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Skin Cancer Prevention, Tanning and Vitamin D: A Content Analysis of Print Media in Germany and Switzerland

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Key Words
Skin neoplasms · Sunburn · Prevention · Ultraviolet rays · Sunscreening agents · Solaria · Vitamin D · Media · Newspapers · Magazines

Abstract
Background: Print media are a major source of health information. ***Objectives:*** To analyse press coverage related to skin cancer prevention. ***Methods:*** We conducted a content analysis of print media articles pertaining to skin cancer prevention, solaria and vitamin D published in Germany and Switzerland over a 1-year period between 2012 and 2013. ***Results:*** Overall, 2,103 articles were analysed. Applying sunscreen was by far the most common sun protection recommendation. A considerable number of articles on solaria and vitamin D advocated exposure to ultraviolet radiation to enhance physical appearance and vitamin D photosynthesis, often without mentioning any precaution measures. In total, 26.8% of the articles contained misleading or erroneous statements mostly related to sunscreen use and vitamin D issues. ***Conclusions:*** Print media can serve as powerful education tools to foster skin cancer prevention. However, misleading or erroneous reports may negatively impact sun-safe behaviour.

Introduction

Skin cancer represents the most frequent malignancy in Caucasian populations [1], although it is largely preventable by minimising exposure to solar and artificial ultraviolet radiation (UVR) [2, 3]. Common barriers to primary prevention (sun protection, avoidance of indoor tanning) include lack of awareness, perceived inconvenience, the pursuit of a tanned skin as well as widely unsubstantiated concerns about the safety of sunscreens and insufficient UVR-mediated vitamin D synthesis [4–7].

A summary of our results was presented in a plenary session and as a poster at the 15th World Congress on Cancers of the Skin, Edinburgh, September 3–6, 2014, and was subsequently published as an abstract in the British Journal of Dermatology.

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Print media are a major source of health information for the general public [8–11], playing a crucial role in improving knowledge, shaping attitudes and potentially modifying behaviours regarding sun protection and tanning [12, 13]. Considering that skin cancer is readily detectable and highly curable at an early stage, the popular press is moreover indispensable for the widespread communication of secondary prevention strategies (skin self-examinations, dermatological screening) [14]. Hence, newspapers and magazines can serve as inexpensive, powerful education tools to foster skin cancer prevention on multiple levels. However, misleading or erroneous reports hold the danger to create confusion and may even negatively impact sun-safe behaviour. In this context, particular mention must be made of unbalanced statements promoting intentional UVR exposure to enhance cutaneous vitamin D photosynthesis, albeit sufficient amounts of the vitamin can be obtained from diet, supplements and incidental protected sun exposure [15].

To gain a detailed insight into the content and quality of press coverage pertaining to skin cancer prevention and related topics (solaria, vitamin D), we conducted a comprehensive analysis of respective print media articles published in Germany and Switzerland over a 1-year period between 2012 and 2013.

Methods

Sample Selection

Two professional media-monitoring agencies (Rothenburg & Partner Medienservice GmbH, Germany, and ARGUS der Presse AG, Switzerland) prospectively identified print media articles pertaining to skin cancer prevention, solaria and vitamin D published in Germany and Switzerland over a period of 12 months between 2012 and 2013. The monitoring programmes covered the content from several thousand daily and weekly newspapers, general interest, special interest and specialist magazines. The complex search profiles included terms like 'skin cancer', 'malignant melanoma', non-melanoma skin cancer', 'sun protection', 'sunscreen', 'UV filters', 'solarium' and 'vitamin D', as well as corresponding synonyms.

We entirely read all retrieved articles and excluded them from further analysis if they focused on portrayal of individual skin cancer patients, cancer statistics, therapy (skin cancer, sunburn), 'sun allergy' or photosensitising substances. We did not consider articles with fewer than 4 relevant sentences, medical press, reader's letters, announcements and reports of events, and advertisements for specific products or institutions.

Coding Procedure

Using a standardised coding sheet, one author (D.R.) assessed the articles' descriptive characteristics (primary topic, publication source, length, authorship, target audience), content (presence or absence of predefined information) and quality (correct, misleading or erroneous information). Articles were defined as 'misleading' if they contained at least one statement that could lead readers to false conclusions without being demonstrably wrong (e.g. ambiguous wording, omission of important facts), and as 'erroneous' if they contained at least one statement that was factually incorrect according to the current state of science. All statements coded as misleading or erroneous were re-evaluated by a second author (C.S.).

Statistical Analysis

We summarised the extracted data using descriptive statistics. Where appropriate, we calculated frequency distributions separately by the articles' primary topic (i.e. skin cancer primary prevention, secondary prevention, solaria and vitamin D).

In addition, we set up a multivariate logistic regression model to examine potential associations between the quality of the articles (outcome: misleading or erroneous information) and selected predictor variables. These comprised the articles' country of publication, publication source, circulation, length and authorship. Odds ratios (ORs) were adjusted for all variables in the model and are presented with the corresponding 95% confidence interval (CI).

All analyses were performed using SAS 9.3 software (SAS Institute, Cary, N.C., USA), and statistical significance was defined at the α-level of 0.05.

Results

Table 1 displays the characteristics of the 2,103 articles included for analysis. The seasonal frequency of media coverage by primary topic is illustrated in figure 1.

Primary Prevention

In the 1,396 articles on primary prevention, the most frequently cited adverse effects of UVR exposure were sunburn (64.8%) and skin cancer (61.7%; malignant melanoma: 18.6%; non-melanoma skin cancer: 14.0%; not specified: 41.5%), followed by premature skin ageing (28.4%) and eye disorders (5.3%). Person groups and areas at increased risk of suffering UV damage were named in 54.2 and 16.0% of the texts, respectively (fig. 2). Only a few articles pointed out that UVR may penetrate into the shade (12.9%), through clouds (8.5%), window glass (7.1%) and the water surface (2.6%). No more than 3.1% mentioned the UV Index as a measure of the current or forecast UVR intensity at a given time and location [16].

Artificial tanning was discouraged in 10.7% of articles on primary prevention, and 2.7% stated that a suntan is a manifestation of cutaneous photodamage. On the other hand, 6.0 and 2.0% associated a tanned skin with terms like 'attractive' and 'healthy', respectively.

Table 1. Characteristics of the analysed print media articles

	Articles, n (%)
Total	2,103 (100.0)
Primary topic	
Primary skin cancer prevention	1,396 (66.4)[1]
Secondary skin cancer prevention	267 (12.7)[1]
Solaria	315 (15.0)
Vitamin D	320 (15.2)
Country of publication	
Germany	1,866 (88.7)
Switzerland	237 (11.3)
Publication source	
Daily and weekly newspapers	1,643 (78.1)
General interest magazines	314 (14.9)
Special interest magazines	129 (6.1)
Other	17 (0.8)
Circulation	
<25,000	598 (28.4)
25,000–99,999	718 (34.1)
100,000–199,999	408 (19.4)
≥200,000	373 (17.7)
Unknown	6 (0.3)
Article length	
Short (approx. <0.5 page)	723 (34.4)
Medium (approx. 0.5–1.5 pages)	1,322 (62.9)
Long (approx. >1.5 pages)	58 (2.8)
Authorship	
Journalist	1,609 (76.5)
Health professional	125 (5.9)
Unknown	369 (17.6)
Target audience	
General public	1,753 (83.4)
Parents	214 (10.2)
Children and adolescents	57 (2.7)
Other	79 (3.8)

[1] 195 articles reported on primary and secondary prevention and were counted in both categories.

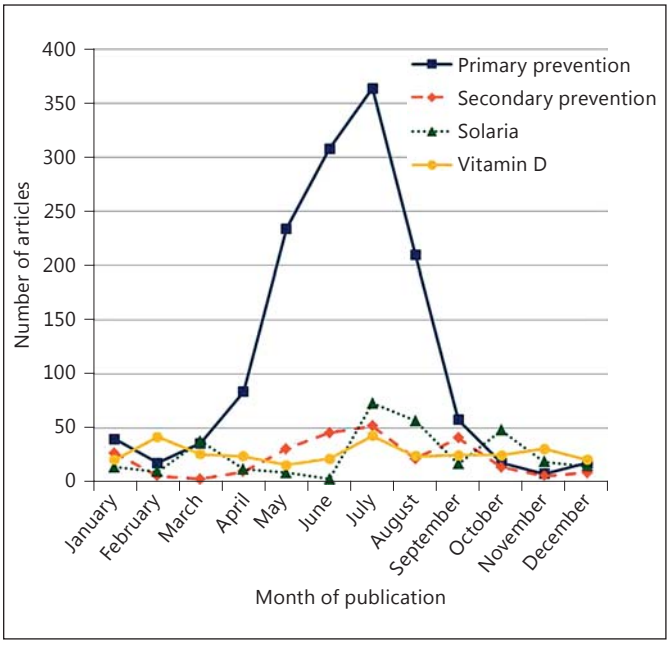

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Fig. 1. Seasonal print media coverage of skin cancer prevention, solaria and vitamin D.

Specific sun protection recommendations were made in 1,287 articles (table 2; fig. 3). Of these, 22.3% exclusively suggested the use of sunscreen.

Secondary Prevention

Of the 267 articles on secondary prevention, 64.8% recommended skin self-examinations to detect early signs of skin cancer. However, 89.6% of these did not explain how to perform self-examination, and 11.0% did not describe skin cancer symptoms. The recommendations regarding skin cancer screening by a health professional differed between Germany and Switzerland, with 66.2% of German and 23.1% of Swiss articles on secondary prevention advocating routine dermatological screening for the general adult population.

Solaria

Of the 315 articles focusing on solaria, 93.3% mentioned potential adverse health effects (skin cancer: 87.9%; premature skin ageing: 16.5%; skin burn: 15.6%; eye disorders: 14.6%). Yet 7.0 and 5.1% promoted artificial tanning to enhance cutaneous vitamin D synthesis and physical appearance, respectively.

Vitamin D

Of the 320 articles focusing on vitamin D, 83.1% recommended UVR exposure to achieve healthy vitamin D levels (5.9% encouraged the use of solaria). Of these, 12.0% neither stated that UVR may present a hazard to health nor that vitamin D photosynthesis requires only a relatively small amount of UVR. Furthermore, 17.5% of all vitamin D articles emphasised that sunscreens may limit or even completely block vitamin D photosynthesis.

Quality of Information

In total, 26.8% of all analysed articles contained misleading or erroneous information (misleading state-

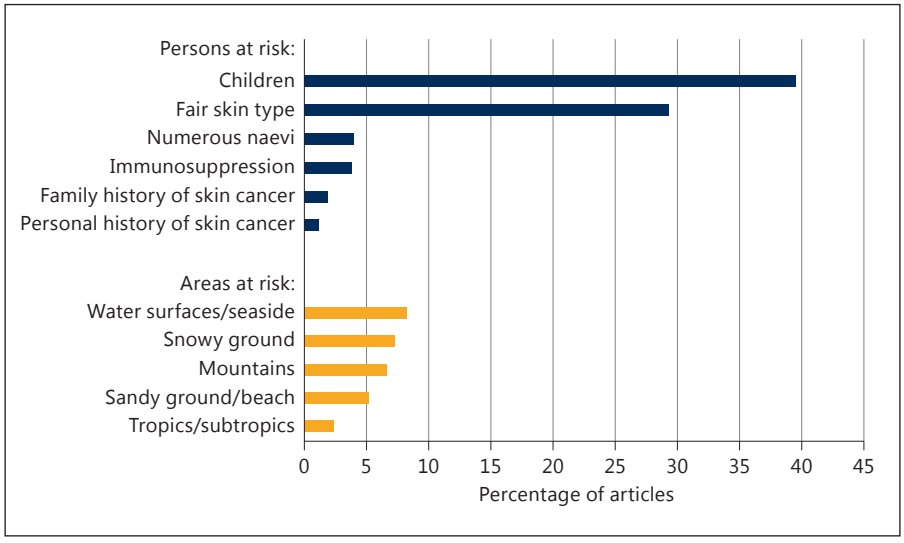

Fig. 2. Frequency of references to person groups and areas at increased risk of suffering UV damage in articles on primary prevention.

ments: 22.4%; erroneous statements: 10.9%). Table 3 shows the frequency of inaccuracies by topic and some illustrative examples along with our comments.

According to the multivariate model, articles published in general interest and special interest magazines were about twice as likely to contain misleading or erroneous information as articles published in daily or weekly newspapers (OR: 2.02, 95% CI: 1.43–2.85 and OR: 1.87, 95% CI: 1.18–2.96, respectively). Furthermore, the odds of misleading or erroneous information were increased for articles authored by health professionals compared to articles authored by journalists (OR: 2.14, 95% CI: 1.41–3.24) and for long and medium articles compared to short articles (OR: 11.97, 95% CI: 6.17–23.22 and OR: 5.47, 95% CI: 4.13–7.23, respectively). The country of publication and the circulation did not significantly influence the articles' quality.

Table 2. Frequency of specific sun protection recommendations

	Articles, n (%)
Any sun protection recommendation	1,287 (100.0)
Sunscreen	1,225 (95.2)
Recommendation of specific (minimum) SPF	492 (38.2)
Reference to regular reapplication	397 (30.8)
Reference to amount of application	322 (25.0)
Broad-spectrum sunscreen	240 (18.6)
Water-resistant sunscreen	127 (9.9)
Clothing	777 (60.4)
With integrated UV protection	213 (16.6)
Made of tightly woven fabric	104 (8.1)
Made of dark fabric	76 (5.9)
Made of synthetic fabric	35 (2.7)
Shade	763 (59.3)
Sun avoidance around noon	523 (40.6)
Protective headgear	574 (44.6)
Wide-brimmed or with neck flaps	155 (12.0)
Sunglasses	354 (27.5)
With UV protection	150 (11.7)
With wrap-around design or large lenses	26 (2.0)
Systemic sun protection	45 (3.5)
Diet (e.g. carrots, tomatoes)	29 (2.3)
Dietary supplements (e.g. β-carotene tablets)	25 (1.9)

SPF = Sun protection factor.

Discussion

The present study represents to our knowledge the most comprehensive content analysis of skin cancer-related print media to date and provides a unique insight into the way prevention messages issued by health organizations reach the public.

Before the 1930s, the association between UVR exposure and skin cancer was rarely mentioned in the popular press and virtually unknown to the general population [17]. Yet in the meantime, skin cancer primary prevention by UVR protection has become a frequently covered media topic, particularly during the summer months.

However, although we identified individual well-written and informative reports, the information content of the analysed articles was in general rather limited. Few authors reported that adequate UVR protection does not merely prevent sunburn and skin cancer, but also prema-

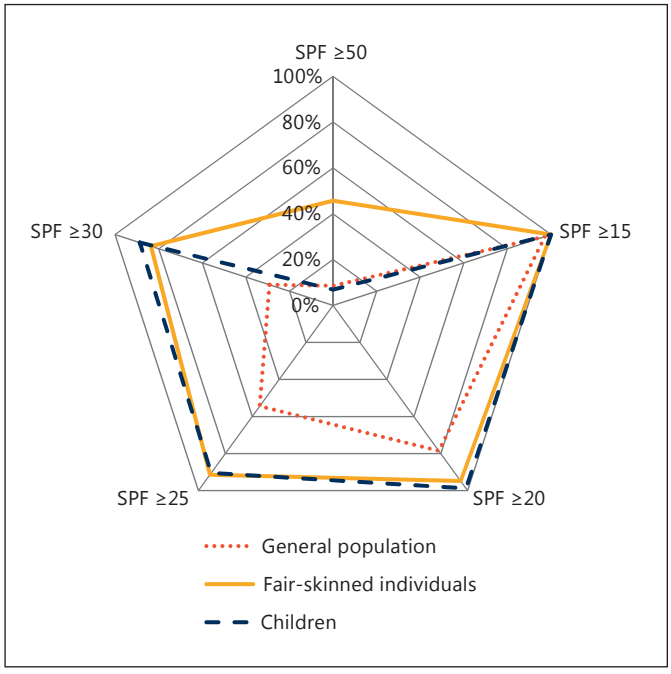

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Fig. 3. Minimum sun protection factor (SPF) of sunscreens recommended in articles on primary prevention for the general population (adults of unspecified skin type), for fair-skinned individuals (Fitzpatrick skin type I/II), and for children; 100% corresponds to all articles stating a (minimum) SPF for the respective target group.

ture skin ageing and eye disorders. Person groups and situations at increased risk of suffering UV damage were not routinely mentioned, and the UV Index as a communication tool of UVR intensity was hardly ever explained. Hence, it is not surprising that the awareness and understanding of the UV Index in Germany as well as in Switzerland was found to be very low [18, 19].

The use of a sunscreen was by far the most common and – in many cases – the sole sun protection recommendation made, even though seeking shade and covering up with clothing are assigned a more important role in the hierarchy of photoprotective strategies [20, 21]. Moreover, only a minority of articles contained detailed advice about what kind of sunscreen [sun protection factor (SPF), UVA protection, water resistance], clothing (fabric properties) and headgear (wide brim, neck flaps) best to use, and about how to apply sunscreen properly (amount and timing of application, reapplication). The recommended SPFs differed substantially, ranging from 10 to 50+ for the general population (adults of unspecified skin type). This reflects in part the diverging SPF recommendations published by national and international cancer control and health agencies. To name a few examples, the Swiss Cancer League generally advises SPF ≥15 [22], the Swiss Federal Office of Public Health recommends SPF ≥20 [23], and the European Skin Cancer Foundation and the German Cancer Aid suggest SPF ≥25 [24] and SPF ≥30 [25], respectively.

Paradoxically, a noteworthy number of articles on skin cancer primary prevention promoted a suntanned skin as attractive or healthy, albeit it is well established that all tanning is a manifestation of DNA photodamage [26].

Skin cancer secondary prevention by skin self-examinations and dermatological screening receives relatively little attention in the press. Accordingly, a representative telephone survey in Germany revealed that in 2011 less than half of the adult population was aware that persons with statutory health insurance above the age of 35 years are entitled to a biennial skin cancer screening by a trained physician [27]. In a recent interview survey among German adults, 51% reported having never had a medical check of pigmented naevi [28]. In Switzerland, routine skin cancer screening is neither generally recommended nor refunded by the health insurance, which may account for the country differences in the media coverage of this topic.

Despite the widely recognized health risks linked to indoor tanning, several newspapers and magazines still release articles which encourage the visit to solaria in order to acquire a tan and to boost vitamin D photosynthesis. Aside from recommending active exposure to a carcinogen, these articles ignore that tanning devices usually emit predominantly UVA, whereas the action spectrum for vitamin D formation lies in the UVB range [29].

Compared to solaria, natural sunlight is very efficient in inducing cutaneous vitamin D synthesis. Maximum vitamin D concentrations are already reached after exposure of a relatively small skin surface to solar UVR doses well below the minimal erythema dose. Thus, incidental protected sun exposure usually results in vitamin D levels considered sufficient to maintain musculoskeletal health and potentially to prevent extraskeletal disorders associated with vitamin D deficiency (e.g. certain internal cancers and autoimmune diseases). Alternatively, diet and oral supplements constitute non-carcinogenic, readily available sources of the vitamin – facts the media often fail to acknowledge [15, 30].

Recent evidence from Australia suggests that concurrently with an increase in media coverage of vitamin D [31, 32], an increasing proportion of the population reduces sun protection practices due to concerns about vitamin D insufficiency [33]. In view of the numerous

Table 3. Frequency and illustrative examples of misleading or erroneous media statements by topic of inaccuracy

Topic of inaccuracy	Articles, n (%)[1]	Examples (original quotes from the articles translated into English)	Comment
Sunscreen: application	139 (24.6)	The sunscreen only grants protection once a day which is not prolonged by repeated application. That just promotes buying!	Although the reapplication of sunscreen does not extend the provided protection time[2], it is indispensable to compensate for initial underapplication and to replace sunscreen that may have been removed by sweat, water, towelling or friction with clothing or sand [34]. (Statement rated as misleading)
Sunscreen: SPF	137 (24.3)	You can calculate how long you can sunbathe without danger. UVB protection factor multiplied by your own natural protection time.	Under laboratory conditions (2 mg sunscreen/cm^2 skin, no abrasion), the protection time[2] of sunscreen-protected skin can be calculated by multiplying the sunscreen's SPF with the natural protection time of the unprotected skin (dependent on the skin phototype) [35]. Under real-world conditions, the protection time of sunscreen-protected skin is usually much shorter, because consumers apply insufficient amounts of sunscreen (typically <1 mg/cm^2) and fail to reapply the product after swimming and sweating [36–38]. (Statement rated as misleading)
		SPF 20 is enough. It already absorbs 95% of all UVB rays. It is absurd to believe that SPF 40 protects you double as well as SPF 20. An additional protection is hardly measurable with sunscreens with a higher factor – they are just more expensive.	Sunscreens with SPF 20 and SPF 40 filter out 95.0 and 97.5% of the erythemogenic UVR, respectively. Hence, the UVR dose that penetrates into the skin and is responsible for UV damage is halved between SPF 20 and SPF 40 (5 vs. 2.5%), i.e. the protection doubles between SPF 20 and SPF 40 [39]. (Statement rated as erroneous)
Sunscreen: labelling (excl. SPF)	60 (10.6)	All sunscreen products nowadays guarantee a protection from UVA and UVB rays.	In Europe, adequate UVA protection is only guaranteed, if a sunscreen is labelled with the UVA logo [39]. (Statement rated as erroneous)
Sunscreen: safety	67 (11.9)	Traditional sunscreens contain chemicals that are known to be toxic.	Before their approval, UV filters have to pass a thorough safety evaluation including studies on acute toxicity, (sub)chronic toxicity, reproductive toxicity, genotoxicity, photogenotoxicity, carcinogenicity, irritation, sensitization, phototoxicity and photosensitisation [40]. (Statement rated as erroneous)
Sunscreen: other	21 (3.7)	Sunscreens protect you from sunburn, but not from skin cancer.	Evidence from randomised controlled trials suggests that regular sunscreen use prevents cutaneous squamous cell carcinoma (including actinic keratosis) [41, 42] and malignant melanoma [43]. (Statement rated as erroneous)
Protective clothing	49 (8.7)	Clothing with UV protection is good, but so is thin cotton clothing.	Clothes with integrated UV absorbers are an excellent means of photoprotection. However, the protection provided by thin clothes made of cotton is limited [20]. (Statement rated as misleading)
Systemic sun protection	45 (8.0)	Someone who is going on holiday to a sunny place should start eating fruit and vegetables with plenty of β-carotene 4 weeks beforehand at the latest.	β-Carotene has proven effective in modestly increasing the skin's photoprotective capacities. Yet the achievement of relevant protection requires the intake of relatively high doses (~10 mg/day) over at least 10 weeks [44]. (Statement rated as misleading)
Sunbathing	94 (16.7)	You should only lie in direct sun for as long as you don't get sunburnt.	Significant molecular and cellular skin damage occurs already at suberythemal UVR doses [45]. (Statement rated as misleading)
Suntan	43 (7.6)	Tanned skin is the best light protector.	The natural skin protection afforded by tanning upon repeated UVR exposure is very modest (~SPF 2) [46]. Furthermore, tanning always comes at the cost of DNA photodamage [26]. (Statement rated as erroneous)

Table 3 (continued)

Topic of inaccuracy	Articles, n (%)[1]	Examples (original quotes from the articles translated into English)	Comment
Solarium	43 (7.6)	Modern sun studios have got tanning beds that are, thanks to new legislation, designed to maximise the healthy effect of the sun as well as the nice tan effect, without damaging the skin.	Irrespective of regulations, solaria users are exposed to high levels of UVR which increase their risk of skin cancer and premature skin ageing [47, 48]. (Statement rated as erroneous)
		By systematic pretanning in the solarium with professional advice, it is possible to heighten the natural protection of the skin and reduce the risk of getting sunburnt.	A tan induced by UVA-rich solaria is essentially not protective against subsequent sun exposure, but per se associated with cutaneous photodamage [49]. (Statement rated as erroneous)
Vitamin D	120 (21.3)	Due to vitamin D being produced in the skin, sunbathing at the beach or in the garden is highly recommendable. In winter the solarium is an alternative.	Since UVR is a human carcinogen, prolonged sun exposure and solaria should be avoided. Adequate vitamin D levels can be obtained from short incidental sun exposure, diet or oral supplements [15, 48]. (Statement rated as erroneous)
		Already an SPF of 10 is enough to practically paralyse vitamin D production.	Sunscreens do not completely block UVR but permit the transmission of a fraction of UVB equal to 1/SPF (i.e. 1/10 or 10% for a SPF 10 sunscreen). Moreover, consumers usually apply less sunscreen than has been used for the SPF determination. In real-life situations, regular sunscreen use does not lead to decreased vitamin D levels [50, 51]. (Statement rated as erroneous)
Other	71 (12.6)	Research has shown that people who work mostly outside, like gardeners or farmers, are less likely to contract skin cancer.	According to two recent meta-analyses, outdoor workers are at increased risk of developing non-melanoma skin cancer [52, 53]. (Statement rated as erroneous)

SPF = Sun protection factor.

[1] 100% corresponds to the 564 articles containing misleading or erroneous information. Articles with several inaccurate statements on different topics were counted in all corresponding categories.

[2] Time of UVR exposure until the occurrence of sunburn.

vitamin D articles unsupportive for UVR protection identified in our study, a similar decline in skin cancer preventive behaviours may be expected in Central Europe.

On the whole, the quality of information across all articles included in our content analysis gives rise to concern, with more than every fourth text containing misleading or erroneous statements. Most ascertained inaccuracies pertained to the use of sunscreens, particularly to their correct application and the meaning and implication of the labelled SPF, followed by vitamin D issues. It should be noted that uncertainties about these topics do not only prevail among journalists, but also among the journalists' sources, namely dermatologists and other health professionals. This explains the somewhat elusive finding that articles authored by health professionals were not of better quality than articles authored by journalists.

In summary, the data reported herein provide a broad picture of skin cancer prevention and vitamin D messages made available to the public through German and Swiss print media. The delivered information was generally rather superficial and in a considerable number of newspaper and magazine articles misleading or factually incorrect. The latter is partly rooted in persistent misconceptions regarding UVR protection which prevail in the medical community and are subsequently adopted by journalists. To assist the media in disseminating sound skin cancer prevention strategies, health organisations should formulate consistent, easily understandable recommendations based on the current state of science. The uneasy relationship between UVR protection and adequate vitamin D synthesis ought to be pro-actively addressed, since unbalanced reports on this issue may seriously undermine the long-standing efforts of sun safety campaigns.

Disclosure Statement

C.S. was associated with Spirig Pharma Ltd., Egerkingen, Switzerland. He is a consultant to Galderma SA, Lausanne, Switzerland.

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