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A Sun Safety Pilot Program Using a Tanning Myths–Focused Video Contest for Utah Adolescents: Cross-sectional Analysis

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Abstract

Background: Adolescents are susceptible to excessive ultraviolet exposure due to intentional tanning, outdoor lifestyles, and poor sunscreen adherence. As skin cancer incidence continues to rise in the United States, effective and focused interventions are needed to encourage photoprotective behaviors.

Objective: This study seeks to determine poor photoprotective behavior risk factors in adolescents residing in Utah and whether video contest participants have increased sun-protective knowledge and intentions.

Methods: In this cross-sectional study, we surveyed Utah high school students (n=20) who participated in a tanning myths-themed public service announcement video contest. A control cohort of students who did not participate in the video contest were also surveyed (n=89). Demographics, sun exposure history, intentions to tan, and intentions to use sunscreen were documented. Knowledge of tanning myths was assessed with a 7-question sun safety quiz.

Results: The survey response rate was 93.2% (109/117). Two-thirds reported at least one sunburn, and 47.7% (52/109) reported intentional tanning within the past 2 years. Higher tanning intentions were associated with a personal (P<.001), family (P=.001), and peer (P<.001) history of tanning. Video contest participants had higher sun safety quiz scores (P<.001) and higher sunscreen use intentions (P=.01), but did not have decreased tanning intentions (P=.47) compared to non–video contest participants. Hispanic and Black students were less likely to participate in the video contest (P<.001 and P=.04, respectively). In a comparison of White students to students of color, there were no differences in sun exposure history, but students of color had lower sun safety knowledge (P=.01) and lower sunscreen use intention (P=.02).

Conclusions: Sun safety educational disparities exist, and targeted efforts are needed to encourage photoprotective behaviors in high-risk populations. Our findings suggest that video contest participation may encourage sunscreen use and sun protection awareness.

(JMIR Dermatol 2021;4(1):e20192) doi:10.3196/20192

KEYWORDS
prevention; sun protection; questionnaire; photoprotection; experiential learning; teenager; safety; pilot; video; cross-sectional; adolescent; young adult; behavior; risk; knowledge; intention

https://derma.jmir.org/2021/1/e20192

JMIR Dermatol 2021 | vol. 4 | iss. 1 | e20192 | p.2
(page number not for citation purposes)
**Introduction**

**Background**

The incidence of skin cancer has been increasing for the past several decades in the United States [1-3]. The state of Utah has one of the nation’s highest skin cancer incidence rates and the highest rate of incidence and death of melanoma, the deadliest type of skin cancer [4]. It has been well established that ultraviolet exposure is a modifiable risk factor for melanoma and nonmelanoma skin cancers [5]. Because adolescents are generally exposed to high amounts of UV radiation from intentional tanning, they are an important target population for skin cancer prevention programming [6].

The most efficacious sun protection programs have been shown to involve children and include active individual participation [7]. Building on this concept, while specifically addressing an adolescent population, we designed and sponsored an annual statewide contest running from 2015 to 2018, in which Utah teenagers voluntarily created 1-minute public service announcement videos debunking tanning myths. Between 3 and 10 finalists and their families attended a celebratory event at the University of Utah Department of Dermatology each year where their public service announcement videos were viewed, students’ achievements were recognized, and the importance of sun-protective behaviors, particularly in Utah, was stressed.

In this study, a cohort of adolescents from high schools who participated in the video contest and a cohort of adolescents from the same high schools who did not participate were electronically surveyed about tanning intentions on sun-protective behaviors and understanding of tanning myths. We sought to identify the demographics and risk factors associated with increased tanning intentions and decreased sunscreen use intentions. We hypothesized that video contest participants would have increased sun-protective intentions and knowledge compared to those who did not participate in the video contest.

**Methods**

**Recruitment**

This study was approved by the institutional review board at the University of Utah (institutional review board no. 00085420). In June 2018, all students (n=22) who participated in the video contest between 2015 and 2018 were emailed an anonymous closed survey eliciting demographic information, sun exposure history prior to video contest participation, and the intention to tan or use sunscreen in the future. A 7-question true-or-false knowledge quiz consisting of 5 tanning myths (false) and 2 skin cancer facts (true) was also included. The score was calculated from the quiz to evaluate the tanning myths knowledge of participants by assigning 1 point for each correct answer. A convenience sample of 95 non–video contest participants attending the same high schools were invited to complete the same electronic survey. These participants were recruited at tabling events during 3 lunch time hours and were asked to complete anonymous surveys on tablets or laptop computers provided by the research team. Participants in both groups were given a US $5 gift card or a candy bar for completing the survey.

**Statistical Analysis**

Tanning intentions were calculated based on participant responses for questions asking likelihood to tan in the future. High tanning intentions corresponded to responses “very likely” or “extremely likely”. Medium tanning intentions corresponded to “moderately likely” or “slightly likely” responses, and low tanning intentions corresponded to a “not likely” response. For sunscreen use intentions, answers for likelihood to use sunscreen in the future included “always” or “most of the time” for high intentions, “sometimes” and “rarely” for medium intentions, and “never” for low intentions.

For participant characteristics, we report descriptive statistics as medians (IQR) or frequencies (percentages). To assess the efficacy of the video contest and evaluate the factors associated with knowledge of tanning myths and tanning intentions, we used chi-square tests for categorical variables and Wilcoxon rank sum tests for continuous variables. If numbers were sparse, Fisher exact tests were performed for categorical variables, and the exact version of the Wilcoxon rank sum tests were performed for continuous variables. To compare race demographics, each was compared to the total of each category (ie, White vs. people of color, Hispanic vs. non-Hispanic etc). Results were considered statistically significant if the 2-sided P values were less than .05. All tests were performed using R studio version 1.0.143.

**Results**

In total, 109 participants completed the survey (20 video contest participants and 89 non–video contest participants), with a survey response rate of 93.2% (109/117). Approximately half of the survey respondents were male. Self-identified race included White (51/109, 46.8%), Hispanic (36/109, 33.0%), Asian or Pacific islander (18/109, 16.5%), Black or African American (16/109, 14.7%), Native American (2/109, 1.8%), and other (8/109, 7.3%). Furthermore, 39.4% (43/109) of respondents reported having 1 sunburn in the past 2 years, and 26.6% (29/109) reported having at least two or more sunburns in the past 2 years. Almost half (52/109) had a history of intentional tanning, 22.9% (25/109) had family members that tan, 45.9% (50/109) had friends who tan, and 26.6% (29/109) had a family history of skin cancer. In the comparison of video contest and non–video contest participants, White students were more likely to participate in the video contest (P<.001), whereas Hispanic and Black students were less likely to participate in the video contest (P<.001 and P=.04, respectively; Table 1).
Table 1. Participant demographics and tanning history comparing video contest (n=20) and non–video contest (n=89) participants.

| Characteristic                               | All participants (N=109) | Video contest participant (n=20) | Non (n=89) | P value |
|----------------------------------------------|--------------------------|---------------------------------|------------|---------|
| **Gender, n (%)**                            |                          |                                 |            |         |
| Male                                         | 62 (56.9)                | 11 (55)                         | 51 (57)    | .85     |
| Female                                       | 47 (43.1)                | 9 (45)                          | 38 (43)    |         |
| **Race, n (%)**                              |                          |                                 |            |         |
| White                                        | 51 (46.8)                | 17 (85)                         | 34 (38)    | <.001b  |
| Hispanic                                     | 36 (33.0)                | 0 (0)                           | 36 (40)    | <.001b  |
| Black/African American                       | 16 (14.7)                | 0 (0)                           | 16 (18)    | .04bc   |
| Native American/American Indian              | 2 (1.8)                  | 0 (0)                           | 2 (2)      | >.99c   |
| Asian/Pacific Islander                       | 18 (16.5)                | 4 (20)                          | 14 (16)    | .74c    |
| Other                                        | 8 (7.3)                  | 0 (0)                           | 8 (9)      | .35c    |
| **Sunburn in the past 2 years, n (%)**       |                          |                                 |            | .81     |
| More than once                               | 29 (26.6)                | 5 (25)                          | 24 (27)    |         |
| Once                                         | 43 (39.5)                | 7 (35)                          | 36 (40)    |         |
| None                                         | 37 (33.9)                | 8 (40)                          | 29 (33)    |         |
| **Personal history of tanning, n (%)**       |                          |                                 |            | .79     |
| Yes                                          | 52 (47.7)                | 9 (45)                          | 43 (48)    |         |
| No                                           | 57 (52.3)                | 11 (55)                         | 46 (52)    |         |
| **Family members that tan, n (%)**           |                          |                                 |            | .39a    |
| Yes                                          | 25 (22.9)                | 6 (30)                          | 19 (21)    |         |
| No                                           | 84 (77.1)                | 14 (70)                         | 70 (79)    |         |
| **Friends that tan, n (%)**                  |                          |                                 |            | .68     |
| Yes                                          | 50 (45.9)                | 10 (50)                         | 40 (45)    |         |
| No                                           | 59 (54.1)                | 10 (50)                         | 49 (55)    |         |
| **Family history of skin cancer, n (%)**     |                          |                                 |            | .13     |
| Yes                                          | 29 (26.6)                | 8 (40)                          | 21 (27)    |         |
| No                                           | 80 (73.4)                | 12 (60)                         | 68 (76)    |         |
| **Sun safety education in class, n (%)**     |                          |                                 |            | .46     |
| Yes                                          | 54 (49.5)                | 8 (40)                          | 46 (52)    |         |
| No                                           | 55 (50.5)                | 12 (60)                         | 43 (48)    |         |

aFor race, participants were allowed to pick more than one response.
bItalics indicate value is statistically significant.
cFisher exact test was used.

Although knowledge of skin cancer facts did not differ between video contest and non–video contest participants (P=.14 and P=.11, respectively), video contest participants were more likely to correctly identify 2 tanning myths: “A base tan protects you against getting a sunburn” (P=.02) and “There is no need for sun protection on cloudy or cold days” (P=.04; Table 2). Overall, video contest participants had a higher total knowledge quiz score compared to non–video contest participants (P<.001; Table 3). Furthermore, quiz scores were not significantly different when students who had prior sun safety classroom education, a history of tanning, or gender or family history of skin cancer were compared to those who did not, but higher quiz scores were associated with high sunscreen intentions (P=.01; Tables 3 and 4).
Table 2. Number of participants answering knowledge quiz questions correctly comparing video contest (n=20) and non–video contest (n=89) participants. Skin cancer facts were used as control questions.

| Quiz items by correct answers | Video contest participant | P value |
|-------------------------------|---------------------------|---------|
|                               | Yes (n=20) | No (n=89) | |
| **Tanning myth (false), n (%)** | | | |
| A “base tan” protects you against getting a sunburn | 19 (95) | 62 (70) | .02<sup>a</sup> |
| Tanning beds are a safe way to tan | 20 (100) | 75 (84) | .07 |
| There is no need for sun protection on cloudy or cold days | 20 (100) | 72 (81) | .04<sup>a</sup> |
| A fake (spray-on or lotion) tan will protect me from the sun | 20 (100) | 76 (85) | .12 |
| Only old people get skin cancer | 20 (100) | 80 (90) | .21 |
| **Skin cancer fact (true), n (%)** | | | |
| Utah has one of the highest rates of skin cancer in the country | 13 (65) | 41 (46) | .14 |
| Skin cancer is the most common type of cancer | 17 (85) | 57 (64) | .11 |

<sup>a</sup>Italics indicate value is statistically significant.

Table 3. Analysis of median tanning myths and skin cancer facts quiz scores (maximum score 7).

| Variable                  | Score, median (IQR) | P value |
|---------------------------|----------------------|---------|
| **Video contest participation** | | <0.001<sup>ab</sup> |
| Yes (n=20)                | 7 (6-7)              |         |
| No (n=89)                 | 5 (4-6)              |         |
| **Sun safety class education** | | .82 |
| Yes (n=54)                | 6 (5-6)              |         |
| No (n=55)                 | 6 (5-6.5)            |         |
| **History of tanning**    | | .29 |
| Yes (n=52)                | 6 (5-6)              |         |
| No (n=57)                 | 5 (4-6)              |         |
| **Gender**                | | .16<sup>a</sup> |
| Male (n=62)               | 6 (4.2-6)            |         |
| Female (n=47)             | 6 (5-7)              |         |
| **Race**                  | | <0.001<sup>ab</sup> |
| White only (n=40)         | 6 (6-7)              |         |
| People of color (n=69)    | 5 (4-6)              |         |
| **Family history of skin cancer** | | .34<sup>a</sup> |
| Yes (n=29)                | 6 (5-7)              |         |
| No (n=80)                 | 6 (5-6)              |         |

<sup>a</sup>Exact version of Wilcoxon rank sum test used.
<sup>b</sup>Italics indicate value is statistically significant.
Table 4. Variables associated with future intentions of sunscreen use and tanning.

| Variable                          | Sunscreen use intention | Tanning intention | P value | P value |
|-----------------------------------|-------------------------|-------------------|---------|---------|
|                                  | High | Medium | Low | High | Medium | Low |         |
| Video contest participation, n (%) |      |        |     |       |        |     |         |
| Yes (n=20)                        | 15 (75) | 5 (25) | 0 (0) | 2 (10) | 7 (35) | 11 (55) | 0.01<sup>ab</sup> | .47<sup>a</sup> |
| No (n=89)                         | 36 (40) | 39 (44) | 14 (16) | 20 (22) | 25 (28) | 44 (49) |         |         |
| Knowledge score, n (%)            |      |        |     |       |        |     |         | 0.01<sup>ab</sup> | .46 |
| ≥5 (n=85)                         | 46 (54) | 31 (36) | 8 (9) | 15 (18) | 26 (31) | 44 (52) |         |         |
| <5 (n=24)                         | 5 (21) | 13 (54) | 6 (25) | 7 (29) | 6 (25) | 11 (46) |         |         |
| Sun safety class education, n (%) |      |        |     |       |        |     |         | 0.21 | .69 |
| Yes (n=54)                        | 23 (43) | 26 (48) | 5 (9) | 12 (22) | 17 (31) | 25 (46) |         |         |
| No (n=55)                         | 28 (51) | 18 (33) | 9 (16) | 10 (18) | 15 (27) | 30 (55) |         |         |
| History of tanning, n (%)         |      |        |     |       |        |     |         | 0.09 | <0.001<sup>ab</sup> |
| Yes (n=52)                        | 25 (48) | 24 (46) | 3 (6) | 18 (35) | 18 (35) | 16 (31) |         |         |
| No (n=57)                         | 26 (46) | 20 (35) | 11 (19) | 4 (7) | 14 (25) | 39 (68) |         |         |
| Peer tanning, n (%)               |      |        |     |       |        |     |         | 0.15 | <0.001<sup>ab</sup> |
| Yes (n=50)                        | 28 (56) | 18 (36) | 4 (8) | 20 (40) | 14 (28) | 16 (32) |         |         |
| No (n=59)                         | 23 (39) | 26 (44) | 10 (17) | 2 (3) | 18 (31) | 39 (66) |         |         |
| Family member tanning, n (%)      |      |        |     |       |        |     |         | 0.78<sup>a</sup> | .001<sup>b</sup> |
| Yes (n=25)                        | 12 (48) | 11 (44) | 2 (8) | 10 (40) | 10 (40) | 5 (20) |         |         |
| No (n=84)                         | 39 (46) | 33 (39) | 12 (14) | 12 (14) | 22 (26) | 50 (60) |         |         |
| Gender, n (%)                     |      |        |     |       |        |     |         | 0.7   | .96 |
| Male (n=62)                       | 27 (44) | 26 (42) | 9 (15) | 12 (19) | 18 (29) | 32 (52) |         |         |
| Female (n=47)                     | 24 (51) | 18 (38) | 5 (11) | 10 (21) | 14 (30) | 23 (49) |         |         |
| Race, n (%)                       |      |        |     |       |        |     |         | 0.002<sup>b</sup> | .98 |
| White (n=39)                      | 25 (64) | 14 (36) | 0 (0) | 8 (21) | 11 (28) | 20 (51) |         |         |
| People of color (n=70)            | 26 (37) | 30 (43) | 14 (20) | 14 (20) | 21 (30) | 35 (30) |         |         |
| Family history of skin cancer, n (%) |      |        |     |       |        |     |         | 0.32<sup>a</sup> | .42 |
| Yes (n=29)                        | 17 (59) | 10 (34) | 2 (7) | 8 (28) | 9 (31) | 12 (41) |         |         |
| No (n=80)                         | 34 (42) | 34 (42) | 12 (15) | 14 (18) | 23 (29) | 43 (54) |         |         |

<sup>a</sup>Fisher exact test was used.
<sup>b</sup>Italics indicate value is statistically significant.

Analysis of all survey respondents revealed that tanning intentions were significantly higher for those with a history of tanning ($P<.001$), those who have friends that tan ($P<.001$), and those with family members who tan ($P=.001$). Future intentions to use sunscreen were higher in video contest participants ($P=.01$) and White students ($P=.002$; Table 4). In addition, White students had higher average knowledge quiz scores compared to students who did not self-identify as only White ($P<.001$; Table 3).

A subsequent analysis of non–video contest participants comparing White students and students of color found no statistical differences in tanning intentions, having family members who tan, having friends who tan, a family history of skin cancer, or a personal history of sunburn. However, students of color had lower tanning myth knowledge scores ($P=.01$) and reported lower intention to use sunscreen in the future ($P=.02$; Table 5).
Table 5. Evaluation of tanning knowledge, history, and intentions of non–video contest participants comparing White students (n=23) to students of color (n=66).

| Variable                              | Total (N=89) | White (n=23) | People of color (n=66) | P value |
|---------------------------------------|--------------|--------------|------------------------|---------|
| Sun safety knowledge, median (IQR)    | 5 (4-6)      | 6 (5.5-6)    | 5 (4-6)                | .01<sup>ab</sup> |
| Personal tanning history, n (%)       |              |              |                        | .16     |
| Yes                                   | 43 (48)      | 14 (61)      | 29 (44)                |         |
| No                                    | 46 (52)      | 9 (39)       | 37 (56)                |         |
| Family tanning history, n (%)         |              |              |                        | >.99<sup>a</sup> |
| Yes                                   | 19 (21)      | 5 (22)       | 14 (21)                |         |
| No                                    | 70 (79)      | 18 (78)      | 52 (79)                |         |
| Peer tanning history, n (%)           |              |              |                        | .08     |
| Yes                                   | 40 (45)      | 14 (61)      | 26 (39)                |         |
| No                                    | 49 (55)      | 9 (39)       | 40 (61)                |         |
| Family history of skin cancer, n (%)  |              |              |                        | .14     |
| Yes                                   | 21 (24)      | 8 (35)       | 13 (20)                |         |
| No                                    | 68 (76)      | 15 (65)      | 53 (80)                |         |
| Sunburn in the past 2 years, n (%)    |              |              |                        | .28     |
| More than once                        | 24 (27)      | 9 (39)       | 15 (23)                |         |
| Once                                  | 36 (40)      | 7 (30)       | 29 (44)                |         |
| None                                  | 29 (33)      | 7 (30)       | 22 (33)                |         |
| Sunscreen use intention, n (%)        |              |              |                        | .02<sup>bc</sup> |
| High                                  | 36 (40)      | 13 (57)      | 23 (35)                |         |
| Medium                                | 39 (44)      | 10 (43)      | 29 (44)                |         |
| Low                                   | 14 (16)      | 0 (0)        | 14 (21)                |         |
| Tanning intention, n (%)              |              |              |                        | .89<sup>c</sup> |
| High                                  | 20 (22)      | 6 (26)       | 14 (21)                |         |
| Medium                                | 25 (28)      | 6 (26)       | 19 (29)                |         |
| Low                                   | 44 (49)      | 11 (48)      | 33 (50)                |         |

<sup>a</sup>Exact version of Wilcoxon rank sum test was used.

<sup>b</sup>Italics indicate value is statistically significant.

<sup>c</sup>Fisher exact test was used.

Discussion

In summary, our study confirms a high percentage of intentional tanning and poor sun-protective behaviors in our adolescent population. In a comparison of those who did and did not participate in a tanning myths–focused video contest, video contest participants had higher sun safety knowledge and higher intentions to use sunscreen, but did not show significant differences in tanning intentions compared to non–video contest participants. In addition, although the video contest was open to all Utah high school students, we had no Black or Hispanic students participate. A subsequent analysis found that students of color had lower sun safety knowledge scores and lower sunscreen use intentions despite having similar sun exposure and tanning histories compared to White students.

We and others have previously shown that sun-protective behaviors decrease as children age [8-10]. Our current study confirms the critical need for continued sun-protective interventions in Utah’s adolescent population: two-thirds had at least one sunburn within the past 2 years and nearly half reported intentional outdoor tanning within the past 2 years. Adolescents who report having family members who purposefully tan have displayed similar behavior [11,12]. Congruently, those who have parental encouragement to practice sun-protective behaviors are significantly more likely to practice them [9,13]. Our study confirms this pattern and another that identifies peer tanning as an important psychosocial factor influencing adolescent tanning behavior [6,14,15]. Interventions focused on parental and peer influence may be beneficial for this population.
Traditional classroom lectures have been shown to be ineffective in promoting photoprotective behavior changes [16-18]. In our cohort, there was no difference in sun safety knowledge or sunscreen and tanning intentions between those that had sun safety education in school versus those that did not. However, our video contest participants were more likely to identify tanning myths resulting in unintentional sun exposure, indicating, “A base tan protects you against getting a sunburn” and “There is no need for sun protection on cloudy or cold days”. Video contest participants also reported increased sunscreen use intentions, although they did not have decreased tanning intentions compared to non–video contest participants. Because preintervention knowledge scores were not assessed, we could not determine whether video contest participants had higher baseline knowledge of tanning myths compared to non–video contest participants. Nevertheless, our findings suggest that although skin cancer prevention may be of importance for video contest participants, as implicated by increased sunscreen use intention, the desire to have tanned skin persists. This is in concordance with recent studies that used individualized appearance-based approaches, such as ultraviolet photography and age-enhancing software to promote photoprotective behaviors [10,19-22]. Thus, future studies evaluating experiential learning methods, such as the video contest described herein, in conjunction with an appearance-based model, may show promise with this population.

Of note, adolescent members of underrepresented racial minority groups did not participate in our video contest. Although skin cancer is indeed far less common in people of color, its incidence is rising, and those diagnosed face a poorer prognosis than do White individuals [23]. Poor prognosis is thought to be caused by delay in treatment, which can result from skin cancer misconceptions and socioeconomic factors influencing access of care in people of color, as well as lack of skin cancer education directed towards this population and their providers [24-27]. These factors may also contribute to the lack of participation in our video contest. In particular, students were asked to use their own recording devices, which may discourage those from resource-limited households. Indeed, adolescents who are people of color in our study had both lower tanning myth knowledge scores and decreased sunscreen use intention. However, our findings did not show differences in tanning history, sunburn history, or family history of skin cancer between White students and students of color. These findings underlie the need for targeted skin cancer prevention education that is community- or family-centered for adolescents who are people of color [28-30].

Our study has several limitations including the small sample size surveyed, which reduces the power of our conclusions and renders them ungeneralizable to the adolescent population as a whole. Furthermore, we cannot comment on the efficacy of the video contest in improving knowledge because preintervention tanning knowledge was not assessed in the video contest participants. The video contest may inherently possess a selection bias for those who have a greater understanding of sun safety or access to video recording devices. Thus, the contest may be unappealing to those who are less informed about sun safety or who are less familiar with video production. Follow-up studies are needed to assess retention of sun-protective knowledge and behaviors long term.

In conclusion, adolescents are at high risk for poor sun-protective behaviors. Participating in a public service announcement video contest may promote sunscreen use, but does not reduce tanning intentions. Our findings highlight the need for targeted photoprotective interventions, specifically for those who report high-risk tanning intentions and also those who are people of color.

Acknowledgments
AT is supported by a National Institutes of Health grant (no. F30CA235964). This investigation was supported by the University of Utah Study Design and Biostatistics Center, with funding in part from the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health (grant no. 8UL1TR000105, formerly no. UL1RR025764).

Conflicts of Interest
None declared.

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Association Between State Indoor Tanning Legislation and Google Search Trends Data in the United States From 2006 to 2019: Time-Series Analysis

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Abstract

Background: Exposure to ultraviolet radiation from the sun or indoor tanning is the cause of most skin cancers. Although indoor tanning has decreased in recent years, it remains most common among adolescents and young adults, whose skin is particularly vulnerable to long-term damage. US states have adopted several types of legislation to attempt to minimize indoor tanning among minors: a ban on indoor tanning among all minors, a partial minor ban by age (eg, <14 years), or the requirement of parental consent or accompaniment for tanning. Currently, only 6 US states have no indoor tanning legislation for minors.

Objective: This study investigated whether internet searches (as an indicator of interest) related to indoor tanning varied across US states by the type of indoor tanning legislation, using data from Google Trends from 2006 to 2019.

Methods: We conducted a time-series analysis of Google Trends data on indoor tanning from 2006 to 2019 by US state. Time-series linear regression models were generated to assess the Google Trends data over time by the type of indoor tanning legislation.

Results: We found that indoor tanning search rates decreased significantly for all 50 states and the District of Columbia over time ($P<.01$). The searches peaked in 2012 when indoor tanning received marked attention (eg, indoor tanning was banned for all minors by the first state—California). The reduction in search rates was more marked for states with a complete ban among minors compared to those with less restrictive types of legislation.

Conclusions: Our findings are consistent with those of other studies on the association between indoor tanning regulations and attitudinal and behavioral trends related to indoor tanning. The main limitation of the study is that raw search data were not available for more precise analysis. With changes in interest and norms, indoor tanning and skin cancer risk among young people may change. Future studies should continue to determine the impact of such public health policies in order to inform policy efforts and minimize risks to public health.

(JMIR Dermatol 2021;4(1):e26707) doi:10.2196/26707

KEYWORDS
adolescents; dermatology; Google Trends; indoor tanning; internet; policy; prevention; skin cancer; skin cancer prevention; tanning; trend; time series; web-based health information; young adult; youth
Introduction

Ultraviolet radiation from the sun or indoor tanning is the cause of most skin cancers [1]. Although indoor tanning has decreased in recent years, it remains most common among adolescents and young adults [2,3], whose skin is particularly vulnerable to long-term damage [1]. US states have adopted several types of legislation to minimize indoor tanning among minors: a ban on indoor tanning among all minors, a partial minor ban by age (eg, <14 years), or the requirement of parental consent or accompaniment during indoor tanning. Currently, only 6 US states (Alaska, Colorado, Iowa, Montana, New Mexico, and South Dakota) have no indoor tanning legislation for minors [4]. The increase in indoor tanning restrictions may explain reductions in the number of indoor tanning providers, consumer spending on indoor tanning [5], and past-year indoor tanning among girls (24.1% in 2009 and 9.5% in 2015) and boys (5.7% in 2009 and 3.3% in 2015) attending high school and young adults aged 18-34 years (14% in 2007 and 4% in 2018) in the United States in recent years [3,6]. More stringent regulations have been associated with greater reductions in indoor tanning behavior and have been estimated to have a greater impact on melanoma incidence, mortality, and cost [7-10].

Internet search trends indicate public interest in a topic and are associated with actual health-related events such as influenza and COVID-19 outbreaks [11,12], medication use [13,14], melanoma mortality rates [15], and tobacco- and alcohol-related policy changes [16,17]. This study investigated whether internet searches (as an indicator of interest) related to indoor tanning varied across US states by the type of indoor tanning legislation, using free, publicly available data from Google Trends from 2006 to 2019. We hypothesized that the reduction in search rates over time would be associated with stricter indoor tanning regulations (eg, a ban on indoor tanning among all minors).

Methods

Data were downloaded from Google Trends [18]; these data reflect how many searches have been conducted on a specified topic relative to the total number of searches on Google within the selected time frame and geographic location. Search volume indices range from 0 (no searches) to 100 (peak number of searches). We selected the topic “indoor tanning,” which includes related search terms (eg, “tanning bed”). The indoor tanning time series consists of search volume indices from January 2006 to October 2019 for each state, along with the District of Columbia, and the United States as a whole. Google Trends data were available for 2004 and 2005, but state data were not sufficient for analysis.

In order to study longitudinal trends, seasonal effects were first excluded from the time series, since indoor tanning is most popular during spring in many parts of the United States [19]. We fitted 2 linear models for each state to evaluate the Google Trends data on indoor tanning and their association with the legislation type (a ban of all minors [n=22], a partial ban [n=10], requirement of parental consent [n=13], and no legislation [n=6] as of October 2019) as documented by the National Conference of State Legislatures [4]. Model 1 is a change-point model with the date of legislation enactment as the change point and as an outlier, since we observed an additional peak for some states on the date of legislation enactment. The first legislation was enacted in Wisconsin in 1991 (a partial ban), and the latest legislation included in the analyses were those enacted in Maine and Maryland (complete bans) in September and October of 2019, respectively. Model 2 is a model without any change points. To account for the correlations among adjacent time points in both models, an autoregressive moving average error structure was used. The fitted slopes (change rates) for all states in both models were calculated. The association between legislation type and the fitted slopes was assessed using a heterogenous variance model owing to unequal variations in slopes among legislation types. For Model 1, the difference in slope before and after the date of legislation enactment was first evaluated to determine whether Model 2 was sufficient for comparisons among legislation types. For multiple comparisons, P values were adjusted on the basis of the Tukey method for multiplicity adjustment. A P value less than .05 was considered significant. Statistical analyses were conducted using R (version 4.0.1, The R Foundation) [20] and SAS (version 9.4, The SAS Institute) [21].

Results

Figure 1 shows the trend in Google searches related to indoor tanning for the United States overall with the fitted regression line for the no-change-point model. The slope (change rate for tanning search trends) decreased over time. When individual states (Multimedia Appendix 1) were grouped by legislation type, the decreasing slope rates differed. These decreasing rates were greater for states that imposed a ban on all minors than for states with other types of legislation. We calculated P values to compare slopes before and after the date of legislation enactment, based on change-point Model 1, for states that imposed a minor ban. Before multiplicity adjustment, P values were significant for only the District of Columbia (2015), Delaware (2015), and Nebraska (2014) (P=.02-.04). After multiplicity adjustment, all these P values were not significant (P≥.44). In addition, the slope differences before and after the enactment of the legislation by legislation type were not significant (P=.84). Hence, we only compared the legislation types in accordance with Model 2.
As indicated in Model 2, the legislation type was significantly associated with a reduction in search rates (slopes) ($P=.01$). Table 1 shows the results of pairwise comparisons in the reduction in search rates by legislation type. We found that the reduction in the indoor tanning search trend was more marked for states that imposed a ban on all minors (0.6% per month smaller search volume) than for those that imposed a partial ban ($P=.009$, adjusted $P=.04$). Furthermore, this rate reduction was more marked for states that imposed a ban on all minors (0.5% per month smaller search volume) than for those that required parental consent ($P=.005$, adjusted $P=.02$). Moreover, this rate reduction was more marked for states that imposed a ban on all minors (0.2% per month smaller search volume) than for those with no legislation; these values were borderline significant before adjustment but did not significantly differ after multiplicity adjustment ($P=.08$, adjusted $P=.28$). The rate reduction was more marked for states with no legislation than for those requiring parental consent and those that imposed a partial ban, but these values did not significantly differ after multiplicity adjustment (adjusted $P=.22$). Finally, rate reductions between states requiring parental consent and those that imposed a partial ban did not significantly differ ($P=.22$, adjusted $P=.98$).

Table 1. Pairwise comparisons of Google Trends search data by legislation type.

| Comparisons                              | Rate difference (SE) | P value$^a$ | Adjusted P value$^b$ |
|------------------------------------------|----------------------|-------------|----------------------|
| States that banned all minors vs states that required parental consent | $-0.60 (0.22)$       | .009        | .04                  |
| States that banned all minors vs states that imposed a partial ban          | $-0.51 (0.17)$       | .005        | .02                  |
| States that banned all minors vs states with no legislation                  | $-0.27 (0.13)$       | .08         | .28                  |
| States with no legislation vs states that required parental consent          | $-0.34 (0.20)$       | .07         | .27                  |
| States with no legislation vs states that imposed a partial ban              | $-0.24 (0.14)$       | .06         | .22                  |
| States that required parental consent vs states that imposed a partial ban   | $0.09 (0.22)$        | .70         | .98                  |

$^a$Significant P values are italicized.

$^b$Values are based on Tukey-Kramer adjustment.

**Discussion**

**Principal Findings**

Studies have previously analyzed Google Trends data related to tanning, skin protection, skin cancer, and other health-related issues, along with tanning trends by season, geographic location, and population demographics of US states [15,19,22-24]. However, to our knowledge, no previous studies have explored an association between Google search rates and indoor tanning–related legislation. This study shows that indoor tanning search rates decreased significantly for all 50 US states and the District of Columbia over time. We observed a peak in 2012
when indoor tanning received increased media attention. For example, in 2012, along with the release of the final season of the television show Jersey Shore (catchphrase: “Gym, Tan, Laundry”), Patricia Krentcil from New Jersey was accused of bringing her fair-skinned, red-headed, 5-year-old daughter to tanning salons with her, and indoor tanning was banned for all minors by the first state—California.

The reduction in the Google search rate was more marked for states that imposed bans among all minors than for those with a less restrictive legislation. Considering the limitations of Google Trends data and the wide variation in the timing of legislation across US states, there are several potential explanations for these findings. For example, restrictive regulations may influence interest in tanning, as evidenced by internet search trends, or decreased interest in tanning may facilitate the enactment of more restrictive policies. These associations may also be accounted for by other unmeasured factors (eg, increasing outdoor temperatures over time). It is not surprising that we observed no significant difference in search trends for states that imposed partial bans and those that require parental consent or accompaniment, since both types of policies are partial restrictions. However, it is difficult to explain the lack of a significant difference in the trends for states with no legislation and those with other types of legislation. Perhaps search trends for states with no legislation are more likely to be similar to the nationwide media trends if state and local media attention is limited.

**Strengths and Limitations**

The strengths of this study include its longitudinal analysis of a nationwide data set based on millions of Google searches. A key limitation of the study is that raw search data were not available for more precise analyses. The data are anonymized; hence, we are unaware of the demographics or other characteristics of the searchers, including (for example) what proportion of searchers are youth or adults or are for, against, or neutral toward indoor tanning. The data are limited to the 90% of people in the United States who use the internet [25] and the 88.1% of internet searches conducted on Google [26], which tends to be more representative of people aged under 45 years, compared to other search engines such as Bing or Yahoo [27]. Arora et al [28] have previously reviewed the potential opportunities and limitations of Google Trends data for use in health and health policy research.

**Conclusions**

In the context of other relevant data, Google Trends data may provide novel insights into health- and health policy–related trends. Longitudinal Google search trends are associated with the type of indoor tanning legislation. As interest in tanning and norms change, indoor tanning and the skin cancer risk among young people may also change [3]. Future studies should continue to investigate the impact of such public health policies to inform policy efforts and minimize the public health risk.

**Acknowledgments**

This study was funded in part by the National Cancer Institute (P30CA072720).

**Conflicts of Interest**

Author MR is an employee of Medtronic Inc. The other authors have no conflicts to declare.

Multimedia Appendix 1

Google search trends with fitted regression lines (Black line: simple linear regression; Red line: Change-point linear regression; Blue line: Time series data after removing seasonal effect).

[DOCX File, 465 KB - derma_v4i1e26707_app1.docx ]

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Factors Contributing to Diagnostic Discordance Between Store-and-Forward Teledermatology Consultations and In-Person Visits: Case Series

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Abstract

Background: Use of asynchronous store-and-forward (SAF) teledermatology can improve access to timely and cost-effective dermatologic care and has increased during the COVID-19 pandemic. Previous research has found high diagnostic concordance rates between SAF teledermatology and face-to-face clinical diagnosis, but to our knowledge, none have used specific cases to illustrate factors contributing to diagnostic discordance.

Objective: To identify and illustrate characteristics that may have contributed to diagnostic discordance between store-and-forward teledermatology and in-person clinical diagnosis in a series of patients.

Methods: We identified 7 cases of diagnostic discordance between teledermatology and in-person visits where the favored diagnosis of the in-person dermatologist was not included in the differential diagnosis formulated by the teledermatologist. Cases were identified from a previously published retrospective chart review of 340 SAF teledermatology consultations, which was previously performed at an academic community health care system in the greater Boston area, Massachusetts, from January 1, 2014, through December 31, 2017. Of 99 patients who completed an in-person dermatology appointment after their teledermatology consultation, 7 had diagnostic disagreement between the teledermatologist and in-person dermatologist where the diagnosis in the in-person consultation was not included in the differential diagnosis in the original teledermatology consult. These 7 cases were examined by 2 author reviewers to identify factors that may have contributed to diagnostic discordance.

Results: Factors contributing to diagnostic discordance between SAF teledermatology consultations and in-person visits included poor image quality, inadequate history or diagnostic workup, inability to evaluate textural characteristics, diagnostic uncertainty due to atypical presentations, and evolution in appearance of skin conditions over time.

Conclusions: We identified multiple factors that contributed to diagnostic discordance. Recognition and mitigation of these factors, when possible, may help to improve diagnostic accuracy and reduce the likelihood of misdiagnosis. Continuing education of referring providers and implementation of standardized guidelines for referrals may also be helpful in reducing the risk of misdiagnosis due to inherent limitations of teledermatology services.

(JMIR Dermatol 2021;4(1):e24820) doi:10.2196/24820

KEYWORDS

teledermatology; eHealth; dermatology; telemedicine; diagnosis

Introduction

Store-and-forward (SAF) teledermatology systems utilize asynchronous evaluation of clinical images and information to provide diagnostic and management guidance directly to patients or other health care providers. In contrast to real-time telemedicine such as video encounters, SAF encounters involve collecting clinical information from a referring provider to be sent electronically to another site or provider, often a specialist,
for review at a later time. SAF teledermatology platforms can increase access to dermatologic care, provide financial savings for patients and health systems, and provide a comparable quality of care to in-person evaluation for numerous dermatologic conditions [1-8]. Utilization of both synchronous video and asynchronous SAF teledermaceutics has increased significantly during the 2020 COVID-19 pandemic [9,10]. SAF teledermatology may play a particularly vital role in the provision of safe and efficient dermatologic care as it requires less resources and coordination to implement compared to live interactive teledermatology [11].

Evaluation of diagnostic concordance for patients who receive both a teledermatology and in-person consultation is one method of assessing the diagnostic quality of SAF teledermatology consultations. Complete diagnostic concordance occurs when the first diagnosis matches between the in-person dermatologist and teledermatologist [12-17]. Previous research has found 79%-94% concordance rates between teledermatology and face-to-face clinical diagnosis, with some variation based on factors including skin condition and whether or not dermatoscopy is utilized [12-17]. High rates of diagnostic concordance help to ensure that the diagnoses patients receive from SAF teledermatology platforms are comparable to those that patients would receive during an in-person encounter.

Although previously published work has examined rates and patterns of discordance [12-17], to our knowledge, none have previously used cases to identify specific characteristics that may contribute to diagnostic discordance. We analyzed a series of 7 cases of diagnostic discordance, identifying contributing factors in hopes of identifying opportunities to improve teledermatology systems and mitigate potential risks that can occur from misdiagnosis.

Methods

Previously, a retrospective chart review of 340 SAF teledermatology consultations performed at our institution from January 1, 2014, through December 31, 2017, was conducted [18]. All SAF teledermatology cases were ordered alphabetically by patient’s last name, and the first 340 cases were reviewed. Among these 340 teledermatology cases, there were 99 patients who also completed an in-person dermatology visit, and further chart review was performed to determine the level of management concordance between teledermatologist and in-person dermatologist, defined by five categories: (1) fully concordant, (2) partially concordant, (3) discordant, (4) unable to assess because treatment was not specified by the referring provider, and (5) treatment not specified by teledermatology provider and an in-person appointment is requested for further evaluation. The definition of diagnostic discordance for this study was based on previous literature, which has defined diagnostic concordance as complete agreement (where the first diagnosis matched between in-person dermatologist and teledermatologist), partial agreement (where diagnoses overlapped between in-person dermatologist and teledermatologist), and discordant (where diagnoses did not match between teledermatologist and in-person dermatologist) [18-20]. Analysis of the 99 patients with both teledermatology and in-person visits found that diagnoses in 76 (77%) encounters were fully concordant, 16 (16%) were partially concordant, and 7 (7%) were fully discordant. We further evaluated these 7 diagnostically discordant cases to identify factors contributing to diagnostic discordance. Both authors (MSL and RS) performed retrospective chart review of the cases and discussed causes of the diagnostic discordance to come to a consensus.

Images from the teledermatology consult were submitted by the referring provider and taken using the Epic Haiku mobile app (Epic Systems Corporation). The teledermatologist was different than the in-person dermatologist in all but the second case reviewed. This project was exempt from full review by our Institutional Review Board.

Results

Overview

A summary of the cases, teledermatology and in-person differential diagnoses, in-person diagnosis, and factors contributing to diagnostic discordance is provided in Table 1.
A 31-year-old male presented to his primary care provider with a several-year history of well-circumscribed, hyperpigmented, nonpruritic, thin, scaly plaques with skin tightening on his back, trunk, and chest, as well as associated gynecomastia. The patient had tried applying moisturizing lotion without relief. Teledermatology consultation resulted in a broad differential diagnosis including superficial morphea, superficial dermatophyte infection, pityriasis rotunda, psoriasis, parapsoriasis, cutaneous T-cell lymphoma, and Hansen disease. Due to the broad differential and no leading diagnosis, he was referred for an in-person consultation. His in-person exam revealed several sharply demarcated hyperpigmented thin plaques with overlying scaly scale on the back as well as well-circumscribed tan thin plaques with overlying scale on the collar distribution of the neck and the upper chest (Figures 1 and 2). The teledermatologist noted that the image quality was limited by patient positioning and lighting, leading to shine artifact; unusual morphology, presentation; lack of historical details provided.

### Table 1. Summary of cases and factors contributing to diagnostic discordance.

| Case | Age (yrs) and gender | Telederm\(^a\) differential diagnosis | Treatment after telederm visit | In-person differential diagnosis | In-person diagnosis (diagnostic test) | Contributing factors to diagnostic uncertainty |
|------|----------------------|--------------------------------------|-------------------------------|---------------------------------|----------------------------------------|------------------------------------------------|
| 1    | 31, male             | Superficial morphea, superficial dermatophyte infection, pityriasis rotunda, psoriasis, parapsoriasis, CTCL\(^b\), Hansen | None                          | Confluent and reticulated papillomatosis of Gougerot and Carteaud, morphea, tinea corporis, and discoid erythrasma | Eczematous dermatitis (punch biopsy) | Image quality compromised by patient positioning and lighting leading to shine artifact; unusual morphology, presentation; lack of historical details provided |
| 2    | 60, male             | Sarcoïd, mycobacterial, hypersensitivity, lichenoid reaction, pseudolymphoma, arthropod bite, folliculitis | Betamethasone dipropionate 0.05% cream twice a day | Tinea corporis, sarcoïd, annular lichen planus | Tinea corporis (KOH prep\(^c\) confirmed) | Image quality compromised by limited view of anatomic area; evolution of rash from time of telederm to time of in-person visit from papular to characteristic annular with scale |
| 3    | 26, male             | Impetigo, tinea faciei, Majocchi, contact dermatitis, rosacea | Empiric doxycycline 100 mg orally twice a day, continue clotrimazole | VZV\(^d\) reactivation (herpes zoster) | Herpes zoster (physical exam) | Limited single-image view made it more difficult to appreciate dermatomal distribution; lack of adequate testing including superficial bacterial culture and KOH prep; evolution of rash from telederm consult to time of in-person visit |
| 4    | 63, male             | Actinic keratoses, excoriated papulopustular rosacea, squamous cell carcinoma | None prescribed | Telangiectasias due to sun damage | Nonspecific telangiectasias due to sun damage (clinical diagnosis) | Inability to palpate lesion to determine textural characteristics; image artifact showing overlying scale; no dermatoscopic images taken during initial consultation |
| 5    | 69, male             | HSV\(^e\), erythema multiforme, contact dermatitis, or pemphigus vulgaris, and paraneoplastic pemphigus | None prescribed | Allergic contact dermatitis vs actinic cheilitis | Lichenoid dermatitis (biopsy) | HSV/VZV viral culture would have been helpful when evaluating vesicles on mucosal surfaces; diagnostically challenging case; lack of historical details provided |
| 6    | 41, male             | HSV, LGV\(^f\) | None prescribed | Condylooma acuminata | Epidermal inclusion cyst (biopsy) | Nonclassic presentation resulting in diagnostic uncertainty; viral and bacterial swab cultures would be helpful for initial consult; difficulty in distinguishing between vesicles, pustules, cysts via telederm |
| 7    | 65, male             | Unable to determine | None prescribed | Irritated seborrheic keratosis vs melanoma | BCC\(^g\) (shave biopsy) | Dermatoscopic images were out of focus, and nondermatoscopic images were not included |

**Case 1**

A 31-year-old male presented to his primary care provider with a several-year history of well-circumscribed, hyperpigmented, nonpruritic, thin, scaly plaques with skin tightening on his back, trunk, and chest, as well as associated gynecomastia. The patient had tried applying moisturizing lotion without relief. Teledermatology consultation resulted in a broad differential diagnosis including superficial morphea, superficial dermatophyte infection, pityriasis rotunda, psoriasis, parapsoriasis, cutaneous T-cell lymphoma, and Hansen disease.

\(^{a}\)Telederm: teledermatology.  
\(^{b}\)CTCL: cutaneous T-cell lymphoma.  
\(^{c}\)KOH prep: potassium hydroxide preparation.  
\(^{d}\)VZV: varicella zoster virus.  
\(^{e}\)HSV: herpes simplex virus.  
\(^{f}\)LGV: lymphogranuloma venereum.  
\(^{g}\)BCC: basal cell carcinoma.
well-demarcated geographic hyperpigmented atrophic and wrinkly patches on the back (Figure 3) and the anterior bilateral shoulders, left flank, and upper arms, as well as gynecomastia. The differential diagnosis included confluent and reticulated papillomatosis of Gougerot-Carteaud, morphea, tinea corporis, and discoid erythrasma. A punch biopsy was performed, which revealed findings most consistent with an eczematous dermatitis. The patient was treated with triamcinolone 0.1% cream and did not return for scheduled follow-up appointments.

**Figure 1.** Case 1. Submitted teledermatology image showing patient’s back with hyperkeratotic plaque and xerotic scale. Image quality compromised by patient positioning and lighting leading to shine artifact.

![Image 1](https://derma.jmir.org/2021/1/e24820)

**Figure 2.** Case 1. Submitted teledermatology image showing patient’s neck and clavicular region with hyperkeratotic plaque and xerotic scale. Image quality compromised by patient positioning and lighting leading to shine artifact.

![Image 2](https://derma.jmir.org/2021/1/e24820)
Figure 3. Case 1. Image for in-person visit showing well-demarcated, geographic, hyperpigmented, atrophic, and wrinkly patches on the back.

Case 2

A 60-year-old man with 3 weeks of pruritic pink papules on the left forearm next to tattooed skin was referred to teledermatology. Submitted photos showed a 1-2 cm light pink patch containing three discrete 4-6 mm pink papules, and the differential diagnosis included sarcoidosis, atypical mycobacterial infection, hypersensitivity reaction, lichenoid reaction, and pseudolymphoma, as well as arthropod assault and folliculitis. The teledermatologist noted that image quality was compromised by the limited anatomic view provided (Figure 4). The patient was prescribed betamethasone dipropionate 0.05% cream twice daily for 2 weeks. In the office 3 weeks later, he was noted to have a pink-red annular plaque with overlying scale (Figure 5) that was suspicious for tinea corporis, which was confirmed with a potassium hydroxide preparation (KOH prep) showing hyphae. The patient was treated with topical ketoconazole 1% cream, and his rash resolved without recurrence.
Figure 4. Case 2. Submitted teledermatology image showing left forearm with 1-2 cm light pink patch containing three discrete 4-6 mm pink papules. Image quality compromised by limited anatomic view.

Figure 5. Case 2. In-office photo obtained from same patient, demonstrating left forearm with pink-red annular plaque with scale (tinea corporis).

Case 3
A 26-year-old male with a 3-day history of a round pink plaque on the left cheek, within which were papules and erosions, was referred to teledermatology. At the time of his referral, the referring provider had prescribed treatment of this plaque with topical clotrimazole. The patient reported that he had worn a mask and participated in paintball and jiu-jitsu a few days prior to presentation and that his lesions appeared shortly afterwards. He reported that the lesion started as a pimple or vesicle, and
then progressed into a plaque. A single submitted clinical image showed a limited view of the left cheek (Figure 6). The teledermatologist’s differential diagnosis included impetigo, tinea faciei, Majocchi granuloma, and contact dermatitis. The teledermatologist advised the referring provider to obtain a superficial bacterial culture of the plaque, continue clotrimazole, and start empiric treatment with doxycycline if the patient was unable to return for the culture. The patient subsequently reported progression of his rash and was scheduled for an in-person visit with the dermatologist 1 week later. At that time, the initial lesions had crusted over, and new lesions on his left upper medial cheek, left nasal bridge, and left nasal ala in a dermatomal distribution were noted (Figure 7). A clinical diagnosis of herpes zoster was made, the patient was prescribed oral acyclovir, and the rash subsequently resolved.

**Figure 6.** Case 3. Limited view of the face from teledermatologist consult.

**Figure 7.** Case 3. Images from clinic 1 week later.

**Case 4**

A 63-year-old man was referred to teledermatology for evaluation of a 7-month history of an enlarging nasal lesion. The teledermatologist reviewed the image and described erythematous macules that appeared to have scale or crust on the nasal tip and ala (Figure 8). The differential diagnosis provided by the teledermatologist was dependent on textural characteristics and included actinic keratoses if the lesion was rough and excoriated papulopustular rosacea if the texture was not rough. The teledermatologist requested additional textural information. Due to the incomplete information on skin texture, the patient was referred for an in-person visit, where his exam revealed no overlying scale or roughness to suggest actinic keratosis and no features suggestive of squamous cell carcinoma. He denied a history of facial flushing or acneiform or pustular eruptions. He was clinically diagnosed with a telangiectasia, likely due to dermatoheliosis, and no further treatment was recommended.
Case 5

A 69-year-old man with a 2-month history of blistering lips with skin peeling and pain unresponsive to Vaseline was referred to teledermatology. The submitted image showed a focal erosion with hemorrhagic crust and vesiculation (Figure 9), and the differential included herpes simplex virus (HSV), erythema multiforme, contact dermatitis, pemphigus vulgaris, and paraneoplastic pemphigus. The teledermatologist pointed out that the patient was not asked about history of similar eruptions, involvement of the oral mucosa, or associated symptoms including pain or burning, which would have aided the diagnosis. The consultant also recommended obtaining HSV/varicella zoster virus viral cultures and applying emollient, and the patient was scheduled for an in-office dermatology appointment. During the first in-person visit, the erosions and vesicles were resolving (Figure 10), and a bacterial culture was taken from a focal erosion which grew methicillin-resistant Staphylococcus aureus. He was treated with doxycycline and the fissure healed. The lip erosions subsequently recurred (Figure 11) and were biopsied, with pathology most consistent with a lichenoid dermatitis. He was treated with triamcinolone 0.1% cream and his symptoms resolved.
Figure 9. Case 5. Submitted teledermatology image of focal erosion with hemorrhagic crust and vesiculation on lips.

Figure 10. Case 5. Image from first in-person visit showing resolving vesicles and erosions.
Case 6
A 41-year-old man with no known history of sexually transmitted infections was referred to teledermatology for 1 month of an unchanging nontender penile rash. He was in a monogamous relationship, and his female partner did not have a similar rash. Submitted images demonstrated a cluster of apparent deep-seated vesicles or pustules on the dorsal penile shaft (Figure 12) as well as documented 1.5-2 cm suprapubic lymphadenopathy. The teledermatologist noted difficulty in distinguishing between vesicles and pustules in the images and recommended obtaining a medication history as well as viral and bacterial swab culture for genital vesicles and pustules. The differential included infectious and inflammatory etiologies, including HSV, lymphogranuloma venereum, and a fixed drug eruption. The patient was scheduled for an in-person evaluation (Figure 13), during which a shave biopsy was obtained that demonstrated a foreign body giant cell reaction suggestive of a ruptured epidermal inclusion cyst.
**Figure 12.** Case 6. Submitted teledermatology image suggestive of vesicles versus pustules on the dorsal penile shaft.

**Figure 13.** Case 6. Image from in-person visit.
Case 7
A 66-year-old man with a 1- to 2-year history of a hyperpigmented nasal papule was referred for teledermatology consultation. The teledermatologist noted that the two dermatoscopic images provided were poorly focused (Figures 14 and 15), and no gross images were submitted. Thus, the consultant was unable to provide a differential diagnosis with the provided clinical images, and the patient was referred for an in-person visit. During the in-office encounter, exam revealed a 5-6 mm black thin papule with a collarette of scale on the nasal bridge (Figure 16) with a differential of irritated seborrheic keratosis versus melanoma. A shave biopsy was performed of the lesion, which resulted in a diagnosis of pigmented basal cell carcinoma. The patient was referred for Mohs surgery.

Figure 14. Case 7. Submitted image to teledermatologist taken with dermoscopy.
Figure 15. Case 7. Submitted image to teledermatologist taken with dermoscopy.
Figure 16. Case 7. In-person image showing 5-6 mm black thin papule with collarette of scale on the nasal bridge.

Discussion

Principal Results

From our case analysis, we identified multiple factors that likely contributed to diagnostic discordance between SAF teledermatology consultations and in-person visits in these cases. One contributing factor was poor image quality, including use of bright lighting creating shine artifact (case 1), submission of photos that showed partial views without showing the entire anatomic area involved (cases 1, 2, 3, and 7), and poorly focused images (case 7). These cases demonstrate the importance of education on appropriate image acquisition techniques. Following previously published best practices [21,22] and ongoing feedback to providers submitting photos may facilitate improved photo quality over time.

In some cases, additional clinical history or diagnostic tests provided by the referring clinician would have been helpful in narrowing the differential diagnosis. For example, diagnostic accuracy may have increased if the referring provider had performed bedside diagnostics such as superficial wound cultures, viral cultures, KOH preps (cases 2, 3, and 5), or dermoscopy (case 7). Use of dermoscopy has previously been shown to be a helpful tool in teledermatology programs, particularly in the evaluation of pigmented lesions [12]. Improved training of referring providers in using these diagnostic modalities may be helpful by providing clinical data to the dermatologist that leads to improved diagnostic accuracy. In addition, many cases illustrate the importance of a complete relevant medical history. For example, in case 6, a clinical history of similar vesicular eruptions, involvement of the oral mucosa, new exposures in the affected area, and associated pain or burning would have been helpful in differentiating between HSV, erythema multiforme, contact dermatitis, or pemphigus. Similarly, increased education for referring providers around questions relevant to certain dermatologic presentations (ie, asking about involvement of oral mucosa for bullous eruptions) would help them obtain an optimal history to aid in diagnosis.

Even with high-quality images, some morphologic characteristics may be difficult to appreciate with photos given visual limitations and inability to evaluate textural characteristics. For example, in case 4, palpation for detection of scale and induration may have helped the teledermatologist differentiate actinic damage from telangiectasias, and the teledermatologist interpreted the initial submitted image as a lesion with apparent overlying scale or crust, which was not seen in person. Case 6 also highlights that cystic, pustular, and vesicular structures can sometimes be difficult to distinguish from photos alone, depending on the angle and lighting of the photo taken. These cases highlight inherent diagnostic limitations of teledermatology services.

Finally, some factors such as atypical presentations and evolution of skin lesions over time were not specific to teledermatology and may have occurred in an initial in-person visit as well. For example, multiple cases remained diagnostically challenging even when patients were seen in person due to atypical presentations (cases 1, 5, and 6). Additionally, cases 2 and 3 highlight how morphology and distribution can evolve over time, leading to changes in suspected diagnosis. Teledermatology may have the highest utility for cases with typical presentations as unusual presentations may be difficult for teledermatologists to manage confidently without in-person evaluation and possible skin biopsy. Recognition of these limitations may also help with appropriate selection of patients more likely to benefit from an in-person encounter rather than a teledermatology visit. Even when patients can be managed with teledermatology, it is...
important for patients and providers to maintain follow-up to ensure appropriate response to management and ongoing support if the patient’s condition or morphology changes from the time of original teledermatology consultation.

Our study has important implications given that the use of asynchronous and other types of virtual care continues to rise [9,10], as incorrect diagnosis via teledermatology or lack of a timely referral for an in-person visit may have potential negative consequences for patients. For example, case 2 highlights how a teledermatologist’s incorrect diagnosis and prescription of betamethasone for tinea corporis may have contributed to the progression of the rash, although the correct diagnosis also may not have been made at an initial in-person visit given its atypical presentation. In case 7, it was essential that a timely referral was made given the indeterminate images, which allowed the patient to receive a biopsy resulting in a diagnosis of pigmented basal cell carcinoma.

In order to improve the quality of SAF consultations and decrease rates of diagnostic discordance, we advocate for use of a standardized guide to help improve the quality of SAF teledermatology consults, including image quality and appropriate workup. In addition to guidelines already outlined by the American Telemedicine Association [21,22], our study highlights the need for guidelines for proper lighting, examples of dermoscopy images, relevant questions to ask in the patient history for certain morphologic presentations, and certain suggested diagnostic tests to perform before submitting a consult.

In addition, the educational value of SAF consults should continue to be emphasized to both referring and consulting providers in order to help improve the quality of consults and ensure the highest level of diagnostic accuracy. Referring providers’ ability to obtain an optimal history and diagnostic testing will also likely improve with increased use of SAF teledermatology and iterative dialogue between providers about patients’ medical management. For example, previous studies have highlighted the educational potential of SAF teledermatology systems on improving referring primary care provider knowledge of dermatologic care [23]. Teledermatologists should also be encouraged to engage in education with referring providers to ensure this ongoing learning process.

The strengths of our study include its in-depth analysis of specific cases and side-by-side comparison of teledermatology and in-person consults for the same patients. While several studies have been published on overall rates of diagnostic discordance, which have been estimated at around 39%-67% [12-17,19], none to our knowledge have presented a case-by-case analysis that illustrates and compares the teledermatology and in-person visits for the same patients.

Limitations
Some of the limitations of our study include that our sample size limits our ability to generalize across all cases of diagnostic concordance, although we intend for this to be a more in-depth study of fewer cases. In addition, only one teledermatologist reviewed each image submitted by the referring provider, which may introduce the possibility that diagnostic uncertainty may have been due to the individual teledermatologist’s level of comfort with the diagnosis rather than the inherent limitations of teledermatology. The teledermatologist was also different than the in-person dermatologist in all but the second case, and thus some of the differences in experience and comfort level between the teledermatologists and in-person dermatologists may have contributed to the discordant diagnoses.

Conclusions
Collectively, these cases highlight factors that can contribute to diagnostic discordance between teledermatologist and in-person dermatologist and the importance of ensuring that teledermatology services are supported by readily available in-person visits when appropriate to achieve the correct diagnosis in these cases. We also highlight the importance of ongoing education of referring providers to ensure optimal history and diagnostic workup and improve quality of consultations and the development of standardized guidelines for submitting referrals.

Teledermatology can provide substantial benefits to patients, and recognition of its limitations and mitigation of the factors identified in these cases provide opportunities to improve the quality and diagnostic accuracy of SAF teledermatology services.

Conflicts of Interest
None declared.

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Abbreviations

HSV: herpes simplex virus
KOH prep: potassium hydroxide preparation
SAF: store-and-forward
Factors Contributing to Diagnostic Discordance Between Store-and-Forward Teledermatology Consultations and In-Person Visits: Case Series

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URL: https://derma.jmir.org/2021/1/e24820
doi:10.2196/24820
PMID:

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Correction: Association Between State Indoor Tanning Legislation and Google Search Trends Data in the United States From 2006 to 2019: Time-Series Analysis

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Related Article:
Correction of: https://derma.jmir.org/2021/1/e26707
doi:10.2196/29516

In “Association Between State Indoor Tanning Legislation and Google Search Trends Data in the United States From 2006 to 2019: Time-Series Analysis” (JMIR Dermatol 2021;4(1):e26707) the authors noted two errors. Due to a system error, the name of one author, Trishnee Bhurosy, was replaced with the name of another author on the paper, Jerod Stapleton. In the originally published paper, the order of authors was listed as follows:

Carolyn Heckman; Yong Lin; Mary Riley; Yaqun Wang; Jerod Stapleton; Anna Mitarotondo; Baichen Xu; Jerod Stapleton

This has been corrected to:

Carolyn Heckman; Yong Lin; Mary Riley; Yaqun Wang; Trishnee Bhurosy; Anna Mitarotondo; Baichen Xu; Jerod Stapleton

In the originally published paper, the ORCID of author Trishnee Bhurosy was incorrectly published as follows:

Trishnee Bhurosy: 0000-0002-8501-1483

This has been corrected to:

Trishnee Bhurosy: 0000-0003-2603-2839

The correction will appear in the online version of the paper on the JMIR Publications website on April 14, 2021, together with the publication of this correction notice. Because this was made after submission to PubMed, PubMed Central, and other full-text repositories, the corrected article has also been resubmitted to those repositories.
Content in YouTube Videos for Rosacea: Cross-sectional Study

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Abstract

Background: Rosacea is an inflammatory skin disease that is chronic in nature. In addition to the physical symptoms, there are substantial quality of life issues that patients with rosacea experience, largely due to the visible nature in which rosacea manifests.

Objective: The purpose of this study was to describe the content related to rosacea in highly viewed English- and Spanish-language videos on YouTube.

Methods: We coded identifying information for each video and categories including characteristics of rosacea, clinical solutions, and alternative solutions. The 100 YouTube videos examined were viewed 18.5 million times between 2006 and 2020, and 57.3% (10,652,665/18,592,742) of these views were of consumer videos.

Results: Videos posted by consumers more often promoted or were trying to sell a product or procedure (32/55, 58% of consumers vs 10/31, 32% of medical professionals and 4/14, 29% of television, internet, news, or entertainment sources; P=.03) and more frequently mentioned the use of makeup or other ways to cover up rosacea (30/55, 55% of consumers vs 6/31, 19% of medical professionals and 2/14, 14% of television, internet, news, or entertainment sources; P<.001). Videos sourced from medical professionals more often mentioned medication (17/31, 55%) than videos uploaded by consumers (14/55, 25%) or TV, internet, news, or entertainment sources (3/14, 21%) (P=.01).

Conclusions: Given that rosacea is experienced differently for each person, consumer advice that works for one individual may not work for another. There is a need for reliable videos on rosacea to emphasize this and clarify misconceptions.

JMIR Dermatol 2021;4(1):e24517 doi:10.2196/24517

KEYWORDS
rosacea; YouTube; social media; skin disease; skin; chronic; dermatology

Introduction

Rosacea is an inflammatory skin disease that is chronic in nature [1]. The cause of rosacea is unknown and the pathophysiology is inadequately comprehended [1]. Current statistics indicate that this is a prevalent problem, with an estimated 416 million adults affected [2] worldwide and an estimated 16 million individuals with rosacea in the United States [3]. Recent research has led to improved understanding of the common triggers and symptomology of this widely experienced issue. Triggers of rosacea include genetic and environmental factors [1], and patients are often encouraged to monitor environmental triggers closely to avoid the onset of symptoms.

The most commonly identifiable symptom of rosacea includes redness or flushing in the face, but the range of symptoms can be variable and are broken down into subtypes. The American Academy of Dermatology has identified 4 subtypes: (1) subtype 1, which is characterized by visible redness, flushing, and blood
vessels; (2) subtype 2, in which acne-like breakouts are common; (3) subtype 3, which is rare and involves thickening skin that can result in rhinophyma, a thickened and bulbous nose; and (4) subtype 4, which affects the eyes with issues ranging from burning and stinging to the development of cysts [4]. It is possible to experience more than one subtype at a time. Naturally, because subtypes are varied and may overlap, treatments are dependent upon related symptoms and patient experiences [5]. These treatments include but are not limited to topical therapies [6-9], antibiotics [10], laser and pulsed light therapies [11-15], and reconstructive surgery [16,17].

In addition to the physical symptoms, there are substantial quality of life issues that patients with rosacea experience, largely due to the visible nature in which rosacea manifests [4]. Much has been written and researched about the medical aspects of rosacea, such as causes, prognosis, and treatment, but the psychological impact of the condition is infrequently discussed and of great importance to those with this condition. With limited ability to control triggers and the lack of a cure, patients are challenged with a lifelong chronic condition that alters their facial appearance, which often impacts their self-esteem and quality of life, especially when the rosacea is severe [18-21].

Current research suggests that 90% of Americans use the internet [22], and many consumers search the web for information related to their health. YouTube is a highly popular medium for sharing information through videos, with an estimated 2 billion unique users [23]. Studies of YouTube are prevalent on a variety of health issues and issues concerning the skin specifically [24-27]. The purpose of this study was to describe the content related to rosacea in highly viewed English- and Spanish-language videos on YouTube.

Methods

The 100 videos with the most views on YouTube were identified using the keyword “rosacea” on May 31, 2020, and were recorded and coded. Videos in English and Spanish were included in the study. Six videos were not reviewed, as they were in a language other than English or Spanish, and they were replaced with the next 6 videos in English or Spanish.

Metadata were identified for each video, including the URL, source of video upload (consumer, medical professional, television- or internet-based news, or entertainment television), number of views, length of video in minutes and seconds, date of upload, language in which the video was recorded, and whether the video featured a medical doctor. A fact sheet from the American Academy of Dermatology was used to create coding categories for content [4]. Categories included characteristics of rosacea, clinical solutions, and alternative solutions.

Characteristics of rosacea included a general description of the condition, triggers and flare-ups of rosacea, the fact that rosacea is more common among women, and the impact of rosacea on the quality of life, such as feelings of frustration, embarrassment, worry, low self-esteem, anxiety, and depression. Mentions by subtype were noted. Specific details of the symptom subtype are noted below. Clinical solutions included mentions of surgery for thickened skin, laser treatment, medication, measures to protect against the sun, a potential cure, and the promotion of products or procedures. Skin care tips and mentions of makeup to cover the skin were included in the alternative solutions category. Responses were coded as “yes” or “no” for whether the video mentioned each of the above characteristics or solutions.

Frequencies and percentages of all categorical variables were calculated, and means, standard deviations, and ranges were determined for the number of views and video length. Video source was recoded as consumer, medical professional, or combined television-based news and entertainment television. Chi-square tests and analysis of variance were used to assess possible associations between video source and the characteristics and content of the videos. Authors EJS and CJ each coded half the videos and then coded a random 10% subset to ascertain interrater reliability. Using Cohen κ (κ=0.92), interrater reliability was shown to be excellent. Because human subjects were not involved in this study, this protocol was not reviewed by an institutional review board, per the policies at William Paterson University and Columbia University.

Results

The 100 YouTube videos examined were viewed 18.5 million times between 2006 and 2020, and 57.3% (10,652,665/18,592,742) of these views were of consumer videos (Table 1).
| Characteristic | Total (N=100) | Consumer (n=55) | Medical professional (n=31) | Television- or internet-based news and entertainment television (n=14) | P value |
|---------------|--------------|----------------|---------------------------|------------------------------------------------|---------|
| **Video characteristics** | | | | | |
| Views, n (%) | 18,592,742 (100) | 10,652,665 (57.3) | 5,527,057 (29.2) | 2,513,020 (13.5) | N/A^a |
| Views, mean (SD) | 185,927 (205,020) | 193,685 (205,962) | 175,066 (210,611) | 179,501 (202,362) | .45 |
| Views, range | 33,006-1,407,672 | 40,254-1,407,672 | 42,443-1,003,575 | 33,076-782,574 | N/A |
| Video length (min), mean (SD) | 10.53 (8.92) | 11.45 (8.60) | 9.20 (7.53) | 9.93 (12.60) | .42 |
| Video length (min), range | 0.82-46.17 | 0.83-46.17 | 0.82-25.93 | 1.60-43.32 | N/A |
| **Video upload date, n (%)** | | | | | .15 |
| 2006-2010 | 6 (6.0) | 3 (5.5) | 2 (6.5) | 1 (7.1) | |
| 2011-2015 | 35 (35.0) | 16 (29.1) | 10 (32.3) | 9 (64.3) | |
| 2016-2020 | 59 (59.0) | 26 (47.3) | 19 (61.3) | 4 (28.6) | |
| **Language of video, n (%)** | | | | | .03 |
| English | 78 (78.0) | 40 (72.7) | 29 (93.5) | 9 (64.3) | |
| Spanish | 22 (22.0) | 15 (27.3) | 2 (6.5) | 5 (35.7) | |
| Features a medical professional, n (%) | 33 (33.0) | 1 (1.8) | 27 (87.1) | 5 (35.7) | <.001 |
| **Characteristics of rosacea, n (%)** | | | | | |
| Included general description of rosacea | 65 (65.0) | 31 (56.4) | 22 (71.0) | 12 (85.7) | .09 |
| Mentions triggers and flare-ups | 52 (52.0) | 23 (41.8) | 19 (61.3) | 10 (71.4) | .07 |
| Mentions rosacea is more common in women | 9 (9.0) | 5 (9.1) | 1 (3.2) | 3 (21.4) | .14 |
| Mentions impact on quality of life | 30 (30.0) | 19 (34.5) | 7 (22.6) | 4 (28.6) | .51 |
| Mentions subtype 1 signs and symptoms^b | 65 (65.0) | 31 (56.4) | 22 (71.0) | 12 (85.7) | .09 |
| Mentions subtype 2 signs and symptoms^c | 65 (65.0) | 30 (54.5) | 23 (74.2) | 12 (85.7) | .04 |
| Mentions subtype 3 signs and symptoms^d | 33 (33.0) | 12 (21.8) | 14 (45.2) | 7 (50.0) | .03 |
| Mentions subtype 4 signs and symptoms^e | 14 (14.0) | 6 (10.9) | 3 (9.7) | 5 (35.7) | .04 |
| **Clinical solutions, n (%)** | | | | | |
| Mentions surgery for thickened skin | 3 (3.0) | 1 (1.8) | 0 (0.0) | 2 (14.3) | .03 |
| Mentions laser treatment | 22 (22.0) | 8 (14.5) | 11 (35.5) | 3 (21.4) | .08 |
| Mentions medication | 34 (34.0) | 14 (25.5) | 17 (54.8) | 3 (21.4) | .01 |
| Mentions sun protection | 40 (40.0) | 17 (30.9) | 18 (58.1) | 5 (35.7) | .05 |
| Mentions a cure | 8 (8.0) | 5 (9.1) | 1 (3.2) | 2 (14.3) | .41 |
| Promotes or sells a product or procedure | 46 (46.0) | 32 (58.2) | 10 (32.3) | 4 (28.6) | .03 |
| **Alternative solutions, n (%)** | | | | | |
| Promotes an alternative treatment | 31 (31.0) | 17 (30.9) | 8 (25.8) | 6 (42.9) | .52 |
| Mentions skin care tips | 54 (54.0) | 32 (58.2) | 17 (54.8) | 5 (35.7) | .32 |
| Mentions makeup or other ways to cover up rosacea | 38 (38.0) | 30 (54.5) | 6 (19.4) | 2 (14.3) | <.001 |

^aN/A: not applicable.

^bSubtype 1 signs and symptoms: flushing and redness, particularly in the center of the face; visible broken blood vessels and spider veins; skin that is swollen, very sensitive, or may sting and burn; rough, dry, or scaling skin; and skin that tends to flush or flush easily.

^cSubtype 2 signs and symptoms: acne-like breakouts that tend to come and go and are found in the areas where the skin is very red, oily skin or skin that is very sensitive or may sting and burn, visible broken blood vessels and spider veins, and plaques with raised patches of skin.
d) Subtype 3 signs and symptoms: bumpy skin or skin that begins to thicken, particularly on the nose, chin, forehead, cheeks, and ears; visible broken blood vessels and spider veins; oily skin; and large pores.

e) Subtype 4 signs and symptoms: rosacea in the eyes where the eyes appear watery or bloodshot, feel gritty, burn or sting, itch, or are dry and sensitive to light; blurry or decreased vision; and visible broken blood vessels or a cyst on the eyelid.

The mean number of views was 185,927 (SD 205,020), and the mean length of the videos was 10.53 minutes (SD 8.92 minutes). Most videos were uploaded between 2016 and 2020 (59/100, 59.0%), recorded in English (78/100, 78.0%), and did not feature a medical professional (67/100, 67.0%).

Consumer videos less often mentioned signs and symptoms of subtypes 2 and 3 (subtype 2: 30/55, 55% of consumers vs 23/31, 74% of medical professionals and 12/14, 86% of television or internet; \( P = .04 \); subtype 3: 12/55, 22% of consumers vs 14/31, 45% of medical professionals and 7/14, 50% of television or internet; \( P = .03 \)). Videos posted by consumers, however, more often promoted or were trying to sell a product or procedure (32/55, 58% of consumers vs 10/31, 32% of medical professionals and 4/14, 29% of television, internet, news, or entertainment; \( P = .03 \)) and more frequently mentioned the use of makeup or other ways to cover up rosacea (30/55, 55% of consumers vs 6/31, 19% of medical professionals and 2/14, 14% of television, internet, news, or entertainment; \( P < .001 \)).

Videos sourced from medical professionals more often mentioned medication (17/31, 55%) than videos uploaded by consumers (14/55, 25%) or television, internet, news, or entertainment sources (3/14, 21%) \( (P = .01) \). Videos uploaded from a television, internet, news, or entertainment source more often mentioned subtype 4 (5/14, 36% vs 6/55, 11% of consumers and 3/31, 10% of medical professionals; \( P = .04 \)) and surgical treatments for thickened skin (2/14, 14%) compared with consumer (1/55, 2%) and medical professional (0/0, 0%) videos \( (P = .03) \).

**Discussion**

To our knowledge, this is the first study to examine the content of both English and Spanish rosacea videos on YouTube. The majority of the 100 most popular rosacea YouTube videos were uploaded by consumers. Thus, medical professionals should be aware that consumer opinions and thoughts on rosacea are accessed more often than professional materials. The type of information presented in the videos analyzed also varied depending on the source. Videos sourced from medical professionals were more likely to mention information on medication and the use of sun protection as treatments for rosacea, while videos sourced from consumers were most likely to mention information on alternative treatments like the use of makeup to cover up rosacea. Research indicates that cosmetics can exacerbate rosacea [28-30], and as such, the prevalent makeup tutorials related to covering rosacea could be promoting products that cause flares. In addition, rather than focusing on avoiding triggers, this content focused on hiding symptoms.

Within the context of the connection between self-esteem and body image [31], research is delving further into rosacea’s social and emotional fallout. Patients may avoid social situations, retreat from relationships, or think negatively about themselves as a result of their symptoms. An increase in symptoms of depression and anxiety related to the severity of the rosacea have been reported [19]. Women are more likely to be diagnosed with rosacea, exacerbating the gaps in self-esteem that already exist between men and women [32], suggesting that, for women, a holistic approach to treating the condition may be warranted to affect both the psychological and physical manifestations of the disease [33].

Further, the videos sourced from consumers were also found to be the most likely to include information to sell a product. This discovery highlights that consumers may have various underlying motivations to upload videos on rosacea, such as commercial sponsorship, which might result in the communication of misinformation to increase sales of a sponsored product to treat rosacea. Analysis of the videos revealed that the accuracy and reliability of the information found in the videos varied greatly. This is best highlighted by the videos that included information on a cure despite the fact that there is no cure for rosacea. The findings of this study are similar to a prior study of rosacea on a variety of internet sources, including YouTube videos, which concluded that internet sources could contain peer-generated content that was harmful or misleading [34].

This study has limitations that warrant mention. The cross-sectional design indicates that data were only collected at one point in time, and given the fact that content on the internet is in flux, the most popular videos could change over time. Additionally, this study only included videos in English and Spanish despite videos being available in an array of languages. Further, there is no way to delineate who viewed each video and the reason they did so. Therefore, the study strictly offers insight on the content and coverage of information in the widely viewed videos on YouTube.

Nonetheless, this study offers insight into the content available on YouTube about rosacea. Given that rosacea is experienced differently for each person, consumer advice that works for one individual may not work for another. There is a need for reliable videos on rosacea to emphasize this and clarify misconceptions. Further study is needed on the accuracy and reliability of information on rosacea in videos sourced by consumers, as well as on the factors that influence consumers to create and upload videos on rosacea for YouTube.

**Conflicts of Interest**

None declared.

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Public Interest in a Potentially Harmful, Non–Evidence-Based “Wellness” Practice: Cross-Sectional Analysis of Perineum Sunning

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Abstract

Background: Perineum sunning/tanning is a potentially harmful yet popular new health trend cultivated by a viral social media post, famous public figures, and subsequent media coverage.

Objective: Our primary objective is to evaluate public interest in perineum sunning.

Methods: Using an observational study design, we extracted data from Google Trends for the terms “perineum sunning,” “perineum tanning,” “Metaphysical Meagan,” and “Josh Brolin”; and Twitter (via SproutSocial) for “perineum sunning” and “perineum tanning” from November 1, 2019, to December 31, 2019. UberSuggest was used to investigate monthly search volumes and user engagement. We used data from Google Trends and Twitter to construct autoregressive integrated moving average (ARIMA) models to forecast public interest in perineum sunning and perineum tanning had the post on social media never occurred. Next, we performed an integral function to calculate the cumulative increase in “perineum tanning” from the day after the post occurred to the end of the year as the area between the forecasted values and the actual values. Using Welch t tests, we compared forecasted and actual values for “perineum sunning” and “perineum tanning” using Twitter and Google Trends data over 1-, 2-, and 4-week periods after the social media post to determine if the increased volumes were statistically significant over time. Lastly, we monitored Google Trends for “perineum sunning” and “perineum tanning” through September 30, 2020, to capture trends during the summer months.

Results: Before the Instagram post went viral, there was no search interest in perineum sunning. ARIMA modeling for perineum tanning forecasted no increase in searches (0.00) if the post had not gone viral, while actual interest conveyed a relative cumulative increase of 919.00% from the day the post went viral through December 31, 2020. The term “perineum sunning” was mentioned on average 804 (SD 766.1) times daily for this 7-day period, which was also significantly higher than predicted (P≤0.03), totaling 5628 tweets for these 7 days. The increased volume of tweets and relative search interest from Google Trends remained significantly higher for both terms over the 1-, 2-, and 4-week intervals. User engagement showed that nearly 50% of people who searched for “perineum sunning” were likely to click a returned link for more information. Continued observance of search interest in perineum sunning demonstrated interest spikes in the summer months, June and July 2020.

Conclusions: Google Trends and Twitter data demonstrated that one social media post claiming non–evidence-based health benefits of regular sun exposure—without the use of sunscreen—generated significant public interest. Medical journals, dermatologists, and other health care professionals are obligated to educate and correct public misperceptions about viral wellness trends such as perineum sunning.

http://derma.jmir.org/2021/1/e24124/
KEYWORDS
general dermatology; perineum sunning; perineum tanning; skin neoplasm; public health; social media; infodemiology; public interest; Google Trends; Twitter

Introduction

Social media may positively affect health behaviors or propagate potentially harmful health information [1,2]. On October 21, 2019, posts on the social media platform Instagram boasted that perineum sunning would improve focus, augment hormonal regulation, increase libido, regulate circadian rhythm, and enhance health and longevity. These posts claimed that only 30 seconds of perineum sunning was equivalent to one day’s worth of sun exposure while also recommending against sunscreen use when perineum sunning [3]. The original post went viral in late November via Twitter, and again in December after well-known actor Josh Brolin received media coverage for the severe sunburn to his anogenital area after attempting perineum sunning.

Given the high potential for sunburns and cutaneous cancers resulting from this practice, our primary objective was to investigate the effects of social media and news coverage of perineum sunning on public interest by examining internet search volume, trends, and engagement, using publicly available data. A more informed understanding of the influence of social media on public search interest in potentially harmful practices like perineum sunning may assist dermatologists and medical journals when developing social media strategies to directly combat medical misinformation.

Methods

Google Trends [4] was used to collect daily relative search interest from November 1, 2019, to December 31, 2019, for “perineum sunning,” “perineum tanning,” “Metaphysical Meagan” (the Instagram user who published the original post), and “Josh Brolin” (who appeared in news stories on December 3, 2019, after getting a severe sunburn while performing this practice). Search interest from Google Trends is provided as a relative measure of total searches from 0-100 estimated from the highest peak within a given time frame. To explore public interest beyond Google Trends, we performed keyword searches for “perineum sunning” and “perineum tanning” occurring on Twitter via SproutSocial [5], a social media analytics platform. We also used UberSuggest [6] to collect monthly internet search volumes and user engagement (defined as a person clicking on the links returned from the search) for the terms “perineum sunning” and “perineum tanning.”

Using Google Trends and Twitter data, we constructed autoregressive integrated moving average (ARIMA) models to forecast predicted values of relative search interest and tweets for the terms “perineum sunning” and “perineum tanning” from November 25, 2019, to the end of the year if the post on social media had not occurred. Next, we calculated the average number of tweets and Google Trends relative search interest for the terms “perineum sunning” and “perineum tanning,” and using Welch’s t tests, compared them to their respective forecasted values over 1-, 2-, and 4-week periods after the social media post to assess if the increased volumes were statistically significant over time. Using an integral function, we calculated the cumulative area between the forecasted baseline and the actual relative search interest data to provide the relative increased search interest through December 31, 2019, for “perineum sunning” from Google Trends. Lastly, Google Trends was monitored for the terms “perineum sunning” and “perineum tanning” through September 30, 2020, to capture public interest trends during the summer months. All analyses were conducted in R, version 3.2.1 (The R Foundation).

Results

Relative search interest for the four search terms through the end of 2019 are compared in Figure 1.

Based on the first 24 days of November, the ARIMA model forecasted that no interest (0.0) would have arisen in “perineum sunning” for the rest of the year if the social media post had not happened.

Relative search interest for perineum sunning and perineum tanning peaked the day after the social media post went viral. Keyword usage on Twitter showed that tweets significantly increased the day following the post with an increase of 2064 (95% CI 2054-2074) tweets over the predicted value (1) for perineum sunning. For the first 7 days after the post went viral, actual search interest for perineum sunning and perineum tanning were on average 42% (SD 33.0) and 43.6% (SD 35.9) higher than predicted, respectively. Additionally, the term “perineum sunning” was mentioned on average 804 (SD 766.1) times daily for this 7-day period, which was also significantly higher than predicted (P≤.03), totaling 5628 tweets for these 7 days. The increased volume of tweets and relative search interest from Google Trends remained significantly higher for both terms over the 1-, 2-, and 4-week intervals (Table 1).
Figure 1. Google Trends analysis of the terms “perineum sunning,” “perineum tanning,” “Metaphysical Meagan,” and “Josh Brolin,” from November 1 to December 31, 2019.

Table 1. Differences of means between actual and forecasted data from 1, 2, and 4 weeks after the social media post.

| Search term         | 7 days  | 14 days | 28 days |
|---------------------|---------|---------|---------|
|                     | Forecast, mean (SD) | Actual, mean (SD) | t test (df=6); P value | Forecast, mean (SD) | Actual, mean (SD) | t test (df=13); P value | Forecast, mean (SD) | Actual, mean (SD) | t test (df=27); P value |
| Google Trends       |         |         |         |
| Perineum sunninga (%) | 0 (0)   | 42.0 (33.0) | −4.2; .001 | 0 (0) | 37.3 (32.4) | −4.3; <.001 | 0 (0) | 21.2 (27.9) | −4.0; <.001 |
| Perineum tanninga (%) | 0 (0)   | 43.6 (35.9) | −3.2; .02  | 0 (0) | 49.2 (31.3) | −5.9; <.001 | 0 (0) | 30.6 (29.2) | −5.5; <.001 |
| Twitter             |         |         |         |
| Perineum sunningb   | 2.8 (7.52) | 804.1 (766.1) | −2.8; .03  | 1.4 (5.3) | 573.4 (630.5) | −3.4; .004 | 0.7 (3.8) | 299.2 (519.1) | −3.0; .005 |
| Perineum tanningb   | 0.1 (0.0) | 36.1 (37.4) | −2.5; .04  | 0.1 (0.0) | 27.8 (28.4) | −3.6; .003 | 0.1(0) | 15.0 (23.7) | −3.3; .002 |

aData reflects average daily relative search interest (0%-100%).

bData reflects average daily number of actual tweets.

The area under the curve (shaded in Figure 2) for “perineum tanning” indicated a cumulative increased interest of 919.00% from the day the post went viral to the end of the year.

Monthly search volumes from UberSuggest show no search interest in “perineum sunning” or “perineum tanning” before the post went viral on November 25, 2019. After the post, search volumes for the search terms “perineum sunning” and “perineum tanning” increased from 0 in October to a combined 52,599 searches for the remaining days in November and climbed to 67,598 searches in December. User engagement showed that nearly half of the individuals who searched for “perineum sunning” or “perineum tanning” were likely to click a returned link for more information. Search trends for perineum sunning showed additional spikes in the week of June 6 (29% of the original search interest peak), June 28 (60% of the original search interest peak), and July 5 (50% of the original search interest peak) (Figure 3).
Discussion

Principal Findings

Our results show that one Instagram post, a subsequent viral tweet, and mainstream media coverage generated significant interest in perineum sunning. This new proposed health trend appeared in over 250 articles from numerous media outlets, which spurred others to engage in the behavior. For example, actor Josh Brolin attempted perineum sunning, which resulted in a severe sunburn to his anogenital area. Other iconic figures such as the famous American music producer Diplo, popular health author and entrepreneur Dave Aspery, and American actress Shailene Woodley have all shared their experience of perineum sunning through news media. Despite being deemed a “wellness” technique, the mainstream attention garnered by perineum sunning could lead to harmful health consequences.

Our trends analysis demonstrates continued public search interest in “perineum sunning” and “perineum tanning” for almost a year since the original post on October 21, 2019. Continued search interest in perineum sunning showed a resurgence during the summer months. This finding is concerning because UV exposure increases during the summer, and the solar radiation during these months has the greatest intensities of UV-B [7]. Additionally, Tripathi et al [8] found an increase in the prevalence and costs associated with sunburn-related emergency department visits, especially during...
the months of June, July, and August. While this study did not explore intent to act, if increased search interest during these summer months resulted in more people attempting this practice, they would be exposing themselves to more dangerous levels of UV radiation. While unsure why other spikes of public interest in perineum sunning occurred, we speculate that continued interest is being generated through social media platforms and ongoing news media coverage. Regardless of the reasons for the increased interest, our study suggests that people are continuing to search for perineum sunning, which may lead to higher rates of cutaneous malignancies and poorer health outcomes if more people attempt this unsafe wellness trend.

Exposure of skin to the UV rays present in sunlight has acute and chronic effects that can occur at doses of UV light that are nonerythemogenic. Short-term effects are sunburn (ranging from solar erythema to vesiculation/bullae formation) and tanning. Long-term effects include photoaging and UV-induced tumor formation [9,10]. It is well known that UV exposure is the most obvious risk factor for cutaneous malignancies such as melanoma, basal cell carcinoma, and squamous cell carcinoma [11]. To make matters worse, melanomas in less visible areas, such as the buttocks and perineum, have worse prognosis independent of tumor characteristics and visibility on self-skin examinations [10]. Furthermore, perineum skin is still vulnerable to risk of sunburn and, over time, cancer formation. To our knowledge, no study has shown perineal skin to have a special ability to generate more vitamin D production than other areas of the skin, nor is there any human evidence that sunning this specific area promotes positive changes in mood, increases libido, and improves regulation of hormones or circadian rhythm. Promotion of health misinformation, such as perineum sunning, via social media is quickly becoming a public health threat.

Non–evidence-based health trends and medical misinformation originating on social media are recognized challenges with serious public health implications (eg, antivaccination campaigns), which can place a significant burden on medical professionals and health care systems in one day, as our results show. Protecting the value of accurate medical information is of utmost importance as science and health information can be strategically manipulated by social media while perpetuating misinformation [12]. Strategies to combat the spread of misinformation require a collaborative approach involving medical journals, researchers, and physicians [13]. Doctors and health care professionals are encouraged to use social media platforms—the source of the majority of misinformation—as educational tools to promote accurate medical information and protect the integrity of online health information [14].

Along with health care professionals, journals must also be proactive in coordinating efforts to address public health misinformation that may harm the general public. We agree with Armstrong et al [15] and recommend journals publish articles with the intention of educating and redirecting public behavior at pertinent times when widespread dissemination of health misinformation has occurred. The Journal of Medical Internet Research, and its sister journal JMIR Dermatology, are two examples of journals that seem to be dedicated to publishing research focused on combating medical misinformation and raising awareness concerning the quality of health information on the internet [1,16-19]. For example, one study recently published by JMIR Dermatology evaluated the quality of sun-protection information by examining the most popular YouTube videos covering sunscreen [16]. Here the authors concluded that content about sunscreen use was often negative or failed to include important sunscreen use recommendations. Low-quality information surrounding sunscreen use, coupled with our study’s results, further demonstrates the need for a collaborative approach to combat medical misinformation, especially in risky sun behaviors.

Limitations

Our study is limited by its cross-sectional design and should not be generalized. While Google Trends has been used to examine increased public interest and subsequent actions [20,21], our study did not determine intent. Therefore, future research in social media health trends may consider collecting participant surveys of intent to act after viewing the post. Lastly, by using Google Trends, we could only calculate relative search volumes.

Conclusion

Our findings suggest that it took only 24 hours for a potentially dangerous “health” trend to capture the spotlight of mainstream media outlets—an alarming exposé in the power of social media concerning perineum sunning. Additionally, continued observance of the search interest in perineum sunning showed a resurgence during the summer months. Exposure to sunlight is dangerous, and sensitive areas such as the perineum have worse prognosis even when detected during skin examinations. Dermatologists and physicians in other fields of medicine should be aware of perineum sunning and should consider that its popularity may warrant additional inquiry about sun exposure and tanning during patient encounters.

Acknowledgments

MV is funded through the US Department of Health and Human Services Office of Research Integrity and the Oklahoma Center for the Advancement of Science and Technology.

Conflicts of Interest

None declared.

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Abbreviations

ARIMA: autoregressive integrated moving average
Instagram Content Addressing Pruritic Urticarial Papules and Plaques of Pregnancy: Observational Study

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Abstract

Background: Pruritic urticarial papules and plaques of pregnancy (PUPPP) is the most commonly diagnosed pregnancy-specific dermatosis. It presents with intense pruritus and can be difficult to manage, which encourages mothers to look to social media for camaraderie and advice.

Objective: This study aimed to characterize the sources and thematic content of Instagram posts in order to define influential groups of users. Our goal was to determine the status of online discourse surrounding PUPPP and elucidate any potential space for health care provider intervention via creation of Instagram accounts dedicated to information dissemination for patient populations.

Methods: Three hashtag categories were selected (#PUPPP, #PUPPPs, and #PUPPPrash), and the top public posts from each were analyzed and organized by source and by thematic content. The numbers of likes and comments were also recorded.

Results: Among the top 150 posts in each hashtag category, only 428 posts in total were eligible for this analysis. Majority (316/428, 73.8%) of posts were created by mothers who experienced PUPPP. These posts were testimonial accounts in nature. A small fraction of posts (14/428, 3.3%) were generated by physician accounts. Posts from blogs with extensive followings garnered the most attention in the form of likes and comments.

Conclusions: Mothers experiencing PUPPP comprised the majority of accounts posting under the hashtags selected. The most common themes included pictures of the rash and personal testimonies. Posts under blog posts received the most likes and comments on average. There is space for physician and health care specialists to improve their social media presence when it comes to discourse surrounding PUPPP. Patients are seeking out communities on social media, like Instagram, in order to have questions answered and obtain advice on management. Accounts with large followings tend to have more likes and more comments, which encourages information dissemination and awareness. Thus, we suggest that physicians create content and potentially partner with blog-type accounts to improve outreach.

(JMIR Dermatol 2021;4(1):e26200) doi:10.2196/26200

KEYWORDS

pruritic urticarial papules and plaques of pregnancy; dermatology; rash; pregnancy; obstetrics; dermatosis; Instagram; social media; patient education
**Introduction**

Pruritic urticarial papules and plaques of pregnancy (PUPPP) is the most common pregnancy-specific dermatosis affecting about 1 in 200 pregnancies [1]. It is also known as polymorphic eruption of pregnancy. PUPPP is more common in primiparous women and is characterized by erythematous papular lesions that classically arise within the confines of striae distensae on the gravid abdomen [1,2].

Typically, the eruptions begin on the abdomen and can spread to the thighs, arms, and buttocks, with onset occurring typically in the third trimester [3,4]. Symptoms tend to resolve 7 to 10 days postpartum [4]. However, this rash can be very pruritic, extensive, and difficult to manage for patients, especially in multiple gestation cases [4]. Many mothers try antipruritus creams and medications, with little or short-lasting relief. This could be one factor driving mothers with PUPPP to seek support in various outlets, including social media.

Social media has taken the spotlight in recent years as a tool for human interaction, which has changed how we learn from and engage with peers. Particularly within younger generations that grew up with internet access, it is increasingly common to find that people turn to social media for information and advice. A recent survey found that 72% of people reported turning to the internet to look up health information within the last year [5]. The convenience of the internet at the tips of our fingers has made it a preferred source for many Americans searching for answers.

Social media has become a way for patients with various unique conditions to post and find camaraderie with others who have similar afflictions, including during pregnancy [6]. We must be cognizant of the power that social media has to influence our decision-making ability in this regard [7,8]. Endorsements on social media sites, such as Instagram, have been shown to activate reward centers of the brain, making social media a powerful tool for peer influence [8]. According to Instagram’s webpage, it boasts of having over 1 billion users worldwide. The Pew Research Center generated an estimate that roughly 72% of American adults have at least one social media account and that 37% have an Instagram account as of 2019 [9]. Creating posts for Instagram is free, and posts can be made available to the public. This makes the app a cost-effective and efficient way for health care specialists to widely distribute quick medical information to the public at large. In light of this, it is important to analyze how patient populations interact with content on social media so that we can determine whether there is space for health care professionals to provide evidence-based medical information and quell patient skepticism about information they are finding online.

PUPPP is a lesser publicized affliction, and thus, its discussion is not common in the public arena despite its relatively high prevalence in pregnant and postpartum mothers [1]. The rash can dramatically impact mothers during pregnancy and alter their experience. We hope to be able to shed some light on what information is being distributed on popular social media sites. In this study, we seek to characterize posts regarding PUPPP circulated on Instagram from the public. It is our goal to determine what discourse is generated by and for these pregnant mothers in order to define a potential space for increased physician and health care provider intervention, education, and advocacy.

**Methods**

**Data Collection**

Using the Instagram app, hashtag-based key terms were searched and identified (n=3; #PUPPP, #PUPPPs, and #PUPPPrash). Note that capitalization does not make a difference on the app hashtag search function; thus, “#PUPPP” yields the same result as “#puppp.”

The top 150 posts from each tag were selected for analysis from all public posts. To be included in the study, the picture’s caption had to include information or opinions regarding PUPPP. We excluded posts that were considered private because they would not be readily accessible to the public when using Instagram’s search function. We excluded posts that had irrelevant material (ie, posts about puppies that were tagged within the #puppp thread and posts that did not include content regarding PUPPP) or were repeat tags (ie, posts tagged in the #puppp and #puppps categories). With these criteria, two of the tag categories yielded fewer than 150 posts that qualified for the study.

**Data Analysis**

Each post was assigned exclusively to a category based on source. The categories included the following: (1) mother, (2) physician/health care provider, (3) health care organization, (4) company/product, and (5) blog/blogger (Table 1). For further clarification, the category for physician/health care provider was scrutinized even further to determine if posts were from physicians or other providers such as midwives and doulas. In order for a post to be determined to be from a mother, caption information was taken into account and designation was granted if first person language was used. Many of these posts were accompanied by “selfies” that contributed to the decision of assigning a post to the mother category.

Characterization of the thematic content of each post was then determined by the team. Thematic content was categorized nonexclusively, meaning that each post could be assigned to more than one category based on image content as well as accompanying caption content. These categories included the following: (1) testimony, (2) educational information, (3) picture of PUPPP rash, (4) therapy advice & guidance, (5) blog post, and (6) product promotion (Table 1).
Table 1. Stratification methodology of Instagram posts that met the inclusion criteria.

| Post source categories (exclusive assignment) | Thematic content categories (nonexclusive assignment) |
|-----------------------------------------------|-------------------------------------------------------|
| 1. Mother                                     | 1. Testimony                                           |
| 2. Physician/health care provider             | 2. Educational information                            |
| 3. Health care organization                   | 3. Picture of PUPPP                                   |
| 4. Company/product                            | 4. Therapy advice & guidance                          |
| 5. Blog/blogger                               | 5. Blog post                                          |
|                                               | 6. Production promotion                                |

Individual posts could be placed exclusively in one category based on their source but were nonexclusively categorized by content of the post.

PUPPP: pruritic urticarial papules and plaques of pregnancy.

The numbers of comments and endorsements or “likes” were recorded for each post after the characterization process. The average numbers of likes and comments were then calculated within each tag category.

Results

Tags

As of November 23, 2020, there were 2100 posts tagged with #PUPPP, 599 posts tagged with #PUPPPs, and 189 posts tagged with #PUPPPrash, which were publicly available on Instagram (totaling 2888 posts).

Table 2. Post source categorization.

| Tag category | Post source, n (%) | Health care organizations | Physicians and health care providers | Companies | Blogs |
|--------------|--------------------|---------------------------|--------------------------------------|-----------|-------|
| #PUPPP (N=150) | 134 (89.3%) | 9 (6.0%) | 7 (4.7%) | 0 (0%) | 0 (0%) |
| #PUPPPs (N=141) | 132 (93.6%) | 1 (0.7%) | 0 (0%) | 8 (5.7%) | 0 (0%) |
| #PUPPPrash (N=137) | 50 (36.5%) | 2 (1.5%) | 7 (5.1%) | 20 (14.6%) | 58 (42.3%) |
| Overall (N=428) | 316 (73.8%) | 12 (2.8%) | 14 (3.3%) | 28 (6.5%) | 58 (13.6%) |

In all categories, except for #PUPPPrash, mothers themselves were the predominant posters of content regarding PUPPP. In #PUPPPrash, the largest portion of content and discussion involved blogs (58/137, 42.3%), most of which were identified as “maternity lifestyle blogs” where women share experiences, advice, and information regarding pregnancy and motherhood to their followers (Table 2).

Only 14 posts came from health care providers overall, seven of which were from physicians licensed with an MD (Doctorate in Medicine) or DO (Doctorate in Osteopathic Medicine) medical degree (Table 2). The other seven advertised themselves as mid-level providers, such as nurse practitioners, lactation consultants or midwives, and doulas. This content made up 3.3% (14/428) of the overall number of posts.

#PUPPP had the majority of posts from accounts deemed as “health care organizations,” such as a public account, @skincancerderminstitute, a dermatology clinic. Nine of the 12 posts coming from health care organizations were in this tag group. Other organizations represented were centered on pregnancy and women’s health.

The “companies” category, which we defined as any account tied to a business that advertised a product or service that they themselves sell and/or provide for financial gain, was most prominent in the #PUPPPrash category, comprising 14.6% (20/137) of all posts analyzed (Table 2). Of the 28 posts from companies, 20 were found under #PUPPPrash.

Thematic Content Analysis

All posts were categorized nonexclusively into six categories based on the content in the image or the caption associated with the image.

By and large, the category “testimony” comprised a majority of the posts across all three tag groups. Out of all 428 posts, 309 (72.2%) were classified as a "testimony" based on the content within the caption provided by the poster. This meant that 72.2% of all posts contained personal accounts and anecdotes from mothers who had experienced PUPPP during one or more of their pregnancies (Table 3). Most of these testimonies were mothers describing their journeys, expressing...
frustration with the pruritic rash, and providing encouragement to their followers who may be experiencing the same affliction.

Table 3. Analysis of thematic content of posts in each tag category and overall (N=428).

| Theme                  | Tag category | #PUPPP, n | #PUPPPs, n | #PUPPPrash, n | Across all, n (%) |
|------------------------|--------------|-----------|------------|---------------|------------------|
| Testimony              | #PUPPP       | 91        | 94         | 124           | 309 (72.2%)      |
| Education              | #PUPPP       | 20        | 8          | 1             | 29 (6.8%)        |
| Therapy advice         | #PUPPP       | 10        | 14         | 5             | 29 (6.8%)        |
| Blog post              | #PUPPP       | 0         | 11         | 89            | 100 (23.4%)      |
| Production promotion   | #PUPPP       | 15        | 23         | 5             | 43 (10.0%)       |
| Picture of rash        | #PUPPP       | 58        | 55         | 115           | 228 (53.3%)      |

Posts were nonexclusively categorized, that is, each post could be tallied in more than one of the six themes represented.

Therapy advice included posts in which accounts offered advice on which over-the-counter products or home remedies worked best for the poster’s PUPPP. These posts only comprised 6.8% (n=29) of all posts.

Lastly, product promotion included posts in which a specific product or service was advertised for financial gain by the poster. These posts included products, such as herbal soap bars, creams, and essential oils, designed to help with the symptoms of PUPPP. These posts could have links to the vendor’s Instagram page or website for consumers to purchase products directly. Product promotion posts comprised 10.0% (43/428) of all posts and were more represented in the PUPPPs group followed by the PUPPP group (Table 3).

Endorsement and Follower Interaction

The number of likes was recorded for each post during analysis, and the average was calculated for each subsection. The highest average number of likes was found in the PUPPPrash tag with 2371.52. The same category also resulted in the highest average number of comments of 34.34 (Table 4).

Table 4. Likes and comments broken down by tag category.

| Tag category | Mean number of endorsements | Range for the number of likes | Mean number of comments | Range for the number of comments |
|--------------|-----------------------------|------------------------------|-------------------------|---------------------------------|
| #PUPPP       | 50.53                       | 0-458                        | 10.46                   | 0-65                            |
| #PUPPPs      | 67.39                       | 1-1452                       | 8.57                    | 0-46                            |
| #PUPPPrash   | 2371.52                     | 4-38,350                     | 34.34                   | 0-389                           |

The PUPPPrash group had the highest average number of likes but also had the largest range of likes from 4 to 38,350. This category had 10 posts with more than 10,000 likes and 32 posts with between 1000 and 9999 likes. No other category had a post with more than 10,000 likes. PUPPPrash also had the highest average number of comments per post with a range of 0 to 389 (Table 4).

Of note, the PUPPPrash category also had the highest concentration of blog accounts (Table 3). These accounts tended to have more followers, which may have accounted for the higher number of likes and comments per post.

Discussion

Principal Findings

The presence of PUPPP on the social media app Instagram is significant yet small in comparison to the estimated number of pregnancies affected each year. With a little under 3000 posts available to the public on the popular app and around 3.7 million births in the United States annually, there appears to be a gap in discourse surrounding this common dermatosis [10]. A search on the Instagram interface reveals that other sequelae of pregnancy, such as hyperemesis gravidarum, have more dedicated posts. For example, searching...
#hyperemesisgravidarum on Instagram returned approximately 49,200 posts as of November 30, 2020. Despite the low census of posts for PUPPP, the posts included in this analysis represented a diverse pool of sources as well as themes.

Interestingly, the overwhelming majority of posts came from mothers who were affected by the rash. These posts tended to contain testimonial captions and frequently included pictures of the mother’s own rash. Based on caption analysis, most of these testimonial posts were intended to bring awareness to a condition that is considered “embarrassing” by many moms. Posts would include candid accounts of the mothers’ experiences with combating PUPPP. Posts like this help to normalize the discourse and make others feel more comfortable discussing their rash with their followers. Some moms even included pictures of their exposed rash. These vulnerable pictures could put others at ease if the rash looks similar to their own. Overall, these testimonial posts really highlight the community’s honesty with PUPPP and willingness to share their experiences for the benefit of others.

The amount of posts coming from health care professionals made up a small fraction of the sample (14/428, 3.3%). As a potential space for physicians to impact the public beyond their clinical domain, this analysis has made it apparent that there is room for improvement on the part of physicians to guide online discussion. Only 14 of all 428 posts were from professional health care providers, and only seven of those were from physicians (Table 2). A post that is created by a trained medical professional might be viewed as more credible by the public than a post from a layperson, meaning these posts could be more influential. The posts that did come from these accounts tended to be educational in nature with the goal of teaching followers about PUPPP. Again, only a small percentage of posts offered educational material signaling a place for growth for specialists who see and treat patients with PUPPP.

The posts that this study found to garner the most attention, in the form of likes and comments, were blog posts, although they made up only 23.4% (100/428) of the posts across all three investigated tags. Some of these posts gained tens of thousands of likes and hundreds of comments. The blog accounts that many of these “high-earning” posts came from boasted large followings, which may have been a contributing factor for the greater interaction of these posts than posts from any one mother. This makes sense given that Instagram’s algorithm puts pictures from accounts you follow into one’s home feed. Therefore, the more followers an account has, the more interaction its posts will receive. Many of the blogs that earned the most likes were advertised as maternity blogs, and the posts dealt with topics and issues for expecting mothers as well as new mothers. It is possible that mothers who have experienced complications during their pregnancy seek out and follow pregnancy-specific blogs on Instagram in the hope of finding camaraderie and reassurance in their peers and influential users.

Limitations and Future Directions

Several limitations became apparent during our analysis. First, Instagram has introduced a new policy that does not allow the general public to view all available posts. Currently, there is a disclaimer when one searches any given hashtag that states not all of the most recent posts will show up on the content feed. This is part of a new initiative by social media companies to stop the spread of misinformation.

On Instagram, we are not able to definitively determine the age or gender of the person posting the content as this information is not distributed by each user’s account. This limited our analysis particularly when looking at the posts coming from mothers affected by PUPPP. Access to the demographic information of the mothers would have given us a better idea of what audience characteristics are better represented on Instagram.

There is future potential for a similar study to analyze the content of the comment sections. Previous studies have demonstrated that examining user comments on social media can provide an in-depth view of questions and concerns brought up by patients [11,12]. Characterization of the comments from followers in order to discover the nature of supportive or inquisitive feedback under each post could strengthen the argument that patients are seeking quality medical information on Instagram. A dive into the nuances of conversation between followers and posters could further elucidate the exact needs and curiosities of patients opting to research conditions on social media.

Other studies could be designed with this paradigm in order to examine other lesser known medical conditions in all specialties. It could be interesting to investigate some more “taboo” conditions as well in order to see how willing online users would be to ask about them behind the comfort and convenience of the keyboard rather than in person to their physician.

Clinical Applications and Conclusions

This study demonstrated that there is a considerable presence on Instagram of the most common dermatosis specific to pregnancy, PUPPP. We were able to examine this common skin condition of pregnancy through the unique lens of publicly available Instagram content. Through the use of hashtags on the popular social media app, we found that mothers with PUPPP readily expressed their experiences, asked questions, and shared advice with their followers. At times, these moms would even share their opinions on various treatments and therapies as well and generate dialogue among one another.

Importantly, there are very few physicians actively posting clinically valid information about the rash, which could address many of the questions and concerns that these mothers pose online. Health care professionals, such as dermatologists and obstetricians, should be aware of this social media presence and consider increasing their influence on applications since a high number of patients turn to internet communities for support.

One suggestion we propose is for physicians to increase their social media presence by creating public professional accounts that display their credentials [13]. In this way, physicians can advertise their professional accounts to the existing clientele and reach patient populations beyond those that they personally serve. Once an account is established, posts can be made that combine informative graphics with educational text. Therefore, if physicians generate more content and use hashtags so that their posts are searchable, they could reach a larger audience...
interested in the topic. It might also behoove the physician to partner with bloggers, such as maternity bloggers in our case, in order to quickly gain visibility and reach a larger audience already seeking information and support [13].

The spread of misinformation has also become a topic of discussion in recent years as social media has become a dominant forum for peer conversation [13]. With the rise of social media as an arena for sharing, it has become apparent that perpetuation of incorrect medical statements may create mistrust and fear among patients [14]. Serious false information has been disseminated, such as the belief that vaccines cause autism, because physicians abuse the trust built. It is the duty of physicians, including physicians participating in online discourse, to ensure that facts are checked. Physicians are in a particularly unique position to create posts containing evidence-based information while also being key opinion leaders.

In a time where we have immediate access to any information through the internet, misinformation is rampant and physicians work hard to dispel concerns that patients bring in with them to the examination room. We suggest that clinicians build up their social media presence to offer legitimate responses and medical information to patients looking for quick answers before their next doctor’s appointment.

Conflicts of Interest
None declared.

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Abbreviations

PUPPP: pruritic urticarial papules and plaques of pregnancy
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Instagram Content Addressing Pruritic Urticarial Papules and Plaques of Pregnancy: Observational Study

JMIR Dermatol 2021;4(1):e26200

URL: http://derma.jmir.org/2021/1/e26200/
doi: 10.2196/26200

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Risks and Benefits of Using Social Media in Dermatology: Cross-sectional Questionnaire Study

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Abstract

Background: Dermatological information on social media is often presented by nondermatologists. Increasing the online engagement of trained dermatologists may improve information quality, patient education, and care.

Objective: Our study assesses dermatologists’ perceptions of social media and patterns of use to identify barriers limiting engagement.

Methods: In our cohort study, a 36-item online survey was distributed to dermatologists in the United States; responses were captured on a 1-100 sliding scale.

Results: Of 166 initiated surveys, 128 valid responses were submitted. Dermatologists showed greater concern for social media risk-related issues (mean 77.9, SD 15.1) than potential benefits (mean 61.8, SD 16.4; \( P < .001 \)). Leading concerns were poor patient care, nonevidence-based information, and breaching patient privacy. Benefits included interphysician collaboration, patient education, and public health awareness. The most avid and enthusiastic social media users were millennials (mean total optimism score 67.5, SD 14.9) and baby boomers (mean total optimism score 63.1, SD 11.2) compared with Generation X dermatologists (mean total optimism score 52.2, SD 16.3, \( P < .001 \)). Of 128 dermatologists, 103 (82.4%) plan on increasing their social media use (\( P = .003 \)). Predictors showing an intent to increase future social media use were younger age, integration into professional use, and an optimistic view (\( r^2 = .39; P < .001 \)).

Conclusions: Dermatologists perceive the risk of social media to be considerable but still intend to increase its use, likely recognizing the value and importance of social media to the field.

(JMIR Dermatol 2021;4(1):e24737) doi:10.2196/24737

KEYWORDS
social media; dermatologist; generational differences; Instagram; Facebook; information quality; patient education; online content; risk; benefit; dermatology; cross-sectional; survey; online health information

Introduction

Americans spend an average of 142 minutes per day on social media, and this number is expected to rise [1]. It is no surprise that patients have turned to social media for information regarding health care, with reports of more than 125 million Americans using social media to search for health-related information [2]. The use of social media as a health care resource has documented benefits. Studies point to improved patient well-being and empowerment through the use of social media, especially among those with new medical diagnoses [3].
Patient use of social media also has its downsides, with little quality control or regulation of the information posted to social media platforms. Patients often encounter misinformation with potentially harmful outcomes [4,5]. Campaigns such as the #VerifyHealthcare movement encourages physicians on social media to validate their credentials to help identify posts with reliable medical information; however, the extent to which such interventions alter health literacy has not been evaluated [6].

Indeed, false information tends to spread 6 times faster on social media than factual information [7,8], and re-educating patients to correct false information can be challenging [9]. For health-related content, a physician’s engagement on social media is effective in spreading quality information and has the potential to reach millions of people [10]. The barriers preventing practitioners and experts from participating are likely multifactorial but may involve concerns over privacy violations [11], fear of litigation [12], and uncertainty surrounding patient-physician boundaries on social media [13].

Dermatologists were early adopters of social media, and many continue to make educational and relevant content for consumers. A recent study showed that “top influencer” dermatologists have large social media audiences and provide a valuable educational service to patients [14]. However, these influencers may not be sufficient to combat the gaps in public health education, as other studies show that as little as 4%-5% of dermatology-related content on Instagram is posted by board-certified dermatologists [2,15].

To increase dermatologist engagement and the positive outcomes associated with a strong physician presence on social media, we aim to understand the perceptions and behaviors of dermatologists in the United States using social media. With this understanding, we can appropriately guide policies to promote safe and effective participation on social media while mitigating risks.

**Methods**

**Study Design**

Using the SurveyMonkey tool (SVMK Inc), we created and distributed an anonymous, open, online survey of 36 questions (Multimedia Appendix 1) to board-certified dermatologists and dermatology residents enrolled in an Accreditation Council for Graduate Medical Education (ACGME)--accredited program in accordance with the Checklist for Reporting Results of Internet eSurveys (CHERRIES) [16]. Participants disclosing non-US–based practices were screened. Multiple entries were prevented by limiting duplicate IP address entries. The survey design was created using prior models [17] and piloted by 6 dermatologists and 2 dermatology residents.

The survey was distributed using an academic listserv (Association of Professors in Dermatology [APD]), which was distributed to 486 members and the private Facebook group “Board Certified Dermatologists,” with more than 4500 board-certified dermatologists. Survey questions used a 0-100 sliding scale, where 100 represented maximal agreement. Information collected included demographic data, social media usage patterns and preferences, and perceptions of social media, including positive and negative effects of social media and its effect on relationships. Upon completion, users were able to share the survey with their peers using our web landing page.

**Data Analysis**

Data were stratified for credentials, degree, employment type, years of experience, years on social media, geographical region, favorite social media platform, and generational differences. We compared millennials (ages 23-38 years in 2019), Generation X (ages 39-54 years), and baby boomers (ages 55-73 years) using definitions outlined by Pew Research [18]. Chi-square and ANOVA tests were used for the analysis of categorical and continuous variables, respectively. When an omnibus ANOVA F-test revealed significant differences between multiple groups, we performed group-to-group post hoc analyses; the Fisher exact test was used due to low n in some cells. A t test was used for group comparisons with unequal variances. Variables associated at P<.1 with a response of “yes” or “maybe” regarding the intention to increase social media use were entered in a backward elimination multiple linear logistic regression model to identify variables independently associated with intent to increase social media use. All analyses were 2-sided with alpha set at .05, and they were conducted using JMP statistical software (version 9.0; SAS Institute Inc).

We created a scoring system to evaluate positive and negative perceptions of social media by calculating the net sum-average of all the responses in each category. Potential benefits yielded a total optimism score, risks and concerns yielded a total pessimism score (wherein a higher value indicates greater pessimism), and a positive or negative effect on relationships generated the total relationship scores (wherein a higher value indicates a positive effect on relationships).

**Results**

**Respondent Demographics**

Of 166 initiated surveys, 128 were valid—38 entries were disqualified from the analysis due to a location outside of the United States, or a nonphysician or nondermatologist status.

Of the 128 valid entries, 48 (37%) respondents were male and 80 (63%) were female, with an average age of 38.7 (SD 9.7) years and an average time in clinical practice of 9.3 (SD 9.2) years. Of the 128 respondents, 36 were residents (28%) and 93 (72%) were board-certified dermatologists; 117 (91%) had Doctor of Medicine (MD) degrees and 11 (9%) had Doctor of Osteopathic Medicine (DO) degrees; 71 (57%) were millennials, 42 (34%) were Generation X, and 12 (10%) were baby boomers. The respondents were evenly distributed by sex (P=.72) and geographical region (P=.34). Our sample was representative of the US dermatological workforce. Additional demographic, experience, and employment characteristics are reported in Table 1.
Table 1. Demographic characteristics of survey responders (n=128).

| Variable                        | Total (n=128) | Millennial (n=71, 56.8%) | Generation X (n=42, 33.6%) | Baby boomer (n=12, 9.6%) | P value   |
|--------------------------------|---------------|--------------------------|-----------------------------|--------------------------|-----------|
| Age in years, mean (SD)        | 38.7 (9.7)    | 31.9 (3.0)               | 44.1 (4.4)                  | 59.6 (6.6)               | <.001a    |
| Gender, n (%)                  |               |                          |                             |                          | .72       |
| Female                         | 80 (62.5)     | 47 (66.2)                | 26 (61.9)                   | 6 (54.6)                 |           |
| Male                           | 48 (37.5)     | 24 (33.8)                | 16 (38.1)                   | 5 (45.5)                 |           |
| Region, n (%)                  |               |                          |                             |                          | .34       |
| Midwest                        | 17 (13.3)     | 9 (12.7)                 | 6 (14.3)                    | 2 (16.7)                 |           |
| Northeast                      | 54 (42.2)     | 34 (47.9)                | 14 (33.3)                   | 3 (25.0)                 |           |
| South                          | 40 (31.3)     | 20 (28.2)                | 16 (38.1)                   | 3 (25.0)                 |           |
| West                           | 18 (14.1)     | 8 (11.3)                 | 6 (14.3)                    | 4 (33.3)                 |           |
| Clinical experience in years, mean (SD) | 9.3 (9.2) | 3.5 (3.3)               | 7.3 (10.1)                  | 29.4 (9.9)               | <.001b    |
| Employment, n (%)              |               |                          |                             |                          | .016c     |
| Academic institution           | 79 (61.7)     | 40 (58.0)                | 28 (66.7)                   | 8 (66.7)                 |           |
| Equity owner of a group practice | 4 (3.1)     | 0 (0.0)                  | 3 (7.1)                     | 1 (8.3)                  |           |
| Owner of a solo practice       | 12 (9.4)      | 5 (7.3)                  | 4 (9.5)                     | 3 (25.0)                 |           |
| Group practice, hospital or health care system | 32 (25.0) | 24 (34.8)               | 7 (16.7)                    | 0 (0.0)                  |           |

a Age: all post hoc comparisons significant at P<.001.
b Years of clinical experience: all post hoc comparisons significant at P<.001.
c Employment: millennials are less likely to be employed as equity owners of a group practice vs. nonmillennials (P=.035) and more likely to be employed at a group practice or hospital (P=.007; baby boomers are less likely to be employed at a group practice or hospital (P=.036).

Social Media Practices
Among the 128 respondents, 120 (93.8%) reported using social media across a variety of platforms, including Facebook (109/128, 85.2%), Instagram (85/128, 66%), and LinkedIn (51/128, 40%; Table 2), for an average of 45.9 (SD 35.2) minutes/day. Millennials had used social media for an average of 11.8 (SD 3.0) years, significantly longer than either GenX (mean 9.4, SD 3.6 years) or baby boomers (mean 6.2, SD 3.4 years; P<.001). The overall time spent on social media for professional use was 16.9 (SD 24.3) minutes/day and 31.1 (SD 22.0) minutes/day for personal use; millennials spent more total time on social media compared to baby boomers and GenX respondents. Unexpectedly, baby boomers’ time spent on social media for professional use (mean 17.3, SD 18.9 minutes/day) was comparable to that of millennials (mean 21.6, SD 28.6 minutes/day; P=.67).

Owners of private practices and solo practitioners spent more time on social media for professional use compared to all other respondents (mean 41.7, SD 41.5 minutes/day vs. mean 13.9, SD 20.2 minutes/day; P<.001), while physicians working at academic institutions spent less time on social media (mean 11.6, SD 18.6 minutes/day vs. mean 24.8, SD 29.9 minutes/day; P=.003). Overall, 44% (53/128) of physicians found Instagram to be the most valuable platform, followed by Facebook (49/128, 40.7%), and preferences varied by generation. Social media usage patterns and preferences are reported in Table 2.
Table 2. Social media patterns and preferences observed from the survey responses (n=128).

| Variable | Total (n=128) | Millennial (n=71, 56.8%) | Generation X (n=42, 33.6%) | Baby boomer (n=12, 9.6%) | P value |
|----------|---------------|--------------------------|----------------------------|--------------------------|---------|
| Years of social media use, mean (SD) | 10.6 (3.7) | 11.8 (3.0) | 9.4 (3.6) | 6.2 (3.4) | <.001a |
| Personal time spent on social media, min/day, mean (SD) | 31.1 (22.0) | 38.5 (20.2) | 22.7 (21.9) | 15.0 (12.8) | <.001b |
| Professional time spent on social media, min/day, mean (SD) | 16.9 (24.3) | 21.6 (28.6) | 8.5 (13.1) | 17.3 (18.9) | .021b |
| Total time spent on social media, min/day, mean (SD) | 45.9 (35.2) | 59.6 (34.7) | 30.5 (29.2) | 29.6 (25.5) | <.001c |
| Plan to increase social media use, n (%) | 103 (82.4) | 67 (94.4) | 28 (66.7) | 8 (66.7) | .001d |

Platforms with an active account, n (%)

| Platform | Total | Millennial | Generation X | Baby boomer | P value |
|----------|-------|------------|--------------|-------------|---------|
| Facebook | 109 (85.2) | 62 (87.3) | 36 (85.7) | 8 (66.7) | .18 |
| Instagram | 85 (66.4) | 58 (81.7) | 21 (50.0) | 4 (33.3) | <.001e |
| LinkedIn | 51 (39.8) | 25 (35.2) | 19 (45.2) | 5 (41.7) | .56 |
| Reddit | 16 (12.5) | 8 (11.3) | 5 (11.9) | 2 (16.7) | .87 |
| Snapchat | 33 (25.8) | 30 (42.3) | 2 (4.8) | 0 (0.0) | <.001f |
| Twitter | 29 (22.7) | 14 (19.7) | 11 (26.2) | 3 (25.0) | .71 |
| WhatsApp | 49 (38.3) | 32 (45.1) | 15 (35.7) | 2 (16.7) | .15 |
| YouTube | 35 (27.3) | 18 (25.4) | 12 (28.6) | 3 (25.0) | .93 |

Most valuable platform, n (%)

| Platform | Total | Millennial | Generation X | Baby boomer | P value |
|----------|-------|------------|--------------|-------------|---------|
| Instagram | 53 (44.4) | 42 (60.0) | 22 (59.5) | 6 (50.0) | .004g |

Location where social media is accessed, n (%)

| Location | Total | Millennial | Generation X | Baby boomer | P value |
|----------|-------|------------|--------------|-------------|---------|
| Home | 114 (89.1) | 66 (93.0) | 35 (83.3) | 10 (83.3) | .24 |
| Work | 54 (42.2) | 38 (53.5) | 11 (26.2) | 4 (7.6) | .014b |
| During commute | 32 (25.0) | 24 (33.8) | 5 (11.9) | 2 (16.7) | .027i |

Perceptions

Overall, dermatologists perceived that social media has many benefits and uses (total optimism score 61.8, SD 16.4). There was strong agreement that social media use increases patient education (69.4, SD 20.6), while less agreement concerning access to care or strengthening the doctor-patient relationship (50.3, SD 21.8, and 46.1, SD 24.7, respectively). Millennials (67.5, SD 14.9) and baby boomers (63.1, SD 11.2) were more optimistic about the benefits of social media than the GenX physicians (52.2, SD 16.3; P<.001 and P=.030, respectively). Attitudes and perceptions regarding social media are reported in Table 3 and Figure 1.

Dermatologists showed greater concern for risk-related issues on social media compared to potential benefits (mean score 77.9, SD 15.1 vs. mean score 61.8, SD 16.4, paired t test; P<.001). The greatest concerns were that social media use contributes to the substitution of proper dermatological care with unqualified providers (88.5, SD18.0), promotion of nonevidence-based products (82.1, SD 20.6), and the threat of breaching patients’ privacy (78.9, SD 19.9); however, this varied by generation, with millennials being less pessimistic than GenX dermatologists (P=.018).

Most dermatologists believed that social media use improves relationships with friends (65.3, SD 21.0) and professional colleagues (61.4, SD 22.3) but were more neutral about social media’s effect on relationships with patients (50.3, SD 21.2).
Table 3. Future users versus nonusers of social media (n=128).

| Survey question                                      | Response score by generation, mean (SD) |  |  |
|------------------------------------------------------|----------------------------------------|---|---|
|                                                       | Total (n=128)                          | Millennial (n=71, 56.8%) | Generation X (n=42, 33.6%) | Baby boomer (n=12, 9.6%) |
|                                                       |                                        | Mean (SD)                  | Mean (SD)                  | Mean (SD)                  |
| Perceived benefits related to social media           |                                        |                            |                            |                            |
| Help deliver health care                             | 61.9 (24.2)                            | 67.3 (24.7)                | 52.3 (22.3)                | 65.8 (19.5)                | .005 |
| Improve clinical knowledge                           | 68.2 (24.6)                            | 74.7 (20.5)                | 59.2 (27.9)                | 63.6 (22.9)                | .003 |
| Increase interphysician collaboration                | 75.3 (21.2)                            | 81.3 (19.0)                | 67.6 (23.4)                | 73.3 (17.3)                | .005 |
| Help recruit patients                                | 65.7 (22.1)                            | 71.9 (21.2)                | 55.9 (23.3)                | 63.1 (11.8)                | <.001 |
| Strengthen doctor-patient relationship               | 46.1 (24.7)                            | 54.4 (23.9)                | 32.7 (23.2)                | 43.0 (16.1)                | <.001 |
| Increase patient education                          | 69.4 (20.6)                            | 74.0 (22.6)                | 61.6 (16.4)                | 70.8 (15.6)                | .008 |
| Increase access to care                              | 50.3 (21.8)                            | 56.5 (19.5)                | 38.5 (22.4)                | 55.3 (20.6)                | <.001 |
| Good tool for public awareness                       | 68.8 (22.6)                            | 73.8 (20.7)                | 59.5 (24.9)                | 73.9 (18.4)                | .004 |
| Good tool for patient compliance                     | 51.5 (22.2)                            | 54.1 (23.1)                | 44.5 (21.0)                | 59.0 (17.9)                | .040 |
| Total optimism score                                 | 61.8 (16.4)                            | 67.5 (14.9)                | 52.2 (16.3)                | 63.1 (11.2)                | <.001 |
| Perceived risks related to social media              |                                        |                            |                            |                            |
| Could damage professional reputation                 | 74.9 (21.4)                            | 72.5 (23.3)                | 80.9 (15.8)                | 72.4 (22.5)                | .11 |
| Breach patient privacy                               | 78.9 (19.9)                            | 75.0 (21.4)                | 84.1 (16.3)                | 82.8 (17.1)                | .044 |
| Untruthfulness                                       | 70.1 (26.3)                            | 65.9 (25.8)                | 79.5 (25.1)                | 69.4 (19.9)                | .024 |
| Emphasis on superficial values                       | 72.9 (24.0)                            | 70.6 (25.0)                | 78.2 (22.1)                | 73.3 (24.0)                | .27 |
| Boosts nonevidence-based products                    | 82.1 (20.6)                            | 80.5 (20.2)                | 85.2 (21.9)                | 86.6 (12.4)                | .38 |
| Allows for unqualified substitution of care          | 88.5 (18.0)                            | 88.7 (18.0)                | 86.5 (20.1)                | 91.7 (9.3)                 | .66 |
| Total pessimism score                                | 77.9 (15.1)                            | 75.5 (14.8)                | 82.4 (15.0)                | 79.4 (12.7)                | .058 |
| Perceived social media effect on relationships       |                                        |                            |                            |                            |
| Affects relationships with family                    | 54.1 (22.5)                            | 60.3 (20.7)                | 41.9 (22.7)                | 57.8 (19.9)                | .002 |
| Affects relationships with friends                   | 65.4 (21.1)                            | 70.7 (20.3)                | 55.4 (20.8)                | 64.4 (18.5)                | .006 |
| Affects professional relationships                   | 61.3 (22.3)                            | 68.0 (21.5)                | 51.4 (23.2)                | 59.9 (15.9)                | .011 |
| Affects relationships with patients                  | 50.2 (21.2)                            | 51.6 (26.0)                | 47.0 (18.5)                | 53.6 (7.9)                 | .68 |
| Average effect on relationships                      | 60.2 (19.1)                            | 60.3 (20.7)                | 41.9 (22.7)                | 57.8 (19.9)                | .002 |

a All significant P values ≤.05 for millennials vs. GenX.

b P≤.05 for GenX vs. baby boomer; there were no significant differences between millennials and baby boomers.
Figure 1. Generational differences of social media use and perceptions. Survey questions were answered on a 0-100 agreement scale. The radar chart demonstrates the average for each question grouped by generation. Questions calculated toward the total optimism score are highlighted teal, pessimistic questions are highlighted pink, and questions affecting relationships are highlighted yellow. (*) denotes statistically significant different answers by generation using a Fisher test, $P \leq 0.05$. min/d: minutes per day; SM: social media.

Future Users vs. Nonusers

Of the 128 dermatologists surveyed, 103 (82.4%) are actively or considering increasing their social media usage. The variables independently associated with a plan to use more social media in the future were younger age ($P=0.023$), use at work ($P=0.028$), and average optimism ($P<0.001$) in the logistic regression model using backward elimination. In contrast, other variables (eg, average pessimism, employment type, favorite social media platform) were codependent or not significant (final model $r^2=0.390$, $P<0.001$).

Discussion

Principal Findings

Our survey of US dermatologists demonstrates that there are many perceived risks and benefits of social media. These views vary significantly across generations, yet our data suggest the perceived benefits outweigh the associated risks. Our study provides insight into physicians’ perceptions of social media; the results may serve as a guide to promoting dermatologist engagement on social media.

The total pessimism score revealed a general negativity surrounding social media use among dermatologists. Pessimism was driven by perceived risks of poor patient care, misinformation, damage to professional reputation, and privacy breaches, consistent with prior reports of social media risks [2,11–13] (Figure 1). Mitigating these risks will be essential for increasing the engagement of dermatologists on social media.

Indeed, the risks associated with physicians sharing information online have been identified as a key area for social media research [13], with little data currently reported. Patient privacy violations resulting from posting and sharing patient photographs are common among some specialties [19] and represent real concern, as images can be downloaded and reshared, increasing patient exposure to privacy breaches. The lack of clear guidelines for sharing photos of patients online may cause physicians to avoid creating patient-centered content altogether [20].

Alternatively, there is promising optimism for social media use among dermatologists. The total optimism score calculated from our survey reflects the perceived benefits of social media, which include increased health care access, improved education, and improved public health (Figure 1). Despite a more prominent, uniform, overall pessimism score acknowledging inherent risks, a preponderance of those surveyed (103/128, 82.4%) plan to increase social media usage. Using a linear regression model, we found that optimism predicts an increase in future social media usage, while the pessimism score has no predictive value. This implies that perceived benefits outweigh the risks.

Additional predictors of increasing social media use are younger age and use at work. Dermatologists may be moving to social media for economic reasons, and younger physicians may consider a social media presence necessary to compete in a modern medical marketplace. This is likely a self-reinforcing process where physicians that use social media to recruit more patients will benefit most and feel more positively about it. Alternatively, physicians who are currently not using social
media are not exposed to its benefits and therefore view social media as nonadvantageous. Studies suggest that 32% of people have made health decisions using social media [21] and may explain that one of the perceived benefits of social media discovered in our survey was the ability to recruit patients. A recent study by Murphy et al [22] found that 43% of all patients consider social media to be moderately to extremely important in choosing a dermatologist, particularly for patients seeking cosmetic procedures [23-25].

Perception of benefits and risks of social media varied by generation. Unexpectedly, millennials (ages 23-38 years in 2019) and baby boomers (ages 55-73 years) shared similar views of social media, while GenX (ages 39-54 years) tended to be the least optimistic. Prior studies show that older internet users are less optimistic about social media [26]; however, the common notion that older practitioners are less likely to adapt to emerging technologies may not be true [27]. The discovery that millennials have more optimism regarding social media may not be surprising; however, the shift in demographics is important, as millennials are now the largest proportion of the adult US population [28]. It is likely that millennial and Generation Z (ages 7-23 years) patients will drive an increased need for quality dermatologic information on social media. This underscores the importance of mitigating risks to encourage dermatologists of all generations to engage on social media.

Finally, our survey found that educational and collaborative capabilities were cited among the key advantages of using social media. The rapid dissemination and easy accessibility of new treatments, interesting cases, and continuing medical education through social media highlight this benefit. The perceived benefit of educational opportunities stands in contrast to the lower utilization of social media by academic dermatologists uncovered in our survey. A list of the top influencers in dermatology was recently published [14]; however, less than half (14/30) were faculty at academic institutions, highlighting an opportunity for academic dermatologists to engage on social media.

Limitations
Our study was limited by a small sample size. Our sample population demonstrates similar demographics to other studies [29]; however, few responses from baby boomers require caution in the interpretation of our generational results. Similarly, bias toward positive social media perceptions may have been introduced by delivering our survey using a social media platform. The APD listerv was utilized to mitigate this bias and increase the practice diversity of our cohort.

Our survey’s completion rate was 77.7% (128/166); however, a response rate could not be calculated since our survey was posted online and was shareable. We mitigated this by tracking clicks on our survey, which produced 166 respondents.

Conclusion
Our survey identified risks that act as barriers and perceived benefits driving increased social media usage. Views varied significantly among generations, with millennial and baby boomer dermatologists expressing more optimistic outlooks than Generation X. Our research can be used to develop best practices to mitigate risks of privacy violation, litigation, and poor patient care, while promoting education and collaboration can help shape the presence of dermatology on social media.

Conflicts of Interest
MYB is a consultant for Med Engagement Labs for work unrelated to this project. JGZ is a consultant for X4Pharmaceuticals for a project unrelated to this paper. The other authors have no conflicts of interest to declare.

Multimedia Appendix 1
Web-based survey assessing dermatologists’ social media perceptions.

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Abbreviations

APD: Association of Professors in Dermatology
Nonprescription Products of Internet Retailers for the Prevention and Management of Herpes Zoster and Postherpetic Neuralgia: Analysis of Consumer Reviews on Amazon

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Abstract

Background: Herpes zoster affects approximately 1 million people annually in the United States, with postherpetic neuralgia as the most common complication. The frequent prescription of opioids as the first-line medication for herpes zoster or postherpetic neuralgia contributes to the increasing health care costs of their treatment. Despite the advent of internet retailers providing alternative products for the prevention and management these conditions, there are limited studies on the availability, ingredients, and consumer preference for the products.

Objective: This study used the internet retailer Amazon to determine the availability of products for the management of herpes zoster and postherpetic neuralgia, and assessed consumer preference based on listed ingredients.

Methods: The internet retailer Amazon was used to perform a search for products related to “shingles” in September 2020. Top products sorted by reviews and ratings were determined to be either shingles-specific (including “shingles” in either the product title or description) or shingles-nonspecific. Analysis of price, rating, type of vehicle, and ingredients was performed. The types of vehicles, ingredients, and percentages of positive and negative reviews related to “shingles” of the product groups were analyzed with a two-tailed two-sample proportions Z-test to assess the difference between shingles-specific and shingles-nonspecific products. Statistical significance was judged at P<.05.

Results: The top 131 products among over 3000 products retrieved were determined based on a rating of 4 or more stars after searching for the term “shingles” on Amazon. Forty-six of the 131 products (35.1%) were shingles-specific. Shingles-nonspecific products were more likely to have positive reviews mentioning “shingles” (P=.005). Vehicles, balms (P=.02), and salves (P=.04) were more likely to be shingles-specific, whereas tablets or capsules (P=.002) were more likely to be shingles-nonspecific. Among the ingredients analyzed, aloe vera was the top-ranked ingredient, included in 29 of the 131 total products (22.1%). Aloe vera (P=.01), lemon balm (P<.001), vitamin E (P=.03), and peppermint oil (P=.008) were more likely to be included in the shingles-specific products, whereas magnesium (P=.01) was more likely to be included in shingles-nonspecific products.

Conclusions: There is an abundance of products and ingredients being used for the management and treatment of shingles with certain ingredients preferred by consumers. There is a discrepancy between approved ingredients and the ingredients preferred by consumers. Furthermore, there are insufficient studies on ingredients used by consumers on internet retailers such as Amazon, and future studies can focus on the effectiveness of popular ingredients to decrease misinformation on the internet.

(JMIR Dermatol 2021;4(1):e24971) doi:10.2196/24971

KEYWORDS

Amazon; consumer preference; herpes zoster; postherpetic neuralgia; shingles; internet; customer; herpes; ingredients; treatment
Introduction

Shingles, or herpes zoster (HZ), is caused by reactivation of latent varicella zoster virus (VZV) in the sensory neurons, typically after the primary infection of chickenpox in childhood [1,2]. Previous studies have shown that more than 95% of adults across North America and Europe are at risk for HZ, and approximately 1 million people are affected by HZ in the United States annually [2,3]. Stress, aging, illness, medication, or other causes of decreased immunity can cause the activation of dormant VZV that commonly affects the cervical, thoracic, and trigeminal nerves [3,4]. Acute herpes zoster (AHZ) manifests as a painful blistering rash along a dermatome, initially presenting as a maculopapular rash that develops into vesicles and pustules [4,5]. Postherpetic neuralgia (PHN) is the most common complication of HZ, which is defined as the persistence of acute HZ pain in a dermatomal distribution that lasts over 3 months [1,3,6,7]. PHN is due to damage to the nerves from an inflammatory response caused by viral replication within the nerve [8]. PHN can cause allodynia, hyperalgesia, anesthesia, and other sensory deficits of the affected dermatome [3,9]. Owing to the debilitating nature of PHN, patients seek medications to manage the pain.

The therapies for AHZ include antivirals, corticosteroids as adjunctive therapy, acetaminophen or nonsteroidal anti-inflammatory drugs (NSAIDs) for analgesia, and capsaicin or lidocaine as topical treatment [8]. For PHN, first-line medications include calcium channel blockers (gabapentin and pregabalin), tricyclic antidepressants, and a lidocaine patch [10]. Second-line treatments include opioid analgesics and a capsaicin patch or cream [10]. A previous study showed that opioids were commonly prescribed as the initial treatment for PHN, followed by gabapentin, prescription NSAIDs, lidocaine patch, pregabalin, tricyclic antidepressant, topical lidocaine, and capsaicin, respectively [3].

However, with the advent of internet information and shopping through internet retailers such as Amazon, patients can now easily access nonprescription remedies for the rashes and neuropathic pain caused by shingles or PHN. Amazon has recently been utilized as a data source in studies to analyze consumer perception and preference for health-related products [11-13]. Some natural treatment choices offered on internet retailers have been studied for either PHN or neuropathic pain, including vitamins and nutrients such as zinc, licorice, honey, aloe vera, and St John’s wort [14-16]. However, most herbal remedies such as St John’s wort have not been assessed in proper clinical trials or have not been proven to be useful [17].

Given the readily available nonprescription options that claim effectiveness for shingles and PHN pain, it is important to understand what products are available for patients and the efficacy of the ingredients in these products. In this study, we evaluated the products that are available and preferred by customers through analyzing the vehicle types, ingredients, and customer reviews of shingles-related products sold on Amazon. Finally, we sought to understand the different factors and ingredients of products used for shingles or PHN prevention and treatment.

Methods

Amazon, the internet retailer, was accessed in September 2020 to search for products related to shingles. “Shingles” was used as the keyword to search in the “Health & Household” department of the website. The searches were screened for customer ratings of 4 stars and above. Products such as bandages or household items were excluded. Finally, only products that included the term “shingles” in the product title, description, Customer Reviews, or Customer Question and Answer were included in the final analysis. Product listings without mention of “shingles” in the product title, description, Customer Reviews, or Customer Question and Answer were excluded. For product listings with different quantities and sizes, only the listing with the most reviews was included. From the overall products, the average price, median price per unit, average ratings, average number of reviews, type of vehicle, and ingredients were determined. Several ingredients studied previously for shingles were analyzed in this study [14,17,18].

Two groups were derived from the original sample set. First, products that included the term “shingles” in either the product title or description were classified as shingles-specific products. Second, products that did not include the term “shingles” in either the product title or description, but included the term in either the Customer Reviews or the Customer Question and Answer sections were classified as shingles-nonspecific products. A two-tailed two-sample proportions Z-test was used to determine if a product specific to “shingles” was more likely to be a specific vehicle or to include certain ingredients. The numbers of positive and negative reviews in Customer Reviews including the term “shingles” were counted. The two-tailed two-sample proportions Z-test was also used to compare the means of percentages of positive and negative reviews among all reviews of products including “shingles” for shingles-specific and shingles-nonspecific products. A P value <.05 was considered to indicate a statistically significant difference.

Results

Over 3000 results were populated on the Amazon internet retailer when searching for the key term “shingles.” There were 742 results in the “Health & Household” department that received a rating of 4 stars and above. Among the 131 top-rated products, there was a total of 215,225 reviews with a median of 698 reviews (range 24-16,523 reviews) and an average rating of 4.4 (out of 5) stars with a median of 4.4 (range 4-4.9 stars). Different types of vehicles for shingles were counted and categorized. Among the 131 total products, 44 (33.6%) were creams or lotions, 30 (22.9%) were tablets or capsules, 11 (8.4%) were gels, 10 (7.7%) were balms, 8 (6.1%) were bath products, 7 (5.3%) were ointments, 6 (4.6%) were oils, 5 (3.8%) were salves, and the remaining 10 products (7.6%) included powders, wipes, pump dispensers, liquids, and sprays. Among all reviews for the products that mentioned “shingles,” there was an average of 82.6% positive reviews and 10% negative reviews.

Among the 131 products, 46 (35.1%) products that included “shingles” in either the title or product description comprised

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shingles-specific products and 85 (64.9%) that did not include “shingles” in either the title or product description comprised the shingles-nonspecific products. Table 1 shows the top 10 most reviewed overall shingles products and Table 2 shows the top 10 most reviewed shingles-specific products. Comparison of the two tables reveals only three products among both the top 10 most reviewed overall products and the top 10 most reviewed shingles-specific products: Leven Rose Store’s Jojoba Oil, Emuaid’s EmuaidMAX Ointment, and Quantum Health’s Super Lysine.

Table 1. Top 10 most reviewed overall products.

| Rank | Manufacturer            | Product name          | Number of reviews | Mean rating (out of 5) |
|------|-------------------------|-----------------------|-------------------|------------------------|
| 1    | Leven Rose Store        | Jojoba Oil            | 16,523            | 4.7                    |
| 2    | Puriya                  | Mother of All Creams  | 11,139            | 4.3                    |
| 3    | Sun Essential Oils      | Geranium              | 9046              | 4.2                    |
| 4    | Emuaid                  | EmuaidMAX Ointment    | 8974              | 4.0                    |
| 5    | Tru remedy              | Remedy Soap           | 8800              | 4.5                    |
| 6    | Mederma                 | Mederma Scar Gel      | 8063              | 4.2                    |
| 7    | Ramina                  | Natural Hemp Cream    | 6377              | 4.3                    |
| 8    | Puriya                  | Wonder Balm           | 6050              | 4.3                    |
| 9    | Quantum Health          | Super Lysine          | 5875              | 4.6                    |
| 10   | NOW Foods               | Double Strength L-Lysine | 5607              | 4.7                    |

Table 2. Top 10 most reviewed shingles-specific products.

| Rank | Manufacturer            | Product name               | Number of reviews | Mean rating (out of 5) |
|------|-------------------------|-----------------------------|-------------------|------------------------|
| 1    | Leven Rose Store        | Jojoba Oil                 | 16,523            | 4.7                    |
| 2    | Emuaid                  | EmuaidMAX Ointment         | 8974              | 4.0                    |
| 3    | Quantum Health          | Super Lysine               | 5875              | 4.6                    |
| 4    | Blue Emu                | Original Blue-Emu Super Strength | 4723              | 4.5                    |
| 5    | Dermachange             | Shingles                   | 3254              | 4.2                    |
| 6    | Wild Naturals           | Eczema & Psoriasis Cream   | 2896              | 4.1                    |
| 7    | Clean Body Organics     | Hemp Relief Cream          | 2828              | 4.4                    |
| 8    | Era Organics            | Relief                     | 1885              | 4.0                    |
| 9    | Emuaid                  | Emuaid                     | 1794              | 4.2                    |
| 10   | Frankincense & Myrrh    | Neuropathy Rubbing Oil     | 1574              | 4.3                    |

When analyzing customer reviews including “shingles” among the shingles-specific products, there was an average of 69.5% positive reviews and 10.1% negative reviews among the total shingles-related reviews per product. Among the shingles-nonspecific products, there was an average of 89.9% positive reviews and 10% negative reviews out of the total shingles-related reviews per product. Shingles-nonspecific products were more likely to have positive customer reviews mentioning “shingles” based on the Z-test analysis (P=.005), whereas there was no significant difference in negative customer reviews between shingles-specific and shingles-nonspecific groups (P=.99).

Out of the 46 shingles-specific products, 18 (39%) were creams or lotions, 7 (15%) were balms, 4 (9%) were oils, 4 (9%) were salves, 3 (7%) were tablets or capsules, 3 (7%) were gels, 3 (7%) were ointments, 1 (2%) was a bath product, and 3 (7%) were other products, including pump dispenser, spray, and liquid. Among the 85 shingles-nonspecific products, 27 (32%) were tablets or capsules, 26 (31%) were creams or lotions, 8 (9%) were gels, 7 (8%) were bath products, 4 (5%) were ointments, 3 (4%) were balms, 2 (2%) were oils, 1 (1%) was a salve, and 7 (8%) were other products, including powders, liquid, sprays, wipes, and solutions. Balms (P=.02) and salves (P=.04) were more likely to be shingles-specific, whereas tablets or capsules (P=.002) were more likely to be shingles-nonspecific.

Based on previous studies related to treatment for shingles, several ingredients were assessed from the products [14,17,18]. Among all 131 products, 29 (22.1%) contained aloe vera, 18 (13.7%) contained honey, 17 (13.0%) contained magnesium, 16 (12.2%) contained lemon balm, 14 (10.7%) contained L-lysine, 13 (9.9%) contained menthol, 11 (8.4%) contained lidocaine, 10 (7.6%) contained zinc, 9 (6.9%) contained oatmeal or oat straw extract, 7 (5.6%) contained St John’s wort, 6 (4.6%) contained licorice, 2 (1.5%) contained capsaicin, 2 (1.5%) contained Reishi mushroom, and 1 (0.8%) contained aspirin.
Out the 46 shingles-specific products, 16 (34.8%) contained aloe vera, 10 (21.7%) contained honey, 1 (2.2%) contained magnesium, 12 (26.1%) contained lemon balm, 5 (10.9%) contained L-lysine, 3 (6.5%) contained menthol, 2 (4.3%) contained lidocaine, 4 (8.7%) contained zinc, 2 (4.3%) contained oatmeal or oat straw extract, 4 (8.7%) contained St John’s wort, 3 (6.5%) contained licorice, and none of the products contained capsaicin, Reishi mushroom, or aspirin. Among the 85 shingles-nonspecific products, 13 (15.3%) contained aloe vera, 8 (9.4%) contained honey, 16 (18.8%) contained magnesium, 4 (4.7%) contained lemon balm, 9 (10.6%) contained L-lysine, 10 (11.8%) contained menthol, 9 (10.6%) contained lidocaine, 6 (7.1%) contained zinc, 7 (8.2%) contained oatmeal or oat straw extract, 3 (3.5%) contained St John’s wort, 3 (3.5%) contained licorice, 2 (2.4%) contained capsicain, 2 (2.4%) contained Reishi mushroom, and 1 (1.2%) contained aspirin. Among all ingredients, aloe vera (P<0.01) and lemon balm (P<0.001) were more likely to be included in shingles-specific products, whereas magnesium (P=0.1) was more likely to be included in shingles-nonspecific products.

Vitamins were assessed individually [15,16,18]. Among all 131 products, 4 (3.1%) included vitamin A, 3 (2.3%) included vitamin B2, 4 (3.1%) included vitamin B6, 2 (1.5%) included vitamin B9, 2 (1.5%) included vitamin B12, 15 (11.5%) included vitamin C, 3 (2.3%) included vitamin D, and 28 (21.4%) included vitamin E. Among the 46 shingles-specific products, 8 (17%) included vitamin C and 15 (33%) included vitamin E, whereas no products included vitamins A, B2, B6, B9, B12, or D. Of the 85 shingles-nonspecific products, 4 (5%) included vitamin A, 3 (4%) included vitamin B2, 4 (4%) included vitamin B6, 2 (2%) included vitamin B9, 2 (2%) included vitamin B12, 7 (8%) included vitamin C, 3 (4%) included vitamin D, and 13 (15%) included vitamin E. Vitamin E was more likely to be used in shingles-specific products (P=0.03).

Specific oils were assessed based off prior studies, including peppermint oil, geranium oil, and hemp oil [19-21]. Among all 131 products, 19 (14.5%) included peppermint oil, 5 (3.8%) included geranium oil, and 15 (11.5%) included hemp oil. Of the 46 shingles-specific products, 12 (26%) included peppermint oil, none included geranium oil, and 8 (17%) included hemp oil. Out the 85 shingles-nonspecific products, 7 (8%) included peppermint oil, 5 (6%) included geranium oil, and 7 (8%) included hemp oil. Peppermint oil was more likely to be included in shingles-specific products (P=0.008).

**Discussion**

**Principal Findings**

With nearly 1 million cases of HZ diagnosed annually in the United States, HZ can affect up to 20% of individuals within their lifetimes [22,23]. HZ is a large health care burden, with opioids prescribed as the most common first-line treatment, further contributing to the already high health insurance cost of opioids [3]. Patients inflicted by PHN can spend 2-4 times more on health costs than patients with only HZ [24]. As such, internet retailers such as Amazon provide other options for the management and treatment of HZ or PHN that can provide relief for patients. However, with the wide variety of products and ingredients available, it can be difficult for patients to determine which products would be effective. This study showed that among the variety of vehicles available, Amazon customers preferred creams or lotions, which comprised 33.6% of the 131 products, with tablets or capsules coming in second comprising 22.9% of the 131 products. Tablets or capsules were more likely to be shingles-nonspecific products, whereas balms and salves were more likely to be shingles-specific products. This suggests a lack of consensus regarding products recommended for shingles and products that patients prefer.

Over 3000 products were retrieved when searching “shingles” on Amazon. “Shingles” was used as the keyword as it is a term more widely known in the general population. Among the products indicated for shingles treatment, there were also household cleaning products, which raises concern that such products are being suggested for shingles use on the internet retailer. Out of the 131 products, only 35.1% included products that specifically mentioned shingles in either the title or product description, and the majority (64.9%) of products did not. Furthermore, only 3 products from the top 10 most reviewed overall shingles products were within the top 10 most reviewed shingles-specific products. This highlights the discrepancy between products that are suggested for shingles use and products that are labeled for shingles use. When comparing customer reviews that mention shingles between shingles-nonspecific and shingles-specific products, shingles-nonspecific products were more likely to have more positive customer reviews (89.9%) compared with shingles-specific products (69.5%). This suggests that customer reviews play a larger role in product selection compared to a specified product indication for shingles. Interestingly, there was no significant difference in customer reviews of shingles-specific and shingles-nonspecific products, further compounding the importance of reviews in the consumer selection of products.

Various ingredients were analyzed that were previously studied in relation to shingles or PHN treatment. A 5% lidocaine patch and 0.075% capsaicin cream are among first- or second-line topical treatment options for PHN [8]. In our analysis of the 131 products, 8.4% contained lidocaine and 1.5% contained capsaicin. Of the shingles-specific products, only 4.3% contained lidocaine and none contained capsaicin, whereas of the shingles-nonspecific products, 10.6% contained lidocaine and 2.4% contained capsaicin. Lidocaine acts as a local anesthetic with a mechanism of action involving partial inhibition of voltage-gated calcium channels and reducing the discharge of activity in afferent pain receptors [25]. Lidocaine is considered a first-line therapy for PHN despite limited studies on its effectiveness [26,27]. The lidocaine products found in the Amazon products were between 4% and 5% in its effectiveness [26,27]. The lidocaine products found in the Amazon products were between 4% and 5% in concentration; however, none of the top products recommended including lidocaine was a patch, which is recommended in the literature [8]. The products including lidocaine were creams, gels, or sprays, which suggests that lidocaine administered using these vehicles was preferred among customers instead of patches. Topical capsaicin is an activator of the TRPV1 channel of nociceptor nerve fibers, leading to an influx of calcium that decreases the function of nociceptor nerve fibers [25]. Studies
have shown that a higher concentration of capsaicin was effective for PHN [28]. The concentration of capsaicin in the products found on Amazon was either 0.025% or 0.1%, whereas high-dose capsaicin products have a concentration of 8%. This may explain why capsaicin was not a highly preferred or recommended product as the smaller concentration only provides moderate relief for patients [25].

Other natural ingredients have been studied for their effects against HZ, such as licorice and Reishi mushroom [14]. Ingredients that have shown efficacy against herpes simplex virus (HSV) may also have a benefit for HZ, such as honey, aloe vera, and St John’s wort [14,29]. Licorice may be able to inactivate viral particles and was reported to show in vitro antiviral activity against VZV, although further studies are needed to evaluate its use as a topical agent [14]. Reishi mushroom was tested in a small clinical trial and a case study, demonstrating relief of pain [14]. Honey has shown faster healing times for patients with HSV infection, suggesting a possible benefit against HZ [14]. Aloe vera is a known ingredient for wound healing, and St John’s wort has shown antiviral activity against HSV-1 [14]. In this study, aloe vera was one of the top ingredients used among the 131 products, accounting for 22.1%, and is more likely to be used as an ingredient in shingles-specific products. This indicates that customers also prefer aloe vera for the treatment of shingles. Honey comprised 13.7% of all products, making it the second most likely included ingredient, suggesting that more studies should be performed to assess the efficacy of honey against HZ. St John’s wort, licorice, and Reishi mushroom were less commonly used as ingredients; however, more studies can reveal if these ingredients will be of benefit to patients with HZ or PHN. Lemon balm was also more likely to be included in shingles-specific products; despite few studies regarding the use of lemon specifically for this condition, it is likely preferred for shingles owing to its high vitamin C level.

Decreased immunity is a known risk factor for HZ and PHN, with nutritional deficiency being a major cause [18]. Vitamin and nutrient deficiencies, such as zinc and magnesium, and their effect on HZ have been studied to assess their efficacy as potential treatments [18,30,31]. Low vitamin C levels have been found to play a role in the development of herpes infection and PHN, with trials of intravenous vitamin C demonstrating efficacy in relieving pain [16]. Hypovitaminosis D has been associated with the development of neuropathic pain due to various mechanisms, including inflammatory processes and an increase of reactive oxygen species [15,32]. Vitamin B such as cobalamin (vitamin B12) was shown to be effective for painful neuropathies, and deficiency of folic acid (vitamin B9) causes peripheral neuropathy [33,34]. Vitamin E has also been shown to act as an analgesic in rat models with neuropathic pain [35]. Zinc deficiency has been shown to be a risk factor for PNH [30]. Magnesium has been found to block the N-methyl-D-aspartate receptor, which is associated with hypersensitivity [30,36]. Among the ingredients assessed, magnesium was more likely to be included in shingles-nonspecific products, whereas vitamin E was more likely to be included in shingles-specific products. Given the sparsity of studies on the efficacy of either magnesium or vitamin E, these results suggest that more studies are warranted for assessing these nutrients in the treatment of HZ and PHN. Vitamin C was the second-ranked nutrient among the 131 products, although it was not necessarily preferred in shingles-specific products despite studies showing its role in HZ and PHN. This discrepancy could be due to the lower concentration of vitamin C as either an oral supplement or within topical agents compared to a higher available systemic dose as an intravenous treatment.

Finally, certain oils were assessed, including peppermint oil, geranium oil, and hemp oil [19-21]. Peppermint oil was more likely to be used as an ingredient in shingles-specific products. The main ingredient of peppermint oil is menthol, which is commonly used for musculoskeletal pain [19]. The possible mechanism of action of peppermint oil is the inhibition of sensitized nociceptors [19]. However, few studies have assessed peppermint oil; thus, its common use in shingles-specific products warrants more studies on its effect on HZ and PHN. Geranium oil was found to relieve pain quickly in a small study [16]; however, it was not widely used in shingles products available on Amazon. Hemp oil was used a primary ingredient in several products (11.5% of 131 total products); however, few studies have focused on its effect for shingles. A small trial showed the effectiveness of a cannabinoid receptor agonist topical for PHN [21]. Given that it is commonly used, hemp oil should be further studied to better understand if it is effective for the treatment of shingles.

Limitations

The main limitation of the study is that not all of the products related to “shingles” from Amazon were included in the analysis since there was over 3000 products found. Only the top 131 products were included with products receiving a rating of less than 4 stars excluded. Furthermore, products that did not include “shingles” in either the product name, description, or mentioned in the customer reviews were excluded. This excluded products that were suggested by the internet retailer algorithm but may not have been suggested by the manufacturer or customers to be used for shingles. Another limitation was that only “shingles” was used as the keyword to narrow down the search based on what the general populace would search. Searching for “postherpetic neuralgia” and “herpes zoster” could potentially produce more results. Furthermore, we did not analyze all of the active ingredients used by all of the products analyzed. Finally, we did not compare ingredients of the products with the amount of positive and negative reviews related to “shingles” that the product received. This comparison would allow for further analysis of whether specific ingredients were perceived to be effective to the general population.

Conclusion

Our analysis of “shingles” products on the internet retailer Amazon demonstrated an abundance of products and available ingredients used for shingles treatment. Although there are already available treatments that are approved for the management of AHZ and PHN, because these are conditions that are typically managed by several treatments, understanding over-the-counter management would benefit patients. Using Amazon to understand what is available to and preferred by
customers can allow us to assess which ingredients require further studies to better educate our patients on what would be effective for AHZ and PHN and to target potential misinformation online.

**Conflicts of Interest**
None declared.

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Abbreviations

AHZ: acute herpes zoster
HSV: herpes simplex virus
HZ: herpes zoster
NSAIDs: nonsteroidal anti-inflammatory drugs
PHN: postherpetic neuralgia
VZV: varicella zoster virus

Edited by G Eysenbach; submitted 12.10.20; peer-reviewed by S Lee, S Chung; comments to author 25.10.20; revised version received 27.10.20; accepted 18.01.21; published 08.02.21.

Please cite as:
Zhu P, Woo BKP
Nonprescription Products of Internet Retailers for the Prevention and Management of Herpes Zoster and Postherpetic Neuralgia: Analysis of Consumer Reviews on Amazon
JMIR Dermatol 2021;4(1):e24971
URL: http://derma.jmir.org/2021/1/e24971/
doi:10.2196/24971
PMID:
