, Whiteman DC; QSkin Study: Risk stratification for melanoma: Models derived and validated in a purpose-designed prospective cohort. J Natl Cancer Inst *110(10)*: 1075-1083, 2018. PMID: 29538697. DOI: 10.1093/jnci/djy023

8 Fears TR, Guerry D, Pfeiffer RM, Sagebiel RW, Elder DE, Halpern A, Holly EA, Hartge P and Tucker MA: Identifying individuals at high risk of melanoma: A practical predictor of absolute risk. J Clin Oncol *24(22)*: 3590-3596, 2006. PMID: 16728488. DOI: 10.1200/JCO.2005.04.1277

9 Coups EJ, Manne SL, Ohman Strickland P, Hilgart M, Goydos JS, Heckman CJ, Chamorro P, Rao BK, Davis M, Smith FO and Thorndike FP: Randomized controlled trial of the mySmartSkin web-based intervention to promote skin self-examination and sun protection behaviors among individuals diagnosed with melanoma: study design and baseline characteristics. Contemp Clin Trials *83*: 117-127, 2019. PMID: 31255801. DOI: 10.1016/j.cct.2019.06.014

10 Usher-Smith JA, Kassianos AP, Emery JD, Abel GA, Teoh Z, Hall S, Neal RD, Murchie P and Walter FM: Identifying people at higher risk of melanoma across the U.K.: a primary-care-based electronic survey. Br J Dermatol *176(4)*: 939-948, 2017. PMID: 28009060. DOI: 10.1111/bjd.15181

11 Davies JR, Chang YM, Bishop DT, Armstrong BK, Bataille V, Bergman W, Berwick M, Bracci PM, Elwood JM, Ernstoff MS, Green A, Gruis NA, Holly EA, Ingvar C, Kanetsky PA, Karagas MR, Lee TK, Le Marchand L, Mackie RM, Olsson H, Østerlind A, Rebbeck TR, Reich K, Sasieni P, Siskind V, Swerdlow AJ, Titus L, Zens MS, Ziegler A, Gallagher RP, Barrett JH and Newton-Bishop J: Development and validation of a melanoma risk score based on pooled data from 16 case-control studies. Cancer Epidemiol Biomarkers Prev *24(5)*: 817-824, 2015. PMID: 25713022. DOI: 10.1158/1055-9965.EPI-14-1062

12 Fitzpatrick TB: The validity and practicality of sun-reactive skin types I through VI. Arch Dermatol 124: 869-871, 1988. PMID: 3377516. DOI: 10.1001/archderm.124.6.869

13 Reeder AI, Hammond VA and Gray AR: Questionnaire items to assess skin color and erythemal sensitivity: reliability, validity, and "the dark shift". Cancer Epidemiol Biomarkers Prev *19(5)*: 1167-1173, 2010. PMID: 20447914. DOI: 10.1158/1055-9965..EPI-09-1300

14 Harrison SL and Büttner PG: Do all fair-skinned caucasians consider themselves fair? Prev Med *29(5)*: 349-354, 1999. PMID: 10564626. DOI: 10.1006/pmed.1999.0555

15 Falk M: Differences in sun exposure habits between self-reported skin type and ultraviolet sensitivity measured by phototest. Photodermatol Photoimmunol Photomed *27(4)*: 190-195, 2011. PMID: 21729167. DOI: 10.1111/j.1600-0781.2011.00599.x

16 Rampen FH, Fleuren BA, de Boo TM and Lemmens WA: Unreliability of self-reported burning tendency and tanning ability. Arch Dermatol *124(6)*: 885-888, 1988. PMID: 3377517.

17 Baron ED, Stern RS and Taylor CR: Correlating skin type and minimum erythema dose. Arch Dermatol *135(10)*: 1278-1279, 1999. PMID: 10522687. DOI: 10.1001/archderm.135.10.1278

18 Boldeman C, Dal H, Kristjansson S and Lindelöf B: Is self-assessment of skin type a valid method for adolescents? J Am Acad Dermatol *50(3)*: 447-449, 2004. PMID: 14988689. DOI: 10.1016/j.jaad.2003.08.009

19 Detert H, Hedlund S, Anderson CD, Rodvall Y, Festin K, Whiteman DC and Falk M: Validation of sun exposure and protection index (SEPI) for estimation of sun habits. Cancer Epidemiol *39(6)*: 986-993, 2015. PMID: 26547793. DOI: 10.1016/j.canep.2015.10.022

20 Berwick M, Buller DB, Cust A, Gallagher R, Lee TK, Meyskens F, Pandey S, Thomas NE, Veierød MB and Ward S*:* Melanoma epidemiology and prevention. Cancer Treat Res *167*: 17-49, 2016. PMID: 26601858. DOI: 10.1007/978-3-319-22539-5_2

21 Falk M and Anderson C: Reliability of self-assessed reading of skin tests: a possible approach in research and clinical practice? Dermatol Online J *16(2)*: 4, 2010. PMID: 20178700.

22 Lock-Andersen J and Wulf HC: Threshold level for measurement of UV sensitivity: reproducibility of phototest. Photodermatol Photoimmunol Photomed *12(4)*: 154-161, 1996. PMID: 9017791. DOI: 10.1111/j.1600-0781.1996.tb00192.x

23 Falk M and Anderson C: Prevention of skin cancer in primary healthcare: An evaluation of three different prevention effort levels and the applicability of a phototest. Eur J Gen Pract *14(2)*: 68-75, 2008. PMID: 18802808. DOI: 10.1080/13814780802423430

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