

YouTube as a source of health information: Analysis of sun protection and skin cancer prevention related issues

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Abstract

Although social media ubiquitously supplements traditional information sources such as newspapers, magazines, radio, and television, investigation of online health information related to sun protection and skin cancer prevention has been scarce and largely limited to English language sources. Using the search terms "sun protection," "sunscreen," "skin cancer prevention," "tanning bed" and "vitamin D," we investigated 281 YouTube videos presented in 6 languages: English, German, French, Spanish, Swedish, and Danish. For each video, we used a four-sectioned checklist to assess general information, popularity, expert driven measures, and heuristic driven measures. Differences between languages were detected: English language videos were most frequently viewed (median number of views: 5488 compared to 248 -1591 in other languages). Approximately 60% of videos revealed negative effects of solar ultraviolet (UV)-exposure. The majority of videos (75%) targeted adults. Videos on tanning beds and sunscreen contained false or misleading information 40% and 20% of the time, respectively. We confirm observations made with respect to other medical disciplines that the general quality of YouTube contributions is often inferior and does not deliver sustainable information. Other sources of information should be included when searching for health information online.

Keywords: Internet, social media, YouTube videos, online health information, sun protection, sunscreen, skin cancer prevention, tanning bed, vitamin D

Introduction

Ultraviolet radiation (UVR) exposure from the sun and artificial UV sources cause skin cancer and premature skin ageing [1-3]. Skin cancers are among the most dangerous and the most numerous of all neoplasms in the Caucasian population worldwide and are increasing in incidence [4, 5]. Despite knowledge about the destructive effects of UVR, enthusiasm (primarily among Caucasians) remains strong for participating in prolonged outdoor activities, vacationing in warm and sunny areas, and considering a sustained tan to impart a sense of wellbeing [6, 7].

In the past, newspapers, magazines, radio, and television were important sources for gaining health information and the dominant channels to disseminate preventive health messages. In addition, health care professionals were sources of reliable, in-depth information. New information platforms accessed by patients and consumers via the World Wide Web now supplement traditional information sources [8, 9]. As an increasing number of patients research symptoms and treatment options prior to their appointment [10], the internet now serves as an indispensable and powerful source of health information.

More specifically, YouTube, a non-peer-reviewed source of videos uploaded by individuals and organizations, has gained extraordinary global popularity. It is the third most popular website in the world [11], accessed by more than one billion users per day. YouTube visitors watch more than 6 billion hours of video each month and more than 100

hours of video material are uploaded every minute [12], including a variety of health content [13, 14]. The latter may be effective at improving knowledge and understanding of specific health topics and may encourage health improvements and behavior change [15]. YouTube may also offer an opportunity to overcome many of the reading and writing barriers people experience related to limitations in their health literacy [16]. However, consumers may also be misled when exposed to wrong or deceptive contents [17].

In recent years, interest in safety aspects of health information provided by social media has gained importance and a vast number of investigations have been published on various aspects of health information delivered by YouTube and the like [18].

Currently, investigations on health information in YouTube videos related to sun protection, skin cancer prevention, and related topics are scarce [19-23]. They have assessed a) the type of content and the viewership of dermatology-related videos using different search terms [19], b) messages on tanning beds in videos [20], c) the promotional value of videos in a contest setting [21], d) the impact of mixed emotions in a persuasive health message [22], and e) the role of videos in dermatologic surgery education [23].

Against this background - including previous experience from print press [24] and internet forum analysis [25], we investigate health information related to sun protection, skin cancer prevention, and related topics presented in YouTube videos. We focused on content, quality, target groups, and the video setting of the videos. Whereas previous studies have mainly assessed only videos in the English language, we include five additional languages (German, French, Spanish, Swedish, and Danish) to explore potential language differences and to broaden insights regarding the health information delivered in YouTube videos.

Methods

After an extensive literature search, expert and guideline consultations were developed for assessing the quality of YouTube videos with health information content a specific evaluation checklist

[26, 27]. In order to assess the quality of information, the checklist consisted of four different sections with a total of 161 variables to gain a) general information, b) popularity driven measures, c) expert driven measures, and d) heuristic driven measures [28]. Four experts (LR, DR, MW and RO) tested applicability and made minor adaptations.

General information: For each video, language, the Uniform Resource Locator (URL), title, authorship, date of upload, duration of video, and date of search were collected.

Popularity driven measures: Number of views, likes, dislikes, and comments were noted and the number of views, likes, and dislikes per month were calculated.

Expert driven measures: The content of the identified videos consisting of the categories a) negative results of excessive solar UV-exposure, b) high risk groups, c) sun protection measures (sunscreen (UVA and UVB protection, water-resistance, recommendation of a specific amount of sunscreen, re-application), head protection, clothing, seeking shade/sun avoidance, sunglasses, advice against tanning bed usage and sunburn-associated increased risk for skin cancer), d) skin cancer (secondary prevention) and e) vitamin D intake was assessed.

Furthermore, false or misleading information on sunscreen and tanning beds was assessed. For the search term "sunscreen," the following video messages were considered to be false or misleading: sun protection factor (SPF-) recommendation <15, SPF reduction recommended as soon as tanning has occurred, negative health consequences from sunscreen use, and advice against sunscreen use. For the search term "tanning bed," the following were considered to be false or misleading: recommendation of tanning bed usage for pre-tanning, beauty aspects, and/or vitamin D-synthesis, and promotion of newer safe or less hazardous tanning beds.

Heuristic driven measures: Target groups (children, adults, outdoor workers, adolescents, others, and multiple answers possible), video setting (health care professional, young or attractive person, advertisement, animation, restaged scene, captured from a TV screen, self-taped/amateur, interview,

personal experience, celebrity, others, and multiple answers possible), source of information (private company, international/national institution, individual person, news, unknown, and others), aim of video (behavior, knowledge, awareness, and multiple answers possible), technical quality (exposure, sound, and resolution) and video excerpt (young/attractive person, skin damage, cosmetic product, health professional, animation or cartoon, female person, person in business outfit, and others) were recorded.

Search procedure: To allow cross-sectional analysis for each search term, we employed the following structured search procedure: a) Open Google Chrome (version 32 or later) on a personal computer (no mobile devices), b) Delete browser history of Chrome, c) Type <https://www.youtube.com/> into the search field of Chrome, d) Set content location to worldwide, e) Set language, f) Set country, g) Set restricted mode off, h) Clear all watch history. British English, German, and French videos were accessed from Germany; Spanish videos from Spain; Danish and Swedish videos from Denmark; and American English videos from the USA.

Assessors: Experts including dermatologists, pharmacists, public health professionals, biologists, and physicists were acquainted with the questionnaire and received a detailed research manual guide for video analysis. Assessors were free to ask questions to the checklist developers at any time throughout the process.

Inclusion and exclusion criteria: Videos in Danish, English, French, German, Spanish, or Swedish with direct reference to the search term and duration of video > 5 minutes were included. Duplicate videos were excluded.

Search terms: <https://www.youtube.com/> was searched for the terms a) sun protection, b) sunscreen, c) skin cancer prevention, d) tanning bed and e) vitamin D.

Languages: The search terms were translated from English to German, French, Spanish, Swedish, and Danish.

Statistical Analyses: A Microsoft Access 2010 database was used for data entry. Statistical analyses were performed using SPSS (version 20) for Windows. Categorical data were evaluated by reporting absolute (n) and relative frequencies (%). For quantification of data variability, means and standard deviation (SD) were reported for normally distributed and medians with inter-quartile ranges (IQR) for non-normally distributed variables. Total scores were calculated where possible. Comparison of more than two groups of means was evaluated using univariate analysis of variance (ANOVA). Chi² statistics were used to identify variables that were significantly associated with misleading or inaccurate information. P-values below 0.05 were considered significant.

Inter-rater reliability: The instrument was tested by calculating intra-class correlations (ICC) for continuous variables and Cohen's kappa for categorical data. We included variables with significant ICC values or kappa > 0.4 in our analyses [29].

Results

General information

281 videos with running times of less than 5 minutes were included. For details on search term and language see Tables 1a and 1b.

Popularity driven measures

American/British English language videos were the most viewed videos (23.9% of videos with ≥1000 views per month, median number of views: 5488 compared to 248-1591 in other languages). English videos received on average the highest amount of likes (median: 17, min: 0, max: 33408) and dislikes (median: 1, min: 0, max: 817) compared to the other languages (median of likes between 0 and 2, median dislikes: 0). Most comments received videos in English (median: 3, min: 0, max: 4788, other languages: median between 0-1) (**Table 2**).

Across all languages, the search term "vitamin D" received the most views per month (median: 153, IQR: 68-579), followed by "sunscreen" (median: 64, IQR: 9-265), "tanning bed" (median: 64, IQR: 12-462), "skin cancer prevention" (median: 28, IQR: 12-82) and "sun protection" (median: 22, IQR: 7-105).

Table 1a. Number of videos (n) analysed per search term and language

Search term	German	Danish	Swedish	English	Spanish	French	Total
Sun protection	10	10	10	12	9	10	61
Sunscreen	10	10	5	16	14	10	65
Skin cancer prevention	11	10	5	11	10	10	57
Tanning bed	9	10	6	17	0	8	50
Vitamin D	10	5	1	17	5	10	48
Total	50	45	27	73	38	48	281

Table 1b. Search terms in the different languages

English	German	Danish	Swedish	Spanish	French
Sun protection	Sonnenschutz	Beskyttelse mod solen	Solskyddsmedel	Protector solar	Protection solaire
Sunscreen	Sonnencreme	solcreme	Solskyddsmedel	Crema solar	Crème solaire
Skin cancer prevention	Hautkrebsprävention	hudkræft forebyggelse	förebygga hudcancer	la prevención del cáncer de piel	la prévention du cancer de la peau
Tanning bed	Solarium	solarium	solarium	solárium	solarium
Vitamin D	Vitamin D	Vitamin D	Vitamin D	vitamina D	vitamine D

Table 2: Popularity (views/likes/dislikes/comments) of videos across languages.

Language	No. of views Median (IQR)	No. of likes Median (Min-Max)	No. of dislikes Median (Min-Max)	No. of comments Median (Min-Max)
Danish	248 (84-3321)	0 (0-3267)	0 (0-1223)	0 (0-1650)
English	5488 (1414-19298)	17 (0-33408)	1 (0-817)	3 (0-4788)
French	554 (227-1928)	1 (0-56)	0 (0-12)	0 (0-17)
German	760 (190-2524)	2 (0-326)	0 (0-78)	1 (0-268)
Spanish	1591 (250-7324)	2 (0-1055)	0 (0-3)	0 (0-9)
Swedish	416 (140-704)	0 (0-62)	0 (0-1)	0 (0-7)
Total	988 (212-4659)	2 (0-33408)	0 (0-1223)	1 (0-4788)

Expert driven measures

Negative results of excessive solar UV-exposure

From the 281 videos analyzed, 160 (57.3%) mentioned up to three deleterious effects of excessive solar UV-exposure (sunburn, skin cancer, photo-ageing). The effects were least mentioned in the Danish (n=23) and French videos (n=22).

High-risk groups

Risk groups with an increased risk for skin damage through UV-exposure were mentioned in 33% (n=92) of all videos. Children were described most often as a high-risk group (22.8%, n=64), followed by persons with fair skin (skin type I or II, 18.5%, n=52), skin cancer in family history (3.6%, n=10) and immune suppression (0.4%, n=1). Videos in Spanish and German mentioned high-risk groups more often (63.1%, n=24 and 58.0%, n=29).

Sun protection measures

Videos retrieved with the search terms “sun protection”, “sunscreen” and “skin cancer prevention” were included (n=183). Of those videos, 8.2% (n=15) did not mention any sun protection measures. Spanish videos showed the highest number of sun protection measures (mean: 1.82; SD: 0.93), whereas Swedish videos indicated the lowest number of sun protection measures (mean: 0.95; SD: 0.39). The variable “sunscreen” was mentioned most often as sun protection measure throughout all videos (76.5%, n=140), see **Table 3**. Overall, 80 recommendations for specific SPF numbers were made, with a majority of recommendations (48.9%, n=44) given for the general population. Concerning SPF recommendations, 16.7% (n=15) were targeted at children and 20.0% (n=18) at people with sensitive skin or skin type I or II. An SPF of 30 or higher was recommended most often (50.0%, n=45).

Skin cancer prevention

Videos retrieved with the search terms “skin cancer prevention” were included (n=57): 21 (36.8%) of those

videos stated that sunburn increases the risk for getting skin cancer, 22 (38.6%) mentioned the rising skin cancer rates, 21 (36.8%) the possible symptoms of skin cancer, 24 (42.1%) the self-examination of the skin and 29 (50.9%) recommended an examination of the skin by a dermatologist. Most detailed information on skin cancer prevention was found in German (n=9), Spanish, and French videos (both n=8). Those videos covered up to 5 different types of information on skin cancer prevention.

Vitamin D

Videos retrieved with the search terms “vitamin D” were included (n=48): 45 (93.8%) recommended UV-exposure for vitamin D synthesis in the skin, 27 (56.3%) mentioned a time limit for UV-exposure, 42 (87.5%) recommended solar-UV exposure as a source for vitamin D synthesis and 6 (12.5%) recommended artificial UV-exposure.

False/misleading information

Videos retrieved with the search terms “sunscreen” were included (n=65): 11 (17.0%) videos contained up

Table 3: Sun protection measures mentioned in the videos across the languages.

Sun protection measure	German		Danish		Swedish		English		Spanish		French		Total	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Sunscreen	23	(74.2)	23	(76.7)	10	(50.0)	36	(92.3)	25	(75.8)	23	(76.7)	140	(76.5)
Specific SPF	14	(45.2)	12	(40.0)	4	(20.0)	19	(48.7)	16	(48.5)	15	(50.0)	80	(43.7)
UVA and UVB	9	(29.0)	4	(13.3)	3	(15.0)	19	(48.7)	12	(36.4)	9	(30.0)	56	(30.6)
Specific amount	6	(19.4)	5	(16.7)	3	(15.0)	8	(20.5)	16	(48.5)	2	(6.7)	40	(21.9)
Water-resistant	6	(20.7)	6	(20.0)	2	(10.0)	7	(17.9)	12	(36.4)	5	(16.7)	38	(21.0)
Re-application	8	(25.8)	3	(10.0)	2	(10.0)	17	(43.6)	17	(51.5)	7	(23.3)	54	(29.5)
Head protection	9	(29.0)	9	(30.0)	2	(10.0)	16	(41.0)	15	(45.5)	9	(30.0)	60	(32.8)
Clothing	10	(32.3)	7	(23.3)	3	(15.0)	12	(30.8)	13	(39.4)	10	(33.3)	55	(30.1)
Seeking shade	15	(48.4)	15	(50.0)	5	(25.0)	11	(28.2)	11	(33.3)	12	(40.0)	69	(37.7)
Sunglasses	6	(19.4)	1	(3.3)	2	(10.0)	13	(33.3)	12	(36.4)	9	(30.0)	43	(23.5)
Advice against tanning bed usage	8	(25.8)	12	(40.0)	1	(5.0)	6	(15.4)	4	(12.1)	1	(3.3)	32	(17.7)
Sunburn increases skin cancer risk	9	(29.0)	0	(0.0)	1	(5.0)	12	(30.8)	15	(45.5)	6	(20.0)	43	(23.6)

to 3 false or misleading kinds of information. Videos retrieved with the search term “tanning bed” were included (n=50): 18 (36.0%) explicitly recommended the use of tanning beds and 9 (18.0%) recommended tanning bed use for vitamin D synthesis. In addition, 21 (42.0%) of the videos contained up to 4 false or misleading information.

Heuristic driven measures

Target group

An adult target audience was noted in 216 (76.9%) of the videos. Adolescents were targeted in 72 (25.6%) and 26 (9.3%) were aimed at children. Only 5 (1.8%) appeared to be produced for outdoor workers. Most videos for children were in Spanish (23.7%, n=9). Videos intended for outdoor workers were Spanish (n=3, 7.9%) or French (n=2, 4.2%).

Setting of video

Health care professionals were present in 37.4% (n=105) of all videos (**Figure 1**), and most often observed in German videos (n=32, 64.0%). Some type of advertisement was exhibited in 23.5% (n=66) of the videos. This type of setting was most often detected in Swedish (n=15, 55.6%) and English (n=20, 27.4%) videos.

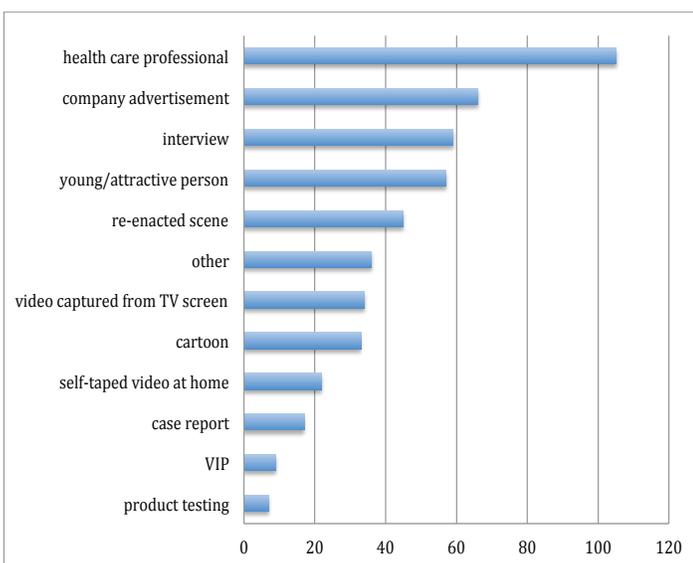


Figure 1. Video settings (number of mentions)

Source of information

The majority of videos provided credentials or contact information for the viewer (73.8%, n=206).

Aim of video

Increasing knowledge was the aim in 203 (72.2%) videos and 91 (32.4%) addressed awareness. Danish (n=39, 86.7%) and English (n=54, 74.0%) videos mentioned knowledge more often, whereas Spanish videos (n=21, 55.3%) mentioned awareness more often.

Technical quality

Technical quality assessment showed that 149 (53%) videos were excellent, 105 (37.5%) fair, and 26 (9.3%). A majority of the Danish, Swedish, English, and Spanish videos showed excellent technical quality.

Video excerpt

Females were most often seen in the video excerpts (n=95, 33.8%), mostly in English and French videos (n=30, 41.1% and n=21, 43.8%). Young and/or attractive individuals were exhibited in 65 (23.1%) video-excerpts.

Inter-rater reliability

Seventy eight videos (27.8%) were analyzed twice by two different researchers (25 German and 53 English videos); of the 161 variables, 17 (10.6%, in all languages) were removed after reliability analysis, e.g., in the section expert driven measures variables related to locations with high UV-intensity or variables related to secondary skin cancer prevention or in the section heuristic driven measures the variable “behavior”. Overall reliability was moderate to almost perfect for included variables (=0.43 to =1). Intra-class correlation ranged from 0.72 to 0.92.

Discussion

The use of social media has become ubiquitous in contemporary society at an astonishingly fast-paced rate. The internet and, in particular, platforms such as Facebook, Twitter, and YouTube are now supplementing traditional information sources such as newspapers, magazines, radio, television [8, 9], and face-to-face interactions. A vast number of investigations have been published on various aspects of health information delivered by internet platforms [18]. So far, only a few systematic

investigations on health information related to sun protection, skin cancer prevention, and related topics have been conducted [19-21].

In our study, we evaluated the ability of YouTube videos to serve as a source of health information on sun protection and skin cancer prevention in five different languages. We discuss numerous key findings in the four sections below.

Owing to the international assessment and the number (8) of researchers actively involved in the assessment, it was not possible to determine an overall inter-rater reliability. Sixteen variables were detected as unreliable in the English and German reliability assessment and were removed from the entire assessment (all languages).

General information

To a certain degree, our observation time of five minutes or less was arbitrarily chosen. Optimal length for social media contributions has been extensively discussed on the internet. It becomes obvious that many factors such as format, topic, and audience influence the viewer's interest and willingness to watch an entire media contribution. Estimates are 3 minutes for YouTube, 6 minutes for slide shares, 18 minutes for TED talks, and 22 minutes for Podcasts (<https://blog.bufferapp.com/optimal-length-social-media>). Another source (<http://www.learn2use.de/optimale-videolange-im-internet/>) states that after just 60 seconds, more than half of the viewers left the link, and after 5 minutes, less than 10% of the viewers remain linked. The value of information on the optimal length of social media contributions often remains unclear because the experimental setup and procedures are not comprehensively documented. Commercials that precede some of the videos can also complicate the picture. Despite the fact that they can be actively skipped, we believe that they may affect viewing behaviors.

Popularity driven measures

Although the numbers of views, likes, dislikes, and comments, may reflect popularities of videos at a first-glance, other factors must also be considered. For example, population size and/or country-specific attitudes toward YouTube watching may blur real insights. In our search, the most popular video was "The Ultimate Guide to Sunscreen" ([\[youtube.com/watch?v=V46vfg-7dEI\]\(https://www.youtube.com/watch?v=V46vfg-7dEI\)\), with slightly more than one million views. However, because our search was limited by our observation time \(May and July 2014\), we missed two outstanding videos addressing sun protection and skin cancer. "How the sun sees you" \(<https://www.youtube.com/watch?v=o9BqrSAHbTc>, 12.08.2014, 03:06 minutes\) authored by Thomas Leveritt and "Dear 16-year-old Me" \(\[https://www.youtube.com/watch?v=_4jgUcxMezM\]\(https://www.youtube.com/watch?v=_4jgUcxMezM\), 02.05.2011, 05:03 minutes\) authored by the David Cornfield Melanoma Fund received exceptionally high numbers of views \(>16 million and >9 million views, respectively, December 2015\). Both videos are professionally produced, of high technical quality, and very informative. They generate an immediate and intimate viewer concern, which, based on our subjective assessment, was not observed in any of our videos.](https://www.</p></div><div data-bbox=)

Certain videos caused considerable numbers of comments. We did not systematically analyze these comments. They ranged from brief and often empty statements to verbose explanations that added false or misleading information. Roughly a third of the comments were comments to an original comment. Often times, a pointed comment triggered a change in the issues addressed.

Expert driven measures

Although a significant number of Danish and French videos did not mention the negative results from solar UV-exposure (i.e.: sunburn, skin cancer, or photo-aging), they often discussed seeking shade as a sun protection measure. The Danish analysis included a number of campaign videos focusing on positive messages [30], indicating that Danish videos focused more on sun protection measures, rather than on avoidance measures. A similar observation was made in French videos.

Furthermore, the use of topical sunscreens was mentioned in more than three-quarters of the videos. Shade was mentioned in less than 40% and clothing in less than 30% of the videos. This reflects that the use of topical sunscreen is considered a quasi-exclusive mode of protection, even though seeking shade and wearing protective clothing provides more protection [31].

Whereas high SPFs (>30) were generally recommended, differences in recommendations among languages existed. In Spanish and French videos, there was a trend towards high factors (>30), whereas in Danish videos, the recommendations were for lower values (30 and below). These observations may reflect recommendations of national organizations [32] or may reflect the still widespread confusion about the meaning of the SPF [33].

Skin cancer prevention issues such as sunburn-related skin cancer risk, rising skin cancer rates, signs of skin cancer, and adequate skin-examinations were well displayed in the videos. The most detailed information was found in German, Spanish, and French videos. Studies reveal that video-based health information may raise awareness for skin cancer prevention [34, 35]. However, we are left to determine how to achieve effective and lasting behavioral changes. Currently, appearance-based video education appears promising in promoting health behavior [34].

Additionally, Vitamin D is currently a controversial topic, both in the medical literature [36], and in the lay press [24]. The majority of the videos recommend solar UV exposure for vitamin D synthesis, but only half of them mention a time limit for UV-exposure. Against all recommendations [31] a few videos recommend artificial UV-exposure.

Additionally, several studies on health information in YouTube videos reveal a high percentage (20-30%) of false or misleading information, as exemplified in videos on immunization [37], kidney stone disease [38], gallstone disease [39], heart transplantation [40], rhino sinusitis [41], and seizure [42]. One fifth of the analyzed videos revealed up to four false or misleading items of information. The search term "tanning bed" was significantly associated with misleading or false information, e.g., explicit - often industry sponsored - recommendations to use tanning beds for leisure and vitamin D synthesis [43]. Despite clear evidence pointing to the hazards of tanning device for cosmetic purposes, their use remains popular, and regulation and bans may be the only means to reduce their use [44].

Heuristic driven measures

Studies reveal that age is the prevailing predictor of whether the internet is used to search for health information. Adults aged 18-34 years were 3.5 times as likely and adults aged 35-49 years were nearly 2.5 times as likely as those 65 years and older to use the internet to search for health information [45]. Consistent with this, our analyses revealed that the majority of the videos target adults. At the same time, this raises the concern regarding a lack of motivational information for vulnerable groups including adolescents, children, and outdoor workers.

The industry (tanning bed and sunscreen) also tries to benefit from the potential reach of YouTube videos. For example, an advertisement for NIVEA sunscreens (<https://www.youtube.com/watch?v=AnUlod4tX98>, 17.12.2014) refers to Thomas Leveritt's video "How the sun sees you," which raises awareness on sun protection (<https://www.youtube.com/watch?v=o9BqrSAHbTc>, 12.08.2014, 03:06 minutes). Furthermore, video settings such as "interview" and "young/attractive person" are omnipresent and often promise immediate and intimate viewer concernment.

Furthermore, owing to the fact that anybody - without relevant restrictions - can upload videos onto the YouTube platform, healthcare providers and governmental agencies alike have expressed concern about the veracity and quality of the information available [17, 18]. Not surprisingly, in our investigation, videos from international or national institutions showed the most correct information on sun protection compared to other sources of information. Videos from unknown sources showed the highest amount of misleading information per video. Also, whereas many videos concurrently aim to deliver knowledge and to increase awareness, significantly less misleading information was found in videos aiming at knowledge improvement.

Our studies also showed that videos rated with high technical quality had more views per month than videos with poor quality. While Stellefson et al. reported that YouTube videos with low technical quality contain more misleading or false information [46], our investigation did not confirm this finding. Finally, we speculate that the video excerpt found in

the search list before selecting one specific video may affect the viewer's decision to actually connect and start watching a video. Although an overwhelming number of excerpts showed female persons or young and/or attractive persons, no associations to other parameters were found.

Conclusion

In our investigation, we confirm observations made in other medical disciplines that the general quality of YouTube contributions is often inferior and these videos do not deliver sustainable information. It seems questionable whether single YouTube contributions are able to influence our knowledge and awareness about sun protection, sunscreen use, skin cancer prevention, tanning bed use, or vitamin D synthesis. It would be desirable to inaugurate some sort of peer review for medical information on YouTube. Based on current rules, the launch of a YouTube channel by a competent organization may be an effective path to disseminate peer-reviewed information to both professionals and laypersons. Well-reputed channels are hosted e.g., by the American Academy of Dermatology (<https://www.youtube.com/user/AcademyofDermatology>) addressing sun protection and skin cancer prevention issues, as well as the American Medical Association (<https://www.youtube.com/user/AmerMedicalAssn>), the Deutsche Krebshilfe (<https://www.youtube.com/user/deutschekrebshilfe>) and the Kræftens Bekæmpelse (<https://www.youtube.com/user/KraeftensBekaempelse>); these address various cancer related issues. These channels offer validated information sorted in playlists. Successful channels are characterized by the topicality of the information. Less attractive channels have few past video uploads, subscribers, and views, e.g., British Association of Dermatologists (<https://www.youtube.com/channel/UCzeJqigHMaAtO5i1QIkULIQ>) or Skin Cancer Foundation (<https://www.youtube.com/user/SkinCancerFoundation>, last viewed on 17.12.2015). Both organizations have subsequently chosen Facebook to communicate with their followers in a timely manner.

A YouTube video as a single non-embedded piece of information is likely to miss its desired target group. Regardless of the genre, today's respected and successful YouTube contributions are generally

of superior quality, but they require professional planning, end up in costly production, and employ various additional accompanying marketing measures to make a strong impression and impact.

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