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Original Paper

Facebook Intervention for Young-Onset Melanoma Patients and Their Family Members: Pilot and Feasibility Study

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Abstract

Background: Despite their elevated melanoma risk, young-onset melanoma patients and their families exhibit low rates of engagement in skin cancer surveillance and sun protection behaviors. Interventions that improve skin cancer surveillance (total cutaneous exam [TCE] and skin self-exam [SSE]) and prevention (sun protection) practices among young-onset patients and their family members would likely have an impact on skin cancer morbidity and mortality; however, such interventions are lacking.

Objective: The objective of our study was to examine the development, feasibility, and preliminary impact of a family-focused Facebook intervention to increase engagement in TCE, SSE, and sun protection among young-onset melanoma patients and their families.

Methods: In this study, 48 young-onset melanoma patients and their 40 family members completed measures of knowledge; beliefs; and TCE, SSE, and sun protection intentions before and 1 month after participating in 1 of 5 separate “secret” (ie, private) Facebook groups. The intervention content consisted of daily postings about skin cancer, skin cancer risk factors, TCE, SSE, and sun protection.

Results: Patient and family member participation rates differed by recruitment setting, with acceptance rates ranging from 24.6% to 39.0% among families recruited from a cancer center setting and from 12.7% to 61.5% among families recruited from a state registry. Among the 5 consecutive groups conducted, engagement, as measured by comments and likes in response to postings, increased across the groups. In addition, participants positively evaluated the intervention content and approach. Preliminary analyses indicated increases in TCE, SSE, and sun protection intentions.

Conclusions: Our family-focused Facebook intervention showed promise as a potentially feasible and efficacious method to increase sun protection and skin cancer surveillance among individuals at increased risk for melanoma.

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KEYWORDS

young adults with melanoma; family interventions; sun protection; skin surveillance; skin examination; social media; Facebook

Introduction

The incidence of young-onset melanoma, defined as a diagnosis of melanoma before the age of 40, is increasing; the risk of developing melanoma is more than 6 times higher among young adults than it was 40 years ago [1]. Melanoma is the most common malignancy occurring among young adults aged 25-29 years and the second most common malignancy among persons aged 15-29 years [2]. Having a first-degree relative with melanoma more than doubles a person's melanoma risk, which can be attributed to genetics as well as shared environmental factors [3]. Furthermore, spouses or partners of melanoma patients are at increased risk for melanoma [4], which may be due to shared environmental or phenotypic risk factors. Thus, the population of family members at an elevated risk for melanoma is growing in tandem with the increase in the patient population.

Melanoma risk is known to be associated with the magnitude of ultraviolet radiation exposure [5-7]. The American Cancer Society and other agencies (eg, Skin Cancer Foundation) recommend prevention by avoiding exposure to ultraviolet light during peak exposure hours and recommend using sunscreen and sun-protective clothing. The American Cancer Society also recommends regular surveillance for adults, including total cutaneous exams (TCEs) by a health care provider and comprehensive skin self-exams (SSEs). TCE is a cost-effective and safe procedure that facilitates the identification of thinner lesions that can be treated more successfully than thicker ones [8,9]. Comprehensive SSE confers up to a 63% reduction in melanoma risk [10]. Reportedly, 40%-45% of diagnosed melanomas are initially detected by patients incidentally or while conducting a deliberate SSE [11]. Adherence to TCE and SSE is likely to reduce the cancer burden as well as the incidence of malignant melanomas diagnosed at advanced stages, particularly among populations at an elevated risk.

The US Preventive Services Task Force states that there is insufficient evidence to recommend regular TCE and SSE for the general population of average-risk adults. However, professional and preventive services groups recommend routine screening for higher-risk persons who have a first-degree relative with melanoma [2,12]. It is recommended that these at-risk family members should engage in regular sun protection and undergo routine TCEs and SSEs [2,12].

Despite their elevated melanoma risk, engagement in TCE, SSE, and sun protection is low among first-degree relatives of melanoma patients. Between 47% and 59% of first-degree relatives report ever having a TCE [13-15], and about one-third of first-degree relatives have not conducted an SSE in the past year [10,14-16]. Reportedly, engagement in regular sun protection ranges from 20% to 59% [13-15]. The limited work conducted to date has indicated that engagement in TCE, SSE, and sun protection is similarly low among first-degree relatives of young-onset melanoma patients (Manne, unpublished data).

Moreover, young-onset melanoma survivors are at a higher relative risk for a second malignancy than adults diagnosed with cancer who are over 39 years of age [17]. The cumulative incidence of secondary malignancies rises faster over time for

young adult survivors than for childhood and older adult survivors [17]. Follow-up guidelines for melanoma patients recommend that they reduce their risk for secondary malignancies by receiving a periodic TCE, conducting a regular SSE, and engaging in regular sun avoidance and protection [18,19]. Although most melanoma patients receive a periodic TCE [20-22], only 14%-39% of patients conduct a thorough SSE on a regular basis [8,9,23,24]. Prior research has indicated that engagement in recommended TCE is very high among young-onset melanoma patients (Manne, unpublished). Only 59% of young-onset melanoma patients have reported engaging in SSE in the past year (Manne, unpublished). Even among those reporting a skin exam, comprehensiveness of self-exams is low (eg, 42% examine their feet, 29% examine their scalp; Manne, unpublished). Furthermore, engagement in regular sun protection is low (Manne, unpublished).

Young-onset melanoma patients and their family members are a growing and unique cancer population who are at elevated skin cancer risk. Effective interventions to improve their surveillance and prevention practices will likely have an impact on skin cancer morbidity and mortality. Prior behavioral interventions for melanoma patients and their family members have primarily been delivered in person or via individual print or telephone counseling [25,26]. Few of these interventions have targeted both patients and their family members. For example, Bowen et al [27] found that a Web-based family communication intervention improved skin surveillance and sun protection behaviors among melanoma patients and their family members compared with that among a wait-list control group. In another study, melanoma patients and their family members reported greater engagement in SSE behaviors after receiving a dyadic compared with a solo learning intervention [28].

An intervention that is delivered via a social media modality offers some advantages over other intervention modalities. One advantage is the high reach. Young adults are high users of Facebook [29]. Second, social media platforms allow users to interact with one another and create their own content. Closed social media platforms such as secret Facebook groups allow for the formation of a group environment where patients can engage with other patients who have undergone similar experiences, family members can interact with the families of other patients, and everyone can view all postings. This engagement may facilitate group support for behavior change and promote the setting of social norms and expectations for practices and attitudes. Normative influences drive attitudinal change and play a role in sun protection and SSE for individuals at increased risk for melanoma, including individuals with a personal or family history of melanoma [15,30]. Third, social media allows health care providers to interact with participants. For example, cutaneous oncologists can address questions about skin cancer that are viewed by all members of the group. Finally, social media modalities provide a less expensive way to disseminate information and skills [31]. Because of these advantages, social media modalities such as Facebook have been incorporated as a component of behavioral interventions to reduce tobacco use [32], improve physical activity [33,34],

and enhance weight loss [35]. To date, there have been few stand-alone Facebook interventions [36].

This study reports on the development and acceptability of a family-focused Facebook intervention for young-onset melanoma patients and their family members. Young-onset survivors face unique challenges and have unique needs and preferences. They manage survivorship recommendations at a time when they manage other life tasks such as choosing life partners, starting or finishing new educational or occupational pursuits, and starting or caring for their own families [37,38]. In addition, their family members are likely younger than those of patients diagnosed at an older age and, therefore, may face similar challenges in engaging in skin cancer risk-reducing behaviors. This study had two aims. The first aim was to evaluate the feasibility of the intervention, which was measured by recruitment rates, participation in the Facebook groups, retention, and acceptability. The second aim was to provide a preliminary examination of the impact of the intervention on knowledge; beliefs (family perceptions and support, sun protection benefits and barriers, SSE benefits and barriers, and norms); and sun protection, SSE, and TCE intentions.

Methods

Procedure

Patients were recruited from the Rutgers Cancer Institute of New Jersey (CINJ) and via referral from the New Jersey State Cancer Registry (NJSCR). At CINJ, potentially eligible patients were identified by reviewing outpatient medical appointments and electronic medical records. Patients were either approached in the clinic area or sent a letter about the study, along with an informed consent form and postage-paid return envelope. The patients who were sent a letter were telephoned by a member of the research team. For the NJSCR, potentially eligible patients were identified through a case review of pathology reports and other surveillance records. Each patient's treating physician of record was contacted by a staff member from the NJSCR to ensure that the patient could be contacted. Physicians had 2 weeks to respond, after which an NJSCR staff member contacted patients via letters and telephone to obtain permission to share their contact information with the research team at CINJ. Patients who provided permission were mailed a letter about the study, along with the informed consent form and a postage-paid return envelope. They were then contacted via telephone to determine their eligibility and interest in the study. Eligible and interested patients were asked to provide the name and contact information of a spouse or partner and one or more first-degree relatives. These family members were recruited using the same procedures as outlined above for patients. All participants provided informed consent either by completing a hard-copy consent form or electronically using a secure Web-based form.

After providing informed consent, participants completed a Web-based or pencil and paper baseline survey that included questions on demographic factors; Facebook use; and skin cancer-related knowledge, beliefs, and behavioral intentions. Participants were then invited to join a study-specific "secret" Facebook group. A secret group on Facebook can only be

viewed by invited individuals, and the name and existence of the group are not publicly disclosed on Facebook. Furthermore, posts to secret Facebook groups cannot be shared on Facebook outside of the group members.

Participants

Participants were melanoma patients and their family members (ie, spouses or partners, siblings, parents, and children). The eligibility criteria for patients were as follows: those diagnosed with melanoma within the past 5 years; diagnosed with stage 0-III melanoma between the ages of 18 and 45 years; not currently on active treatment for melanoma or any others cancer; able to speak and read English; with access to a computer with internet access and familiarity with social media platforms; with a spouse, partner, or first-degree relative(s) eligible and willing to participate in the study; and able to give meaningful informed consent. For family members, the eligibility criteria were as follows: those aged 18-89 years; able to speak and read English; with access to a computer with internet access and familiarity with social media platforms; and able to give meaningful informed consent.

Survey Measures

A copy of the survey is available in [Multimedia Appendix 1](#).

Demographics and Facebook Use (Assessed at Baseline Only)

Participants reported their sex, age, and highest level of education. They also indicated the number of Facebook friends they have and the amount of time per day they spend on Facebook.

Knowledge and Beliefs (Assessed at Baseline and Follow-Up)

Knowledge about skin cancer risk factors was assessed using 13 true or false items drawn from prior research [15]. A total knowledge score was obtained by summing the number of correct responses for each participant. Family perceptions about skin cancer risk, sun protection, and SSE [15,39] is a 9-item measure assessing perceived benefits of sun protection and SSE to one's family as well as discussions with family about these topics (Cronbach alpha=.92 and .94 for the baseline and follow-up surveys, respectively). The family support measure was developed for this study; its 4 items measured the degree to which the participants supported their family members engaging in regular sun protection and regular SSE as well as how important it is that their family members engage in these behaviors (Cronbach alpha=.92 and .95, respectively). An 8-item measure assessed the benefits of sun protection (sunscreen, sun-protective clothing; Cronbach alpha=.84 and .82, respectively) [15]. A 15-item measure assessed perceived barriers to using sunscreen (Cronbach alpha=.87 and .83, respectively), and an 11-item measure assessed barriers to wearing sun-protective clothing (Cronbach alpha=.86 and .89, respectively) [40]. An 8-item measure assessed SSE benefits (Cronbach alpha=.79 and .87, respectively) [15], and an 11-item measure assessed barriers to SSE (Cronbach alpha=.76 and .80, respectively) [15]. Tanning norms (5 items) measured family and friends' sunbathing practices (Cronbach alpha=.74 and .72,

respectively). Sun protection norms (7 items) measured family and friends' sun protection practices and attitudes (Cronbach alpha=.83 and .71, respectively). Furthermore, image norms for tanness (5 items) assessed participants' beliefs about societal beliefs regarding the importance of tanned appearance for celebrities and society (Cronbach alpha=.67 and .56, respectively) [41].

Behavioral Intentions (Assessed at Baseline and Follow-Up)

Sun protection intentions were assessed by averaging responses to 8 items (Cronbach alpha=.85 and .86 at baseline and follow-up, respectively) [42]. SSE intentions were assessed by averaging responses to 2 items (Cronbach alpha=.98 and .92, respectively) [42], and a single item was used to assess TCE intentions [42]. Furthermore, the measure of TCE intentions was only included in the final 2 Facebook groups.

Evaluations of the Facebook Groups (Assessed Immediately After Group Completion)

Drawing on prior research [42-44] and items developed for this project, 20 items assessed participants' evaluations in each Facebook group. Each item utilized a 7-point response scale. We created 3 subscales: evaluation of the content (7 items, Cronbach alpha=.92; eg, "The information I received was interesting"); helped prepare participants to discuss sun protection and exams with one's family (5 items, Cronbach alpha=.97; eg, "After participating in the group and viewing posts, I feel more prepared to talk to my family about engaging in regular sun protection, skin self-exams, and exams by a doctor"); and the overall Facebook experience (8 items, Cronbach alpha=.93; eg, "I felt comfortable participating in the discussions that we had on the Facebook group"). Correlations among the 3 subscales varied from $r=.56$ to $r=.81$. Additionally, we used open-ended questions to solicit additional feedback.

Overview of the Facebook Groups

We conducted 5 separate secret Facebook groups. After each group, the team met to decide upon changes to be made to content based on the information garnered from debriefing interviews with participants. An overview of the characteristics of the 5 groups is shown in Table 1. For each group, the research team posted approximately two times per day on average (typically morning and late afternoon), including weekends.

The posts focused on the following broad topics: skin cancer risks, sun protection, SSE, and TCE. Additionally, the content of the posts was informed by the Preventive Health Model [45] and the Theory of Normative Social Behavior [46,47]. For example, posts focused on skin cancer knowledge, benefits and barriers to behavior change, goal setting, family support, and normative beliefs. As outlined later, some variation existed in the content and order of posts across the Facebook groups. In general, posts included a small amount of text content, typically accompanied by a photograph or graphic image. Some posts asked participants to respond to a poll, complete a quiz, or provide a viewpoint or answer to a question by commenting on the post. Example Facebook posts are shown in Figure 1 (a welcome message) and Figure 2 (a family support and engagement message).

For all Facebook groups, participants were asked to complete a Web-based, paper and pencil, or telephone Facebook evaluation survey immediately after the end of the group. The evaluation survey was completed by 76% (67/88) of the participants. In addition, participants were invited to complete a semistructured telephone interview at the end of the group that solicited feedback on study procedures and the content of the Facebook groups. For participants who had previously completed the Facebook evaluation survey, the interview provided them with an opportunity to expand on their survey responses. The number of individuals completing a semistructured interview for each group was as follows: group 1, $n=4$; group 2, $n=8$; group 3, $n=5$; group 4, $n=19$; group 5, $n=17$ (overall completion rate=53/88, 60%). Results of the Facebook evaluation surveys and semistructured interviews were reviewed by research team members and used to inform the content and approach of subsequent groups. Participants in groups 2-5 were asked to complete a follow-up Web-based or pencil and paper survey 1 month after the end of the group that included the questions on skin cancer-related knowledge, beliefs, and behavioral intentions from the baseline survey (overall completion rate=65/80, 81%). Furthermore, participants received a US \$50 gift card for completing each of the baseline and follow-up surveys (but did not receive compensation for completing the Facebook evaluation survey or the telephone interview). This study was approved by the Rutgers Health Sciences Institutional Review Board.

Table 1. Characteristics of the Facebook groups.

Group number	Date of group	Length of group (days)	Posts (n)	Patients in the group (n)	Family members in the group (n)	Total group members (N)
1	May 2016	15	31	2	6	8
2	July-August 2016	28	53	7	4	11
3	November-December 2016	29	56	4	6	10
4	January-February 2016	28	54	14	10	24
5	June-July 2017	28	55	21	14	35

Figure 1. Example Facebook post 1. Photograph from Getty Images; credit: andres; creative #: 489039170; licensed under fair use.

Hi everyone! Welcome to the Young Melanoma Family Facebook Group. This group, which will last for one month, is made up of 21 young people who have been diagnosed with melanoma as well as 12 of their family members. In this Facebook group, we encourage participation in the form of comments and "likes" so that we can make this a great group experience for everyone! Even brief comments ("I agree!" or "I am not sure about that...") are encouraged!

Tell us a little about yourself or your family.



Figure 2. Example Facebook post 2.

We have brothers, sisters, and parents as well as people with skin cancer in this group. I know that families can really help one another with sun protection habits. For example, my mom has had skin cancer, and before we go to the car, I remind her to get her sunglasses.

What ways can you support your family members who are in this group with their sun protection goals?



Facebook Group 1

For this group, participants received a 1-page handout in the mail after completing the baseline survey. As shown in Figure 3, the handout welcomed individuals to the program, described the goals of the program, and gave brief advice on how to reduce risk for skin cancer. There was no specific order to the Facebook posts, and the moderator only posted content but did not reply or engage in any conversation with participants in the group. The posts focused primarily on skin cancer risks and sun protection, with only 2 messages on SSE and 1 message on TCE. Several posts were memes or links to external sites. Changes suggested by one or more participants included the following: (1) organize messages by weekly topics; (2) increase the duration of the group to provide more content; (3) increase interactivity (eg, quizzes); (4) drop memes; and (5) use personal narratives.

Facebook Group 2

For this group, participants again received a 1-page handout in the mail after completing the baseline survey; we extended the length of the group to 28 days and included moderator's comments on most posts. Additionally, we grouped the posts into weekly topics: week 1, skin cancer risks; week 2, sun protection; week 3, SSE; and week 4, TCE. The posts included quizzes, personal narratives, polls, tailored information about

the group's beliefs and behaviors (based on data from the baseline survey), and also addressed family influences. Several "ask the doctor" posts with prepared questions and answers were posted on behalf of a medical oncologist. Changes suggested by one or more participants included the following: (1) include information on planning behavior change; (2) provide alternate ways to consider barriers; (3) include more information on benefits; (4) include more pictures with posts; (5) reduce the length of posts; (6) add more discussion questions, and; (7) include more interaction with a medical oncologist.

Facebook Group 3

For this group and the subsequent groups, we removed the mailed 1-page handout. Posts for Facebook group 3 were revised to address the changes suggested by group 2 participants. For example, posts encouraged participants to develop behavior change goals and to identify potential barriers and solutions. In addition, a medical oncologist joined the group and answered questions on a more regular basis. Furthermore, more posts were made by moderators, and they encouraged group participation. Changes suggested by one or more participants included the following: (1) have larger groups to promote group interaction; (2) include more information about the dangers of indoor tanning; (3) increase the number of posts targeting young adults; and (4) include recent news or research about skin cancer.

Figure 3. Handout mailed to participants in Facebook groups 1 and 2.


Welcome to the Melanoma Family Program

INFORMATION SHEET 1

The Melanoma Family Program is a research study focusing on individuals and families affected by melanoma skin cancer.

You were asked to take part in this study because you have been diagnosed with melanoma skin cancer or you have a family history of melanoma skin cancer. Your personal or family history of melanoma makes you at higher risk for skin cancer than the general population.

Before we get started, we wanted to share a personal melanoma story.




"My mother was diagnosed with melanoma skin cancer three years ago. At that time, I wasn't aware that I was at risk for the disease. Since that time, I have seen a dermatologist every year to have her examine my skin. I feel reassured after I see her."

How will you benefit from this program?


- Learn more about skin cancer.
- Engage in behavioral changes to reduce your skin cancer risk.
- Help your family members to engage in better sun protection habits.



What will you get out of this program?




Receive several information sheets emailed to you over the next two weeks containing important facts about melanoma skin cancer and ways to reduce your and your family members' risk.



Be a member of the Secret Family Facebook Group where you will join members of your family and other families affected by melanoma to share your experiences and learn more about skin cancer risk reduction.

How can you reduce your risk for skin cancer?

- ✓ Minimize your exposure to direct sunlight between the hours of 10 a.m. and 4 p.m.
- ✓ Examine your own skin regularly and see a dermatologist if you find something suspicious.
- ✓ Have a dermatologist examine your skin for signs of skin cancer every year or more frequently if that is recommended for you.

Facebook Group 4

The primary change for this group was to increase the number of group members to 24. Additionally, posts were revised to focus more on indoor tanning, young adults, and skin cancer-related news and research. Participants provided positive feedback about the group, with the primary suggestion being to have an even larger group.

Facebook Group 5

This group utilized the same posts and approach for group 4 but with a larger group of 35 individuals. Again, participants were enthusiastic about the group, suggested more encouragement of group support, and suggested a larger group size.

Results

Sample Characteristics

As detailed below, a total of 88 individuals (48 melanoma patients and 40 family members) participated across 5 separate Facebook groups. The demographic characteristics of the study sample are shown in [Table 2](#). Among the 40 family members, 8 were the spouse or partner of the patient, 1 was the child, 19 were the sibling, and 12 were the parents. Among both patients and family members, the proportion of female participants was markedly higher than that of male participants. In part, this may be due to the higher rate of melanoma among young adult women than among men. The sample exhibited a relatively high level of education, with more than three-quarters of participants (71/88, 81%) reporting completing college or a graduate degree. Patients reported having a greater number of Facebook friends than their family members ($P=.01$), but the 2 groups did not differ with regard to the amount of time per week spent on Facebook ($P=.81$).

Acceptability

Enrollment

At CINJ, a total of 64 patients were approached for the study. Of them, 7 were ineligible and 40 declined to participate (either actively or passively); 17 patients consented and completed the baseline survey (consent rate=17/57, 30%) and 14 joined a Facebook group (overall Facebook joining rate=14/57, 25%). The 17 recruited patients provided contact information for a total of 44 spouses or partners and first-degree relatives. Of those 44 individuals, 3 were ineligible, 23 declined participation, 18 consented and completed the baseline survey (consent rate=18/41, 44%), and 16 joined a Facebook group (overall Facebook joining rate=16/41, 39%).

The staff of the NJSCR approached 292 patients regarding the study, 23 of whom were ineligible and 203 declined to provide permission to be contacted by the CINJ research team. Among 66 patients who gave permission to be contacted by the CINJ research team, 2 patients were ineligible, 27 declined to participate, 37 completed Web-based consent and the baseline survey (consent rate=37/267, 13.9%), and 34 joined a Facebook group (overall Facebook joining rate=34/267, 12.7%). The 37 recruited patients provided contact information for a total of 40 spouses or partners and first-degree relatives. Of those 40

individuals, 1 was ineligible, 11 declined participation, 28 completed Web-based consent and the baseline survey (consent rate=28/39, 72%), and 24 joined a Facebook group (overall Facebook joining rate=24/39, 62%).

Retention

Completion of the follow-up survey varied from 60% (6/10 for group 3) to 85% (50/59 for groups 4 and 5 combined).

Engagement

The engagement characteristics of the Facebook groups are shown in [Multimedia Appendix 2](#). On average, participants viewed 66%-83% of posts. The average number of likes and comments per post was higher for groups 4 and 5, even after taking into account the higher number of participants in those groups and higher number of moderator posts in the latter groups. Furthermore, [Multimedia Appendix 2](#) illustrates that the percentage of participants who liked and commented on 25% of the posts increased over the 5 subsequent groups. As outlined earlier, we increased the number of posts across each subsequent Facebook group.

Evaluation

The descriptive statistics for participants' evaluations of each Facebook group are shown in [Table 3](#). Mean ratings of the intervention content in Facebook group 1 were relatively low compared with those in the subsequent groups. In groups 2-5, there were positive evaluations across the evaluation subscales, particularly with regard to the intervention content and feeling more prepared to discuss relevant issues with family members.

Comments made during the debriefing interview included input about the delivery method ("Facebook is a good medium for what you are doing"), content that was well liked ("I liked the Ask the Expert posts," "I liked the Mole Map," "I liked when we shared our personal stories"), impact on behavior ("I enjoyed information about sunscreen. I never used it before, and now I am more conscious," "I am going to see a dermatologist," "I need to ask my doctor to do a more thorough exam of my skin"), and how the material impacted discussions with family (eg, "I shared the posts with my children," "My mom talked to me about the posts"). Some participants commented that they wished there be more group discussion.

Changes in Outcomes From the Baseline to the Follow-Up

Changes in the outcomes from the baseline to the follow-up are shown in [Table 4](#), which includes mean changes and their respective 95% CIs. Owing to the small sample sizes, we did not conduct formal inferential statistics. We provided CIs to provide a preliminary indication of potential effects. We conducted analyses separately for groups 2 and 3 due to the substantive differences between the messages and approach utilized in these groups. We analyzed results combined for groups 4 and 5 due to the strong similarity between their messages, approach, and sample sizes and to reduce the CI widths. There was some indication that knowledge scores improved across some groups, as did family perceptions and sun protection benefits. Counter to expectations, barriers to using sunscreen and sun-protective clothing were higher in

several groups at follow-up compared with those at baseline. There was some indication that SSE benefits increased over time, but evidence was inconsistent with regard to changes in SSE barriers. Moreover, results were inconsistent with regard to changes in norms across the groups. Encouragingly, the most

consistent beneficial effects were observed for behavioral intentions, particularly with regard to groups 4 and 5. For these groups, each of the CIs excluded zero and indicated increases in sun protection, SSE, and TCE intentions from baseline to follow-up.

Table 2. Demographic characteristics of the study sample (N=88).

Characteristic	Patients (n=48)	Family members (n=40)
Recruitment site, n (%)		
Rutgers Cancer Institute of New Jersey	14 (29)	16 (40)
New Jersey State Cancer Registry	34 (71)	24 (60)
Relation to patient, n (%)		
Spouse or partner	— ^a	8 (20)
Daughter	—	1 (3)
Son	—	0 (0)
Sister	—	12 (30)
Brother	—	7 (18)
Mother	—	8 (20)
Father	—	4 (10)
Sex, n (%)		
Female	42 (88)	26 (65)
Male	6 (13)	14 (35)
Age (years), mean (SD)		
	34.5 (6.4)	39.5 (13.2)
18-25, n (%)	7 (15)	7 (18)
26-35, n (%)	17 (35)	10 (25)
36-45, n (%)	24 (50)	8 (20)
46-55, n (%)	0 (0)	8 (20)
≥56, n (%)	0 (0)	7 (18)
Education level, n (%)		
≤High school or General Educational Development	5 (10)	4 (10)
Some college	3 (6)	5 (13)
College graduate	27 (56)	19 (48)
Graduate degree	13 (27)	12 (30)
Number of Facebook friends, n (%)		
≤100	5 (11)	15 (40)
101-200	7 (15)	5 (13)
201-300	12 (26)	4 (11)
301-400	8 (17)	14 (37)
>400	15 (32)	0 (0)
Minutes per day of Facebook use, n (%)		
<10	8 (17)	5 (13)
10-60	18 (38)	18 (47)
61-120	10 (21)	6 (16)
>120	11 (23)	9 (24)

^aNot applicable.

Table 3. Participants' evaluations of each Facebook group.

Variable ^a	Group 1 (n=6), mean (SD)	Group 2 (n=9), mean (SD)	Group 3 (n=7), mean (SD)	Group 4 (n=19), mean (SD)	Group 5 (n=26), mean (SD)	All groups, mean (SD)
Evaluation of content	4.86 (1.68)	6.19 (1.05)	6.31 (0.79)	5.66 (1.37)	6.21 (0.71)	5.94 (1.14)
Helped prepare me	3.56 (1.46)	6.37 (1.32)	6.16 (1.08)	5.05 (1.72)	6.14 (0.93)	5.63 (1.52)
Facebook experience	— ^b	—	5.25 (1.16)	5.45 (1.55)	5.87 (0.99)	5.63 (1.25)
Overall, mean (SD)	4.43 (1.53)	6.25 (1.13)	5.84 (0.93)	5.42 (1.38)	6.06 (0.79)	5.73 (1.19)

^aAll subscales were scored on a 1-7 scale, with higher numbers reflecting more positive evaluations.

^bSubscale questions were not asked of participants in that Facebook group.

Table 4. Mean changes in outcomes from baseline (BL) to follow-up (FU) for the Facebook groups.

Outcomes	Group 2 (n=9)			Group 3 (n=6)			Groups 4 and 5 (n=50)		
	BL	FU	Change (95% CI)	BL	FU	Change (95% CI)	BL	FU	Change (95% CI)
Knowledge	11.67	11.89	0.22 (−0.42 to 0.86)	11.50	12.17	0.67 (0.12 to 1.21)	12.00	12.04	0.04 (−0.27 to 0.35)
Family perceptions	4.43	4.49	0.06 (−0.19 to 0.32)	4.39	4.69	0.30 (−0.28 to 0.88)	4.54	4.50	−0.04 (−0.25 to 0.17)
Family support	4.72	4.72	0.00 (−0.10 to 0.10)	4.88	4.83	−0.04 (−0.30 to 0.22)	4.79	4.74	−0.06 (−0.24 to 0.13)
Sun protection benefits	4.63	4.38	−0.25 (−1.03 to 0.53)	4.48	4.63	0.14 (−0.72 to 1.01)	4.62	4.67	0.05 (−0.04 to 0.14)
Sunscreen barriers	1.73	1.92	0.18 (−0.26 to 0.63)	2.43	2.53	0.11 (−0.48 to 0.69)	2.25	2.26	0.02 (−0.16 to 0.20)
Clothing barriers	2.47	2.92	0.45 (−0.83 to 1.74)	2.55	2.91	0.36 (−0.53 to 1.26)	3.01	2.97	−0.04 (−0.22 to 0.14)
Sun protection intentions	5.64	5.69	0.05 (−0.28 to 0.37)	5.15	5.30	0.15 (−1.98 to 2.28)	4.94	5.33	0.39 (0.17 to 0.61)
SSE ^a benefits	5.47	5.42	−0.05 (−0.58 to 0.49)	5.28	5.65	0.38 (−0.04 to 0.79)	5.16	5.28	0.12 (−0.11 to 0.35)
SSE barriers	3.05	3.18	0.14 (−0.82 to 1.10)	3.13	3.18	0.05 (−0.42 to 0.52)	2.98	2.93	−0.06 (−0.22 to 0.11)
SSE intentions	6.25	6.06	−0.19 (−1.23 to 0.86)	4.90	6.00	1.10 (−1.44 to 3.64)	5.29	6.13	0.84 (0.42 to 1.26)
TCE ^b intentions	— ^c	—	—	—	—	—	6.02	6.58	0.56 (0.18 to 0.94)
Tanning norms	3.95	3.48	−0.48 (−1.00 to 0.05)	4.52	4.28	−0.24 (−1.05 to 0.57)	3.73	3.76	0.02 (−0.22 to 0.27)
Sun protection norms	3.98	3.48	−0.50 (−0.94 to −0.06)	3.29	3.77	0.49 (−0.72 to 1.69)	3.79	3.70	−0.08 (−0.31 to 0.15)
Image norms	3.44	3.33	−0.12 (−0.81 to 0.57)	3.36	3.64	0.28 (−0.52 to 1.08)	3.66	3.53	−0.13 (−0.36 to 0.10)

^aSSE: skin self-examination.

^bTCE: total cutaneous examination.

^cThe measure was not included for that Facebook group.

Discussion

Principal Findings

To the best of our knowledge, this is one of the first studies to evaluate a family-based skin cancer risk reduction intervention for young adults with melanoma and their relatives and the first behavioral intervention for this population delivered entirely through Facebook. Interventions delivered through social media are innovative and a promising way to reach young adults and their family members. In addition, Facebook provides a novel way to engage family members with one another, encourage young survivors to interact with other young survivors and their relatives, and facilitate engagement between families in learning and discussion about skin cancer. During the year-long development of the Facebook group methodology and its content, our team learned several lessons.

First, group engagement, as defined by participation (ie, likes and comments to original posts), improved steadily over the

groups (eg, 0% of group 1 members and 9% of group 2 members commented on at least 25% of posts compared with 40% of group 5 members). Several factors may have contributed to this increase. A higher number of group members were recruited into each group over time, which may have increased the likelihood that one or more participants would post comments, find commonalities, and promote discussion. Another factor that may have increased participation was the quality of the posts. Based on the postgroup debriefing with participants and team discussion, we created posts that were briefer and designed to elicit interaction (eg, posed a question). Posts such as personal stories, goal-setting exercises, quizzes, and the opportunity to have questions answered by a cutaneous oncologist were rated as particularly engaging by group members.

The second lesson learned was that recruitment was challenging. Patient provision of relatives' contact information, reaching out to and enrolling relatives, completion of surveys, and ultimate acceptance into the Facebook group represent different steps with the potential loss of participants associated with each step.

The most common point for participant loss was at the initial patient contact. Acceptance rates among patients differed by recruitment source, with a lower acceptance rate from the cancer center recruitment (at CINJ) than from the NJSCR. Family members joined the Facebook groups at higher rates than did patients. It is possible that recruitment from the cancer center provides the advantage of patient trust on the oncologist and knowledge of the institution. However, registry recruitment has the advantage of provision of greater reach into the general patient population. Another challenge was the relatively small number of relatives provided by each patient. One possible explanation is that patients stated they did not have siblings, suggesting smaller family size to be a reason.

The third lesson learned was that despite the challenges of enrollment, once enrolled, engagement was high, particularly in the latter groups. In their comments, participants shared their personal experiences with melanoma, provided each other with encouragement to undergo SSE and TCE and to engage in sun protection, asked one another for advice about sun protection products and recommendations for dermatologists who could perform exams, discussed personal barriers to sun protection and skin exams, set skin exam and sun protection goals, and posed questions for the cutaneous oncologist about melanoma and skin exams. Negative, off-topic, or unhelpful comments were not observed, although some members stated in their debriefing interviews that they did not share as much as they might have to not upset the family member who was diagnosed with cancer.

The fourth lesson learned was that evaluations of the groups, other than group 1, were positive. Participants reported that the content was informative and valid, the group prepared them to discuss skin cancer prevention with their family, and they felt comfortable sharing their experiences and connected with other group members. Given one of the key goals of this intervention was to encourage family members to support one another's skin cancer risk reduction, the fact that participants reported that the posts prompted discussions with their family members and that the group facilitated interactions with family members who were not participating in the group was encouraging.

Owing to the small sample size and the fact that outcomes were reported separately by group, it is difficult to make firm conclusions about the efficacy of the intervention. Our preliminary data suggest that there were increases in sun protection, SSE, and TCE intentions for the final 2 groups. There were generally inconsistent results with regard to improvements in the knowledge and beliefs outcomes. Definitive conclusions with regard to the efficacy of the intervention will require larger randomized clinical trials.

Limitations

Limitations of this study include low recruitment rates for patients and the small sample size. Future research is warranted to examine patients' and their family members' preferences with regard to delivery platforms for skin cancer prevention and surveillance interventions. Additionally, efforts are needed to identify strategies for maximizing participant recruitment, engagement, and retention for interventions delivered via social media and other platforms. The fact that we conducted 5 separate Facebook groups allowed the team to develop and refine the intervention in a deliberate, iterative manner based on participant engagement and feedback, which was the primary purpose of this study. The sample size in this study meant that we were not able to conduct a factor analysis of the Facebook group evaluation survey items. This should be addressed in future studies with larger sample sizes.

Conclusions

This pilot and feasibility study demonstrated that a moderated family-focused Facebook intervention for young-onset melanoma survivors and their family members is feasible and acceptable. For future similar research, we recommend Facebook group durations of at least 1 month with ≥ 35 participants and regular posts by moderators. Because recruitment of patients was challenging, future studies may benefit from focusing on methods of enhancing patient recruitment. Additionally, although this study provided preliminary evidence of positive changes in outcomes, particularly with regard to behavioral intentions, further research is needed with larger sample sizes to determine the statistical and practical significance of such effects and to examine behavioral outcomes.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Study survey measures.

[[PDF File \(Adobe PDF File\), 99KB - derma_v1i2e3_app1.pdf](#)]

Multimedia Appendix 2

Engagement characteristics of the Facebook groups.

[PDF File (Adobe PDF File), 25KB - [derma_v1i2e3_app2.pdf](#)]

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Abbreviations

CINJ: Cancer Institute of New Jersey

NJSCR: New Jersey State Cancer Registry

SSE: skin self-exam

TCE: total cutaneous exam

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Original Paper

College Students' Attitudes and Behaviors Related to Sun Safety and Appearance in Relation to Health Information-Seeking Behavior and Social Media Use: Cross-Sectional Study

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Abstract

Background: Skin cancer is the most common type of cancer in the United States. Rates of melanoma, a malignant form of skin cancer, are on the rise and are high among people under 30 years of age.

Objective: This study aims to explore factors related to sun protection and tanning behavior and examine the influence of social media use and health information-seeking behaviors (HISB) on sun protection actions among a group of college students.

Methods: In this cross-sectional study, students (N=258) at a large public university completed a survey that included questions on sun safety and tanning attitudes and behaviors, as well as HISB. A sun protection behavior score was created on the basis of behaviors related to seeking shade, using sunscreen, tanning booth and bed use, and the number of lifetime blistering sunburns. Multivariate logistic regression analyses were performed to assess associations between high and low sun protection behavior and sun safety and tanning attitudes and HISB.

Results: The majority of participants were females (164/258, 63.8%), 31.0% (80/258) were white, and the mean age was 20.3 (SD 4.1) years. Females (odds ratio [OR] 0.42, 95% CI 0.22-0.81) and believers that suntan improves appearance (OR 0.25, 95% CI 0.10-0.66) were less likely to have "high" sun protection behaviors.

Conclusions: The cultural belief that having a suntan improves appearance, especially among female college students, results in low sun protection behaviors. Interventions can be developed to improve skin cancer-related HISB among college students with the aim of developing better cognizance of skin cancer and sun protection behaviors.

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KEYWORDS

United States; universities; students; skin neoplasms; ultraviolet rays

Introduction

Skin cancer is the most common type of cancer in the United States [1]. Rates of melanoma, a malignant form of skin cancer, have risen over the years [1,2]. The American Cancer Society

estimates there will be 99,550 new cases of skin cancer in 2018, excluding basal and squamous types (as there is no requirement to report these to cancer registries), of which, 91,270 (92%) are melanoma [3]. In addition, a recent study suggested that the number of individuals diagnosed with melanoma will nearly

double in 2026-2031 [4]. Melanoma is among the most common cancers in people under 30 years of age [4]. Ultraviolet exposure is a well-known risk factor for the development of melanoma [5]. College students tend to have high levels of sun exposure, low levels of concern for sun protection, and a strong desire to suntan [6-10].

Behaviors can be influenced by a number of factors, one of which is social media. The use of digital platforms, particularly social media, is at an all-time high [11]. The emergence of social media has allowed individuals opportunities in networking, navigation, and real-time connection [11,12]. College-aged individuals, who are part of a technologically adapted generation, frequently use social media, with 88% of those aged 18-29 years reporting that they are using social media [13]. College-aged individuals (age: 18-24 years) are markedly more likely to use Twitter, Snapchat, and Instagram, highly popular social media platforms [13]; of individuals in this age bracket, 51% reported that social media would be difficult for them to give up [13]. These young consumers are regularly productive through social media (eg, messaging, searching, sharing, and discussing various topics) [12]. As individuals continue to embrace social media, public health professionals should be aware of the potential health implications in nature of the information and messages that are accessed or shared.

One study specifically examined social media use and indoor tanning behavior and determined that social media is a medium that could increase peer pressure to partake in indoor tanning [14]. College-aged individuals, particularly women, are among individuals that frequently tan [15,16] and use social media [13]. As social media is so widespread, there are potential risks in spreading messages that could endanger health. As active information and image sharing on these platforms may be encouraging indoor tanning [14], a concern should be raised as indoor tanning is a major risk factor for skin cancer [17].

With the use of social media on the rise, there is a heightened sensitivity to self-image and physical appearance among younger age groups [18-20]. Many of these individuals associate tanned skin to attractiveness. Recent studies indicated that appearance dissatisfaction and tanning intentions strongly associated with social media use [18,21]. Current literature regarding social media [18,22] is consistent with research on traditional media in that images are often pro-tan and lack focus on skin cancer prevention [23-27].

As social media is reportedly used to promote tanning activity [28], it can also be used to promote health and can be highly effective as a medium for disseminating information in this population and promoting prevention efforts [29,30]. There remains a gap in the literature in terms of health information-seeking behaviors (HISB) of college students when it comes to skin cancer. Therefore, this study aims to explore factors related to sun protection and tanning behavior and examine the influence of health information seeking on sun protection behaviors among a group of college students.

Methods

This cross-sectional study, conducted in March-May of 2018, was ancillary to a larger study that focused on HISB of college students in general [31]. Instructors of 9 sections of a personal health course at a large public university in New Jersey distributed surveys to all students who were present (n=329) in class and voluntarily participated (n=258). The response rate was 78.4%. Of note, the course is part of the University Core Curriculum in which all students must take a personal health course, and this course is one of the offerings. Survey questions were adapted from the Health Information National Trends Survey questionnaire, and from our prior study on sun safety [6]. The survey questions pertinent to this study are described below.

Sun safety and tanning behaviors were captured in 5 questions. Sun safety behaviors were measured in 2 questions aimed at the likelihood that respondents would (1) seek shade; and (2) use sunblock on a sunny day. In addition, tanning behaviors were captured in 2 questions that encompassed the likelihood that respondents would go indoor tanning and specifically how many times they have used a tanning booth and bed in the past 12 months. The overall exposure was measured by asking how many blistering sunburns respondents experienced in their lives.

When looking at reasons for tanning and sun protection, we queried students regarding their perceived satisfaction in appearance and whether they believed that having a tan improves appearance. Moreover, we included questions concerning self-esteem and stress to further investigate the influence of social factors and individual thoughts and beliefs about the tanned skin. Appearance-based questions included the following: *Have you ever been dissatisfied with your appearance? Are you currently satisfied with your physical appearance? Do you think having a suntan improves your appearance? Do you think having a suntan improves your self-esteem? Do you think sun-tanning or sunbathing is a way to relieve stress?*

Respondents were asked questions related to HISB, specifically how many hours per day they were engaged on social media. Furthermore, questions were posed to assess respondents' attitudes toward the accuracy of information on social media, in general, and beliefs related to the helpfulness of social media as resources for health issues.

Descriptive analyses included frequency distributions, mean, median, and range. To construct the outcome variable, "sun protection behaviors," the following variables were recoded and summed: seek shade on sunny days ("likely" or "very likely"), use sunscreen on sunny days ("likely" or "very likely"), use a tanning booth and bed ("very unlikely" or "unlikely"), zero times using a tanning booth and bed in the past 12 months, and zero blistering sunburns in one's lifetime. The potential range of the 5 variables was 0-5; mean and median scores were 3.1 (SD 1.0) and 3.0, respectively. The sun protection behavior score was dichotomized with values of 0-3 coded as "low" sun protection behaviors and values of 4-5 as "high" sun protection behaviors. The race was recoded as black or African American individuals versus all other races and college year as "freshmen" versus "upper classmen." Variables coded on a 5-point Likert

scale “very inaccurate” through “very accurate” were collapsed and recorded as “inaccurate” versus “accurate” and “strongly disagree” through “strongly agree” as “disagree” versus “agree.” Univariate analyses were performed to test the association between sun protection behaviors (low vs high) using the chi-square test for categorical variables and the analysis of variance for continuous variables.

The unadjusted logistic regression was conducted for all variables with $P < .05$ in the univariate analysis followed by the backward, stepwise multivariable regression. Because the number of variables in each family examined (eg, demographics, attitudes toward tanning and sun protection, use of internet, social media, and attitudes toward internet, social media) were relatively few and a single comparison (low vs high sun protection behaviors) was conducted, Bonferroni correction for multiple analyses was not judged to be necessary. All analyses were conducted using IBM SPSS version 25. In addition, $P < .05$ was considered statistically significant. This study was approved by the Institutional Review Board at William Paterson University.

Results

Table 1 outlines the demographic characteristics, sun protection attitudes and behaviors, and health information-seeking beliefs

and attitudes. Of 258 respondents, 63.8% (164/258) were females. The race was fairly equally distributed with 25.2% (65/258) black or African American, 28.3% (73/258) Hispanic, and 31.0% (80/258) white individuals. The mean age of a respondent was 20.3 (SD 4.1) years, and most were freshmen (156/258, 60.5%). Slightly more than half of the respondents declared a health-related major (135/258, 52.3%). No respondents reporting personally having had skin cancer, and few had a friend or family member with skin cancer (36/258, 14.0%). Approximately one-third of respondents reported they were “likely” to seek shade (93/258, 36.1%) and use sunscreen on a sunny day (71/258, 27.5%). The majority (225/258, 87.2%) were “very unlikely” or “unlikely” to use a tanning booth and bed, with 92.2% (238/258) stating they have not used a tanning booth and bed in the past 12 months. Nearly two-thirds were dissatisfied with their appearance at some time in the past, but 57.4% (148/258) were currently satisfied with their appearance. One-third believed that tanning improved their appearance (87/258, 33.7%), whereas roughly one-quarter believed it improved their self-esteem (66/258, 25.6%) or felt that sun tanning was a way to relieve stress (60/258, 23.3%). The use of social media was limited to about 4.5 hours per day with many (125/258, 48.4%) believing that social media is accurate to some degree and a helpful resource for health information (108/258, 41.9%).

Table 1. Demographic characteristics, sun protection attitudes and behaviors, and health information-seeking beliefs and attitudes among college students.

Characteristics	Value (n=258)
Demographics	
Gender, n (%)	
Female	164 (63.8)
Male	92 (35.7)
Other	1 (0.4)
Race, n (%)	
American Indian or Alaskan Native individuals	1 (0.4)
Asian individuals	28 (10.9)
Black or African American individuals	65 (25.2)
Hispanic individuals	73 (28.3)
Nat Haw or Other Pacific Islander individuals	1 (0.4)
White individuals	80 (31.0)
Mixed-race individuals	3 (1.2)
Other individuals	7 (2.7)
Age	
Mean (SD)	20.3 (4.1)
Median	19.0
Range	18-59
Health-related major, n (%)	
Yes	135 (52.3)
No	122 (47.3)
Missing	1 (0.4)
College year, n (%)	
Freshmen	156 (60.5)
Sophomore	38 (14.7)
Junior	41 (15.9)
Senior	20 (7.8)
Graduate student	0 (0.0)
Other	3 (1.2)
Relative with skin cancer, n (%)	
Yes	36 (14.0)
No	215 (83.3)
Missing	7 (2.7)
Self-skin cancer, n (%)	
Yes	252 (97.7)
No	0 (0.0)
Missing	6 (2.3)
Sun safety and tanning behaviors	
Seek shade on sunny days, n (%)	
Very unlikely	12 (4.7)
Unlikely	50 (19.4)

Characteristics	Value (n=258)
Neutral	100 (38.8)
Likely	67 (26.0)
Very likely	26 (10.1)
Missing	3 (1.2)
Use sunscreen on a sunny day, n (%)	
Very unlikely	58 (22.5)
Unlikely	60 (23.3)
Neutral	65 (25.2)
Likely	45 (17.4)
Very likely	26 (10.1)
Missing	4 (1.6)
Use of a tanning bed, n (%)	
Very unlikely	203 (78.7)
Unlikely	22 (8.5)
Neutral	20 (7.8)
Likely	7 (2.7)
Very likely	2 (0.8)
Missing	4 (1.6)
Number of times tanning booth and bed used in the past 12 mo, n (%)	
0	238 (92.2)
1-2	8 (3.1)
3-5	3 (1.2)
≥6	8 (3.1)
Missing	1 (0.4)
Number of lifetime blistering sunburns	
Mean (SD)	1.0 (2.3)
Median	0.0
Range	0-15
Reasons for tanning and sun protection, n (%)	
Dissatisfied with appearance	
Yes	163 (63.2)
No	93 (36.0)
Missing	2 (0.8)
Currently satisfied with the appearance	
Yes	148 (57.4)
No	110 (42.6)
Tanning improves appearance	
Yes	87 (33.7)
No	171 (66.3)
Tanning improves self-esteem	
Yes	66 (25.6)
No	191 (74.0)
Sun tanning relieves stress	

Characteristics	Value (n=258)
Yes	60 (23.3)
No	193 (74.8)
Missing	5 (1.9)
Use of social media	
Social media use (hours per day)	
Mean (SD)	4.5 (3.6)
Median	4.0
Range	0-24
Social media attitudes, n (%)	
How accurate is social media	
Very inaccurate	38 (14.7)
Inaccurate	93 (36.0)
Somewhat accurate	105 (40.7)
Accurate	15 (5.8)
Very accurate	5 (1.9)
Missing	2 (0.8)
Social media provides helpful health resource	
Strongly disagree	34 (13.2)
Disagree	74 (28.7)
Somewhat agree	108 (41.9)
Agree	34 (13.2)
Strongly agree	4 (1.6)
Missing	4 (1.6)

Table 2 presents a comparison of demographic characteristics, sun protection attitudes, and health information-seeking attitudes and behaviors by the level of sun protection behavior. Those who reported “low” sun protection behaviors (153/241, 63%) more often stated that tanning improves one’s appearance (43.1% vs 17.8%, $P<.001$), that tanning improves their self-esteem (31.4% vs 15.7%, $P=.01$), and that sun tanning relieves stress (29.1% vs 12.6%, $P=.004$) compared with those with “high” sun protection behaviors. In addition, individuals

with “low” sun protection behaviors more often believed that social media was an accurate source of health information (10.5% vs 3.3%, $P=.046$) and a helpful resource for health information (62.5% vs 46.7%, $P=.02$) compared with those with a “high” sun protection behavior score. More often females (76.7% vs 57.2%, $P=.01$) and those who were in a health-related major (60.7% vs 47.7%, $P=.05$) had a “high” sun protection behavior score.

Table 2. The comparison of demographic characteristics, sun protection attitudes, and health information-seeking attitudes and behaviors by the level of sun protection behavior.

Characteristics	Total (n=258)	Sun protection behaviors (n=241)		<i>P</i> value ^a
		Low (n=153)	High (n=90)	
Demographics				
Gender, n (%)				.01
Female	156 (64.5)	87 (57.2)	69 (76.7)	
Male	85 (35.1)	64 (42.1)	21 (23.3)	
Other	1 (0.4)	1 (0.7)	0 (0.0)	
Race, n (%)				.18
Black or African American individuals	61 (25.1)	34 (22.2)	27 (30.0)	
All other races	182 (74.9)	119 (77.8)	63 (70.0)	
Age in years, mean (SD)	20.3 (4.1)	20.5 (4.7)	19.7 (2.7)	.17
Health-related major concern, n (%)				.05
Yes	127 (52.5)	73 (47.7)	54 (60.7)	
No	115 (47.5)	80 (52.3)	35 (39.3)	
College year, n (%)				.12
Freshman	152 (62.6)	90 (58.8)	62 (68.9)	
Upper classmen	91 (37.4)	63 (41.2)	28 (31.1)	
Relative with skin cancer, n (%)				.54
Yes	35 (14.8)	24 (15.9)	11 (12.9)	
No	201 (85.2)	127 (84.1)	74 (87.1)	
Reasons for tanning and sun protection				
Dissatisfied with appearance, n (%)				.68
Yes	153 (63.5)	95 (62.5)	58 (65.2)	
No	88 (36.5)	57 (37.5)	31 (34.8)	
Currently satisfied with the appearance, n (%)				.25
Yes	137 (56.4)	82 (53.6)	55 (61.1)	
No	106 (43.6)	71 (46.4)	35 (38.9)	
Tanning improves appearance, n (%)				<.001
Yes	82 (33.7)	66 (43.1)	16 (17.8)	
No	161 (66.3)	87 (56.9)	74 (82.2)	
Tanning improves self-esteem, n (%)				.01
Yes	62 (25.6)	48 (31.4)	14 (15.7)	
No	180 (74.4)	105 (68.6)	75 (84.3)	
Sun tanning relieves stress, n (%)				.004
Yes	55 (23.1)	44 (29.1)	11 (12.6)	
No	183 (76.9)	107 (70.9)	76 (87.4)	
Use of social media (hours/day), mean (SD)	4.5 (3.6)	4.4 (3.2)	5.0 (4.4)	.22
Social media attitudes, n (%)				
How accurate is social media				.046
Inaccurate	224 (92.2)	137 (89.5)	87 (96.7)	
Accurate	19 (7.8)	16 (10.5)	3 (3.3)	
Social media provides helpful health resource				.02

Characteristics	Total (n=258)	Sun protection behaviors (n=241)		<i>P</i> value ^a
		Low (n=153)	High (n=90)	
Disagree	105 (43.4)	57 (37.5)	48 (53.3)	
Agree	137 (56.6)	95 (62.5)	42 (46.7)	

^aItalicized *P* values indicate significance (*P*<.05).

Table 3. Factors associated with high sun protection behaviors.

Characteristics	Unadjusted OR ^a		Adjusted OR	
	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value ^b
Gender				
Male	1.00	Referent	1.00	Referent
Female	<i>0.41 (0.23-0.74)</i>	<i>.003</i>	<i>0.42 (0.22-0.81)</i>	<i>.01</i>
Race				
Black or African American individuals	1.00	Referent	1.00	Referent
All other races	0.67 (0.37-1.20)	.18	0.92 (0.47-1.82)	.82
Health-related major concern				
No	1.00	Referent	1.00	Referent
Yes	0.59 (0.35-1.00)	.052	0.63 (0.35-1.15)	.14
Suntan improves appearance				
No	1.00	Referent	1.00	Referent
Yes	<i>0.28 (0.15-0.53)</i>	<i><.001</i>	<i>0.25 (0.10-0.66)</i>	<i>.01</i>
Suntan improves self-esteem				
No	1.00	Referent	1.00	Referent
Yes	<i>0.41 (0.21-0.79)</i>	<i>.01</i>	1.31 (0.41-3.13)	.81
Sun tanning relieves stress				
No	1.00	Referent	1.00	
Yes	<i>0.35 (0.17-0.73)</i>	<i>.01</i>	0.61 (0.27-1.38)	.24
Social media is accurate				
Disagree	1.00	Referent	1.00	Referent
Agree	0.30 (0.08-1.04)	.06	0.61 (0.15-2.49)	.49
Social media is helpful				
Disagree	1.00	Referent	1.00	Referent
Agree	<i>0.53 (0.31-0.89)</i>	<i>.02</i>	0.60 (0.33-1.09)	.09

^aOR: odds ratio.

^bItalicized *P* values indicate significance (*P*<.05).

In the unadjusted logistic regression (Table 3), females (odds ratio, OR, 0.41, 95% CI 0.23-0.74) and individuals who believed a suntan improves appearance (OR 0.28, 95% CI 0.015-0.53), suntan improves self-esteem (OR 0.41, 95% CI 0.21-0.79), sun tanning relieves stress (OR 0.35, 95% CI 0.17-0.73), and that social media is a helpful resource for health information were all less likely to have “high” sun protection behaviors. After including all variables in the multivariate model, females (OR 0.42, 95% CI 0.22-0.81) and believers that suntan improves appearance (OR 0.25, 95% CI 0.10-0.66) remained less likely to have “high” sun protection behaviors.

Discussion

This study revealed that white female respondents were less likely to have a high sun protection behavior; this is consistent with the literature [16] and remains troubling, as this is a high-risk group for the development of melanoma [3]. In addition, this study corroborates previous research reporting that college students tan for psychosocial reasons, namely appearance [9,32]. In addition, this study revealed that those who were dissatisfied with their appearance were markedly more likely to believe that suntan improves self-esteem.

Interestingly, those who spent more time on the internet were more likely to be dissatisfied with their appearance.

Research indicates that knowledge does not necessarily result in the adoption of healthy behaviors [9]. Reportedly, college students who understand the dangers of tanning and sun exposure, but also feel having a tan is important, often still desire to tan and forego means of sun protection [9,32]. Students in this study reported that they, by and large, felt that information related to health on the internet was accurate. Our ancillary study on HISB delves deeper into how these respondents use the internet to seek health information [31]. A tenet of HISB is that as an individual utilizes technology and understands more about how to use it, the person is more likely to use that specific technology as a source to search and gather health-related information [33,34]. Future studies can focus on interventions to ascertain the rate at which college students follow best practices in skin cancer-related HISBs.

Although social media is linked to risky behaviors, this source can incite opportunities for interventions promoting behavioral changes. Key issues can be communicated through popular social media platforms, such as Instagram, Twitter, and Facebook. To effectively address issues related to using Web-based methods, the target population must also understand the purpose of interventions. On the topic of skin cancer, interventions should inform college students regarding the influence of social media on knowledge and attitudes, and how this may lead to the adoption of risky health behaviors. Much like electronic health literacy, media literacy should be carefully utilized to increase the understanding of skin cancer; however,

it must be strategic, as audience members may respond differently to an array of communication platforms. For instance, research confirms that young women, in particular, are visually oriented social media users, thus using images with prevention messages may be more effective [18,30]. By improving the methods of Web-based skin cancer prevention, college students may be motivated to appropriately and efficiently engage in HISB and, in turn, adopt healthier behaviors in the long term.

This study has several limitations that warrant mention. First, the cross-sectional design creates the inability to generalize these results. Second, the data were based on self-report and, thus, subject to recall bias. Third, the timing of the survey could influence thoughts and ideas related to sun safety. Despite these limitations, this study contributes to the literature on an important topic.

In sum, sharing content on social media is common. Personal stories of this nature can spark public engagement and result in Web-based search related to skin cancer and prevention [29]. By incorporating personal stories and graphic images with skin cancer prevention messages, this may improve message recall. The degree to which this incites a behavioral change warrants further study. Given that knowledge alone may not necessarily influence behaviors, effective interventions focused on skin cancer prevention and sun protection behaviors must be multifaceted. Furthermore, future research may be able to present critical data on seeking information about health topics (skin cancer, particularly) in social media, an underrecognized area of study.

Conflicts of Interest

None declared.

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Abbreviations

HISB: health information-seeking behaviors

OR: odds ratio

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Original Paper

Impact of an Intrainstitutional Teledermatology Service: Mixed-Methods Case Study

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Abstract

Background: Teledermatology provides timely access to consultative dermatology services while reducing the need for travel among patients in rural and underserved areas. However, knowledge about the potential benefits of such a service in urban areas is limited.

Objective: This study aimed to determine the impact of a geographically unrestricted, intrainstitutional, secure, email teledermatology service for dermatology.

Methods: We employed a mixed-methods approach using chart review, surveys, and semistructured interviews from the Canada Health Infoway Benefits Evaluation Framework. Patient charts were reviewed for demographics, clinical characteristics, and outcomes. Electronic and paper surveys were sent to patients and providers to quantify aspects of the service, such as satisfaction and usability, on a Likert scale. Semistructured interviews of referring providers and a convenience sample of academic consultant dermatologists who were considering teledermatology for their practice were conducted. Interviews were transcribed and analyzed using manual coding and thematic analysis by both the primary author and a second independent reviewer. All results were concurrently triangulated in an overarching analysis.

Results: A total of 76 consultations were reviewed over a period of 18 months, of which 84% were completely managed without an in-person visit. Only 6% of rashes required a subsequent in-person visit to a dermatologist for management, compared to 41% of lesions. In addition, 28% (21/76) of patients responded to the survey. Patients “strongly agreed” to use the service again, were satisfied with the management of their skin issue, and thought the service saved them time. In general, providers who answered the electronic survey “strongly agreed” that the service demonstrated quality, timeliness, and an educational benefit, but increased their administrative time. A total of 9 interviews of 5 referring providers and 4 dermatologists were completed. Triangulation of all study components supported the hypothesis that teledermatology benefits providers, patients, and the health care system.

Conclusions: Intrainstitutional teledermatology has high satisfaction among patients and providers and saves patients time, even when there are no geographic or systemic barriers to access. This service may be most effective when targeted at rashes rather than lesions. Additional research on the cost-effectiveness and educational benefits of this service is warranted.

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KEYWORDS

dermatology; e-health; teledermatology

Introduction

Teledermatology allows dermatologists to manage patients with generally equivalent clinical outcomes and requires less resources and less time with the consultant than in-person visits [1]. Its impact is evident in geographic areas that do not have timely access to dermatology, which is the most-studied aspect of teledermatology; for example, in the United States, 80% of dermatologists are clustered in 3 large metropolitan areas [2]. There is a similar disproportionate clustering of dermatologists in metropolitan areas in Canada [3]. These substantial disparities in the geographic distribution of dermatologists have been increasing [4].

Knowledge of the potential of *intrainstitutional* teledermatology, wherein geographic access is not a factor of the net benefit assessment of the value of teledermatology, is limited. Other pilot studies have assessed the feasibility and diagnostic concordance of these implementations [5], but formal assessments of their impact are lacking.

We hypothesize that teledermatology will have value beyond geographic access if implemented by the consultants and referring physicians intrainstitutionally. We designed this study to investigate the potential benefits, barriers, and impact of teledermatology in such an intrainstitutional setting, where the traditional geographic barriers to access do not exist. We further hoped to identify specific characteristics of the teledermatology service that would be useful for implementing the service at other institutions. Studies have reported the usefulness of teledermatology in only a few specific scenarios, and there is disagreement about the clinical conditions that are suitable for

teledermatology in the literature; for example, several studies have reported the potential of teledermatology for identifying any suspicious skin lesions [6,7]; in contrast, the American Telemedicine Association guidelines for teledermatology [8] state that it is difficult to assess pigmented lesions and special sites such as the scalp with teledermatology.

Methods

Overview

We performed a mixed-methods evaluation using broad categories of the Canada Health Infoway (CHI) Benefits Evaluation Framework [9] to include at least one aspect of qualitative and quantitative analyses for each category as well as case studies, surveys, and semistructured interviews. The key results were triangulated in a final, overarching analysis. This study was approved by the research ethics boards of Women's College Hospital and the University of Toronto in Toronto, Ontario, Canada.

Design of the Intrainstitutional Teledermatology Service

Parameters were chosen to balance convenience (encourage use) and pragmatic considerations of the practice guidelines for teledermatology [8]. We selected a store-and-forward design with secondary teledermatology, as it is a funded model in our region, and secure institutional email as a common, accessible technology. Clinically, the referring providers were informed that they could send any request they deemed appropriate and a response would be guaranteed within 1 week. The primary author was the sole consultant providing responses. The details of the implementation are described in Table 1.

Table 1. Components of the intrainstitutional teledermatology service and the rationale for choosing the components.

Component	Rationale
Modality	
Asynchronous	Most-convenient method for the consultant dermatologist and requires the least amount of coordination or additional technology
Secondary teledermatology (referring a health care provider to a consultant dermatologist)	Meets identity and privacy guideline requirements, and secondary teledermatology is a regionally insured service by the provincial government
Technology	
Secure intrainstitutional email	A convenient, ubiquitous technology that is secure; limited to institutional use, with no barrier to entry; and shared across clinics
Photography	Referring providers were requested to provide in-focus images; at least one close-up image; and if widespread, photos representing the overall distribution
Clinical	
One-week response time	A four-fold improvement over existing wait times at our institution, and enough time to discourage urgent consultations through this service, which would be better provided at an emergency care institution
Free-form text permitted (no template)	To permit benefit evaluation, we did not restrict the clinical use of the system or make implicit suggestions about what conditions would be appropriate

Data Collection

Chart Review

Stored medical records for each consultation were reviewed from service initiation in late 2016 through 2017. All patients were previously registered in the hospital electronic medical record system, as they were a part of the referring family-practice unit. Contact information was collected for emailing or mailing surveys. Demographic information including age and gender was collated. Each chart was reviewed for clinical characteristics including diagnosis and management. For each patient, the hospital-wide electronic medical record was additionally reviewed for evidence of treatment failure, symptom recurrence of the treated dermatosis, or any other pertinent follow-up information.

Referring Provider Survey

Emails for each referring attending provider who submitted at least one consultation request were collated, and an email invitation from SurveyMonkey [10] was sent to request their participation in an electronic survey assessing satisfaction, time expenditure, educational value, and adverse events, which ranked these parameters on a Likert scale. If the provider did not complete the survey, invitations were resent 2 weeks and 1 month after the initial invitation. Health care providers rated each question on a scale of 1-7, where 1 was "Strongly disagree," 7 was "Strongly agree," and 4 was "Neutral."

Patient Survey

Patients were invited to participate in a survey assessing satisfaction with the service, potential benefits, and attitudes toward teledermatology. Email invitations were sent to the subset of patients who had provided an email address for hospital registration. An email was resent a month after the initial invitation if a survey was not received by the patient. For all patients, a paper survey with a self-addressed, stamped return envelope was mailed. Patients rated each question on a scale of 1-7, where 1 was "Strongly disagree," 7 was "Strongly agree," and 4 was "Neutral." The responses were averaged and interpreted according to the final score.

Participants were offered the opportunity to submit their email at the end of the study to be entered in a draw to receive a Can \$100 gift card.

Referring Provider and Potential Consultant Semistructured Interviews

In the email invitations mentioned above (see Patient Survey section), referring providers were invited to participate in a semistructured interview exploring the perceived impact, current use, and attitudes and opinions toward teledermatology. Similarly, potential consultant dermatologists identified from a convenience sample of dermatologists in academic practice in the same hospital setting, who could potentially participate in a teledermatology service, were recruited via email for the semistructured interviews. Interview guidelines were prepared using the categories of the CHI Benefits Evaluation Framework to complement other data-collection strategies assessing satisfaction, use, educational benefits, and experience and attitudes toward teledermatology.

The primary author conducted interviews over a 3-month period after study initiation, with no other parties present. The interviews were audio-recorded and subsequently transcribed verbatim from the recordings by a professional transcription service.

Data Analysis

Chart Review

Demographic and clinical information including complaints and diagnoses was collected. The primary author characterized complaints as "lesion," "rash," or "other," depending on whether the consultation was consistent with multiple or progressive skin findings over a generalized area (rash) or a single, stable skin finding in a localized area (lesion). We recorded the immediate follow-up plan including recommendation for subsequent in-person consultation, optional in-person consultation if the issue was not resolved by the prescribed method, and the proposed timing.

Referring Provider and Patient Surveys

Results from the Likert scales were collated, and the scores averaged with standard deviation. Free-form text answers were collated and reviewed using word cloud analysis and manual inspection for incorporation of the patterns or pertinent feedback into the final triangulation.

Referring Provider and Potential Consultant Interviews

For each set of interviews, the primary author and a secondary independent reviewer conducted independent qualitative analyses according to the interpretive description [11]. The transcripts were sequentially reviewed and evaluated with reference to categories from the CHI Benefits Evaluation Framework. Thematic analysis was used to identify unique emerging concepts potentially beyond the scope of the interview guide. The independent reviewers submitted their qualitative analyses to the primary author for review. Identified themes from both sets of analyses were included in the final mixed-methods analysis. No discordant themes required dispute management by a third party.

Mixed-Methods Concurrent Triangulation

For the final overarching analysis, we used the CHI Benefits Evaluation Framework to organize a mixed-methods concurrent triangulation strategy that used both qualitative and quantitative assessment methods. We added the evaluative components of potential educational benefits to this strategy. Emergent themes derived from any component were triangulated with other data analyses to support the conclusions.

Results

Chart Review

A total of 76 participants used the service between November 2016 and December 2017, including 17 (22%) pediatric patients, 3 pregnant patients, 28 men (37%), and 48 women (63%). Consultation data for all patients were subjected to chart review. The average age of patients using the service was 39.3 years, and the average response time was 23.5 h, with a minimum response time of 0.5 h and a maximum time of 142.6 h (6 days).

Clinical characteristics were grouped into diagnostic dermatology categories, similar to previous teledermatology evaluations [12], and are presented in Table 2. Each case was broadly categorized into an easily recognizable presenting complaint: a “rash,” which presents in multiple areas of the skin with the same general appearance, most typically represented by eczematous dermatoses, infections, or reactive skin conditions; a “lesion,” which is a focal, persistent eruption on the skin, typified by benign and malignant growths; or a “question” about a treatment (Table 3). Of all cases, 12 (16%) required a subsequent in-person visit.

We assumed that clinicians would use photographs from a patient visit to their office; however, in 14% of all consultations, parent- or patient-initiated photographs were used. In 6 (35%) of the pediatric cases, photographs for analysis were provided by the parents, and 5 adult patients provided their own photographs to the clinician. None of these patients required additional photographs or in-person follow-up, and cases wherein the data were available, the conditions were appropriately resolved. In one case, the parent-initiated photograph showed evidence of a rare condition that occurs only under specific conditions.

Our results showed that it was possible to manage 94% of “rashes” by teledermatology alone, but only 59% of “lesions” could be managed by this method. Additionally, in 21 cases (27%), the primary management aimed to increase the prescribed potency of or choose a more-effective vehicle for the topical steroid used. Finally, in at least one case, a response time of 24 h permitted initiation of therapy to prevent postherpetic neuralgia complications of herpes zoster; however, the

recommended 72-h time window for treatment [13] would have been exceeded if the maximum response time of the service (1 week) was applied in this case.

Referring Provider Survey

Of the 14 invitations sent, we received 11 responses for the online survey (79% response rate). Responses were averaged and interpreted according to the final score. The results of the survey and the Likert interpretation of the average score are presented in Table 4. Feedback was generally very positive for satisfaction and educational value. The clinicians reported that the service did not save any time, but increased the administrative time. However, they indicated that the benefits of the service outweighed the lost time and the service had educational value. No adverse events were reported.

Patient Survey

A total of 76 patients were sent paper surveys and 26 patients, who had provided an email address for provider registration at the institution, were sent a duplicate email invitation.

We received 22 responses (29%). Patients were generally satisfied with the service and reported that it saved time and money and prevented them from missing work. However, their views were divided when they were asked if they “prefer to use this system instead of going to see a specialist in-person.” Their responses were instructive: Some patients indicated that they generally prefer in-person consultations, as they provide a greater opportunity to ask questions and clarify the rationale for therapeutic choices. These results are summarized in Table 5.

Table 2. Clinical characteristics of the consultations grouped by diagnostic categories in dermatology.

Diagnosis	Cases (N=76), n (%) ^a	Patients transitioned to in-person consultation (N=76), n (%) ^b
Eczematous or inflammatory (eczema or contact dermatitis)	30 (39)	1 (1)
Infection requiring Intervention (fungal, viral, or bacterial)	10 (13)	0 (0)
Urticarial or self-limited (morbilliform eruptions or pediatric urticaria)	7 (9)	1 (1)
Lesion (malignant, premalignant, indeterminate, or benign)	21 (28)	9 (43)
Other (genetic, acneiform, etc)	8 (11)	1 (1)
Total	76 (100)	12 (16)

^aTotal number of cases seen within the category.

^bCases where the primary and only recommendation was that the patient visit a dermatologist in-person.

Table 3. Clinical characteristics of the consultations grouped by the presenting complaint.

Presenting complaint	Cases (N=76), n (%)	Patients transitioned to in-person consultation (N=76), n (%)
Rash	53 (70)	3 (6)
Lesion	22 (29)	9 (41)
Question	1 (1)	0 (0)
Total	76 (100)	12 (16)

Table 4. Health care providers' responses to the survey (N=11).

Question	Mean (SD)	Interpretation
The responses from the dermatologist were complete.	6.6 (0.6)	Strongly agree
The responses from the dermatologist were timely.	6.8 (0.4)	Strongly agree
The service was reliable.	6.5 (0.8)	Strongly agree
I was satisfied with the answers to the clinical questions.	6.5 (0.7)	Strongly agree
I was satisfied with the educational value of the system.	6.4 (0.9)	Strongly agree
The service was easy to use.	6.6 (0.5)	Strongly agree
The educational value of the e-consults was generally superior to that of in-person consult letters.	5.5 (1.2)	Agree
This service saves me time.	4.9 (1.2)	Neither
This service provides advantages to me that outweigh any lost time.	5.8 (1.0)	Agree
This service saves patients time.	6.8 (0.4)	Strongly agree
This service saves the health care system resources. ^a	6.5 (0.7)	Strongly agree

^an=10.**Table 5.** Patients' responses to the surveys.

Question	n (%)	Mean (SD)	Interpretation
I would want to use this service again.	22 (100)	6.7 (0.6)	Strongly agree
I would recommend this service to a friend or family member.	21 (95)	6.6 (0.7)	Strongly agree
I was satisfied with how my skin issue was managed.	21 (95)	6.4 (1.0)	Strongly agree
I am comfortable with the idea of a physician I have never met evaluating my skin condition based on pictures.	22 (100)	6.2 (0.7)	Strongly agree
I would prefer to use this system instead of going to see a specialist in-person.	20 (91)	4.9 (1.8)	Neutral
I would recommend this type of medical care to a friend or family member.	22 (100)	5.8 (1.1)	Agree
I think that the government should pay for me to talk to the dermatologist online directly.	21 (95)	5.4 (1.8)	Agree
I would personally pay to talk to the dermatologist online directly if it was not paid for by the government.	20 (91)	3.7 (2.0)	Disagree
I would have liked to see what was said between my family doctor and the dermatologist.	22 (100)	5.2 (1.8)	Agree
Overall, this service saved me time.	22 (100)	6.6 (0.6)	Strongly agree
Overall, this service saved me money.	15 (68)	5.7 (1.8)	Agree
Because of this service, I missed less work for my health appointments.	16 (73)	5.9 (1.3)	Agree

Referring Provider and Potential Consultant Interviews

A total of 8 interviews of 4 referring providers who had experience with the system and 4 consultant dermatologists who had experience with other implementations of tele dermatology or were open to participating in the service were analyzed.

Efficiency of care emerged as a theme. For referring providers...

...the option to send a photo with a quick email and get a response really quickly is actually a huge asset...[The patients are] really happy not to go and see another physician for the same matter because some things are easily treatable or diagnosed through that service. [Interview F2]

Although dermatologists were open to email communication, they expressed concern that additional administrative overhead may prevent uptake; for example, one dermatologist felt that,

[In some systems,] the platform is not efficient, it doesn't keep track of cases seen, billing codes, billing numbers, the kind of information that we need in the logistics of how we provide care...a proper kind of charting system or billing system. [Interview D3]

Interviews supported the data from patient surveys that both providers and patients were satisfied with the service. One provider stated,

The patients are absolutely thrilled because...You can get back to them so quickly with such an informed opinion. [Interview F4]

Table 6. Summary and interpretation of the unified mixed-methods evaluation using the Canada Health Infoway Benefits Evaluation Framework [9].

Component	Chart review	Quantitative (surveys)	Qualitative (interviews)	Interpretation
System quality: functionality, performance, and security	The technology demonstrated robustness with no lost messages	Providers “strongly agreed” that the service was reliable and easy to use	Referring providers and dermatologists found the institutional email to be an appropriate medium, despite the increased administrative burden	Institutional email facilitated a functional service with adequate performance and security
Information quality: content and availability	All consultations were generally completed with one question and one response	Providers “strongly agreed” that the responses were complete, provided satisfactory answers to the clinical questions, and had educational value	Interviewees spoke positively about the structure of the consultations; one interviewee commented, “What I like to have the best is a plan that has multiple steps if the first doesn’t work” (Interview F1)	A consultation format that incorporates morphology, diagnosis, reasoning used, and a treatment ladder was satisfactory and educational to providers
Service quality: responsiveness	The average response time was consistent with that of other systems in the literature [14], and in at least one case, potentially prevented morbidity	Providers “strongly agreed” that the responses were timely. Patients also commented positively on the rapid response	“It works because your notes are good and your turnaround time is fast” (Interview F5)	A 24-h average response rate was appropriate for most outpatient clinical situations
Use: behavior, self-reported use, and intention to use	Unexpectedly, parent- and patient-initiated photos were used. Recent research suggests they can be used accurately for diagnosis while saving additional visits [15]	Although the service did not generally save providers time, they “agreed” that the benefits outweighed the increased administrative burden	In interviews, dermatologists expressed that they would be more likely to offer the service if it represented an integrated workflow with medical records and billing	Although the evident benefits to patients and the educational value ameliorates the burden to providers, a more integrated workflow may have increased utilization by referees and potential consultants
User satisfaction: competency, satisfaction, and ease of use	A total of 92.8% (13 of 14) providers used the service more than once	Providers and patients “strongly agreed” that they were satisfied with the outcomes of the system	“Most patients that I follow up with afterwards are really happy that they didn’t have to go to any more measures (to be treated)” (Interview F2)	The service demonstrated satisfaction for providers and patients
Quality: safety and outcomes	In cases of independent follow-up, the results supported the diagnosis and management plan of the teledermatology consultant	No adverse events were reported in the survey. Patients “strongly agreed” that they would use this service again or recommend its use. Patient comments supported the idea that the correct management plan was identified	No adverse events or areas for improvement were reported in interviews	Intrahospital teledermatology (concordant with existing literature) was safe and effective
Access: ability to access services, and patient and caregiver participation	The service was used for a broad demographic of patients and complaints, suggesting no barriers to access	Patients “strongly agreed” that they were comfortable if a physician they had never met evaluated their skin. However, they also “agreed” they would like to know what was communicated between the consultant and referring physician; this idea was supported by patient comments	Interviewees cited several patient factors (anxiety, sensitive locations, etc) that could theoretically prevent use, but no barriers noted in interviews actually prevented use	Although easy to access, further integration of the patient into the physician-physician communication channel may have been beneficial
Productivity: efficiency, care coordination, and net cost	For the Ontario billing codes, managing 84% of the consultations by teledermatology results in 30% savings overall for visits to consultant dermatologists ^a	Providers “strongly agreed” that the service saved health care system resources. Patients “agreed” that the service saved them time and money and resulted in less work missed	Both potential dermatologists and referring providers characterized institutional email as an efficient tool for consultations. This efficiency increased when email communication was used between the provider and the patients	Intrahospital teledermatology increased productivity and efficiency even when geography was not a barrier to care

^aA dermatology consultation is billed at Can \$72.15; a teleconsultation, at Can \$44.45; and a subsequent visit required after teledermatology, at Can \$38.70. The calculation on savings from billing of services was performed as follows: $1 - (0.16 * [44.45 + 38.70] + 0.84 * 44.45) / 72.15 = 0.298$ [16].

In addition, providers expressed satisfaction for the educational value of the system with regard to the speed of access; for example, one provider commented,

When you get a referral back a month later or a few weeks later, sometimes you can’t relate the two things and remember exactly, but when you get it back in

real time or very promptly, it's a better learning experience for me and I can do a better job. [Interview F4]

Finally, referring providers noted that the service was very useful in situations when they identified the diagnosis but wanted to be up to date on management. One provider stated,

Next time that I see a similar presentation I know how to treat it and then if it doesn't work then I know where I should go. [Interview F2]

Dermatologists agreed that they were more comfortable answering management questions than diagnostic questions in telemedicine or remote situations; one dermatologist said,

I like questions about disease entities and management, as long as the diagnosis has already been established. [Interview D4]

Mixed-Methods Analysis

Triangulation Using the CHI Benefits Evaluation Framework

In the concurrent triangulation evaluation, we correlated the categories of the CHI Benefits Evaluation Framework with our multiple lines of inquiry (Table 6). The hypothesis of net benefit was supported by both qualitative and quantitative evidence.

Discussion

Principal Findings

The concurrent triangulation analysis was consistent with our hypothesis: The intrainstitutional teledermatology service was effective and satisfying to providers and patients even when geographic access was not a barrier. Store-and-forward teledermatology demonstrated diagnostic concordance [17]. In addition, a previous systematic review supported the idea that teledermatology is associated with high satisfaction [18]. Prior work has suggested that cost-effectiveness is not a universal feature of teledermatology [19] and would be highly dependent on regional factors. In our study, the service demonstrated 30% savings in visitation fees [16], and according to the patients, the service saved time and money and prevented them from missing work, which are important components of social cost.

To our knowledge, this is one of the first few studies to investigate the educational potential of teledermatology for referring providers embedded in a consultation service. Other studies have reported the value of incorporating trainees into the teleconsultation process [20] or initiatives such as project ECHO [21] that explore virtual education separate from the service. In our initiative, we found that an appropriately structured consultation note that explains clinical reasoning and offers a treatment ladder was educational and helpful to the referring provider. Furthermore, both dermatologists and referring providers suggested that the greatest educational value of this service was management, not diagnosis. This is supported by the chart review, which showed that 27% of all recommendations involved only alteration of the existing topical treatment. A dermatologist noted, "We all know that the challenge with skin diseases; people don't think about it from

a morphology point of view. They think about it as; that person I saw with psoriasis three years ago, this looks like that, right? And so that educated piece, in terms of diagnostics, I think would be lost." (Interview D4). Incorporating formal management and educational initiatives into teleconsultation is an area of potential expansion and study in the future.

In our chart review, 41% of lesions required a subsequent in-person visit compared to only 6% of rashes. Therefore, in the future, such a service would be most productive and efficient if it targeted the management of "rashes" alone. This finding is in line with the view of dermatologists who expressed concern about their comfort with regard to managing lesions by traditional teledermatology and the abovementioned educational findings: There are fewer management options for lesions and therefore potentially less educational value in the discussion of those consultations.

Future services should consider a 24-h consultation response time to manage the most-serious outpatient clinical scenarios. Other pilot services in the literature meet or surpass this response time [22,23]. Important clinical conditions that are time sensitive, meaning that they need ≤ 24 h for diagnosis and rapid management in dermatology, are infections requiring intervention and serious drug rashes [24] because of the risk of significant morbidity and mortality. In our study, there was only one case of a treatable infection where identification within the period prevented morbidity; however, this may be because referring providers would less likely consider using teledermatology for high-acuity dermatoses if the "maximum" response time allotted was 1 week. However, setting the response time too low may decrease the number of potential dermatologists willing to participate in the service, unless adequately remunerated or alternatively structured (eg, shared "on-call" responsibilities or triage responsibilities delegated to trainees or other health care professionals).

Limitations

One limitation of this study is that this was a small case study at a single institution in a region that is supportive of virtual care. Therefore, the results may not be generalizable. As the primary author is currently the only consulting teledermatologist in our institution, there may be a better way to provide improved care and faster response times than a "usual case" scenario, which could lead to potential bias towards positivity. In addition, follow-ups or "second opinion" consultations may not have been accounted for if they were referred to other care clinics in the city outside the circle of care of the institution.

Conclusion

This is the first reported study on intrainstitutional teledermatology using a mixed-methods approach to explore the benefits of teledermatology, namely, rapid access, high satisfaction, safe and effective clinical outcomes, and increased efficiency and productivity in the health care system. The integration of teledermatology into a routine clinical workflow has remarkable potential value, irrespective of existing access to consultative dermatology. Specifically, by reducing healthcare visits, patients can save time and money and avoid missing work. Additionally, this study provides evidence that

management of rashes is ideal via teledermatology, which may lead to better outcomes because of the rapid response and high proportion of cases that can be managed through teledermatology alone. This finding is concordant with the expressed opinions of dermatologists in our study who did not want to assess lesions with traditional teledermatology. The impact and satisfaction of an intrainstitutional teledermatology

service that primarily targets rashes and, according to our study, ideally provides responses within 24 h to maximize safety, is worth evaluating in future studies. Further research is necessary to elucidate the educational value of intrainstitutional teledermatology for referring providers and its potential for saving costs.

Conflicts of Interest

None declared.

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Abbreviations

CHI: Canada Health Infoway

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Original Paper

Skin and Wound Map From 23,453 Nursing Home Resident Records: Relative Prevalence Study

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Abstract

Background: The overall distribution of all skin and wound problems experienced by residents in skilled nursing facilities, with respect to the location on the body, is poorly understood. Previous studies focused largely on one disease type, rather than all possible skin lesions. Hence, the relative distribution of skin and wound problems as mapped on the body has not previously been reported. In addition, existing data come mainly from clinical studies and voluntarily reported statistics; unbiased real-world evidence is lacking.

Objective: The aim of this study was to understand the type and location of skin and wound lesions found in skilled nursing facilities and to map these on the body.

Methods: Data from 23,453 wounds were used to generate heat maps to identify the most common areas of skin and wound lesions, as well as the most common wound types at different body locations.

Results: The most common wound types were abrasion (8792/23,453, 37.49%), pressure ulcers (4089/23,453, 17.43%), surgical wounds (3107/23,453, 13.25%), skin tears (2206/23,453, 9.41%), and moisture-associated skin damage (959/23,453, 4.09%). The most common skin and wound locations were the coccyx (962/23,453, 4.10%), right (853/23,453, 3.64%) and left (841/23,453, 3.59%) forearms, and sacrum (818/23,453, 3.49%).

Conclusions: Here, we present the body location hot spots of skin and wound lesions experienced by residents of skilled nursing facilities. In addition, the relative prevalence of these conditions is presented. We believe that identifying areas on the body prone to preventable wounds can help direct actions by care workers and improve the quality of care for skilled nursing residents. This study represents an example of how analysis of specialized electronic medical records can be used to generate insights to educate and inform facility managers where to focus their efforts to prevent these injuries from occurring, not only from retrospective database analysis but also in near real time.

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KEYWORDS

mobile health; wounds and injuries; skin; skilled nursing facilities; smartphone

Introduction

Background

Our ability to generate, acquire, and analyze data has increased exponentially over the past decade, leading to profound insights into clinically important problems. The digital health care revolution enabled by *big data* has expanded the realm of possibilities in health care and is transforming how it is executed, including the management of workflows, clinical guidelines, and care pathways, in ways that will undoubtedly yield valuable improvements in the delivery of care. An abundance of data already exists in electronic medical records, but the meaningful use of these data has yet to be fully explored in detail because little analysis has been conducted on such datasets. Specialized apps built on data analytics and centered on specific health care areas present a powerful and focused means to gain clinically valuable insights that can help improve the quality of care.

The overall care for residents in skilled nursing facilities (also known as nursing homes or long-term care facilities) is mandated using the Long Term Care Minimum Data Set, which is a standardized screening tool designed to measure resident health status at facilities covered by the Centers for Medicare and Medicaid Services [1]. Features measured by this tool include routine skin assessments, which cover wounds such as pressure ulcers (PUs); these guidelines are described by the National Pressure Ulcer Advisory Panel [2]. PUs are an unfortunate occurrence and represent a key quality metric for skilled nursing facilities.

Numerous studies spanning many years indicate that PUs are a significant problem for skilled nursing residents [3-7]. The multiyear nature of these studies means they do not provide dynamic measures of prevalence but an average over long time frames. It can therefore be difficult to identify mitigating or exacerbating factors that could be easily acted on, particularly those pertinent to care and management strategy and workflow.

The reported prevalence rates of PUs are fairly consistent; for example, the 1999 National Pressure Ulcer Prevalence Survey, which included data from almost 43,000 patients from 356 acute care facilities across the United States, found an overall prevalence rate of 14.8% [8]. A 2009 study in a hospital setting spanning 2 years (2008-2009) and covering data from over 90,000 patients, reported an overall prevalence rate of 13.5% and 12.3% for the years analyzed [4]. Rates were found to be highest in patients experiencing long-term acute care, with prevalence almost double at 22%.

More recently, a 10-year study involving almost 920,000 patients in acute and long-term care facilities revealed a decline in the overall prevalence of PUs from 13.5% to 9.3% [6]. Separate studies have examined the most frequent locations of PUs, which include the sacrum, heels [3,9,10], and buttocks [3,5]. A major caveat is these results have been obtained in a clinical setting where data collection is based on voluntary participation, which by itself introduces a bias as facilities that do not participate are excluded from these analyses.

Insights into the frequency of occurrence and of the common body locations of PUs, other types of wounds, as well as skin lesions would enable better care management and help guide care providers. Access to more holistic information in wound care management can also improve outcomes; a study on the prevalence of skin tears and pressure injuries at 2 aged care facilities highlighted the importance of care practices that are often ignored and the positive impact they can have in mitigating these injuries [11]. However, in virtually all health care settings including skilled nursing facilities, there remains a lack of understanding of all types of skin and wound occurrence frequency and wound-prone body locations.

Swift Medical has produced Swift Skin and Wound, a point-of-care wound care management software that includes a smartphone app, Web-based dashboards that provide real-time views of critical wound data, and the HealX, a Food and Drug Administration and Health Canada registered marker that calibrates wound images for size, color, and lighting. Swift Skin and Wound was developed to provide objective, standardized wound assessments using digital wound imaging and instant, automatic measurements, providing an accurate record of wounds. It also allows the tracking of wound healing over time, enabling consistent and standardized wound care management [12].

Swift Skin and Wound has been adopted by over 1000 skilled nursing facilities. This has resulted in the accumulation of an extensive and unique dataset that can be analyzed to provide novel insights that can guide care practices at different levels, from facility to organizational. Swift Skin and Wound data are particularly unique and valuable for researchers and clinicians because they are gathered at the point-of-care and provide near real-time information on all individuals monitored by the Swift app as part of a facility's routine workflow. By comparison, other datasets are derived by information submitted for surveys, making them subject to acquisition bias. Previous studies on the prevalence of wounds have generally documented the presence and location of single wound types.

Objectives

The objective of this study was to understand the location of all types of skin and wound lesions of patients in skilled nursing facilities by analyzing data from skin and wound assessments using Swift Skin and Wound and to represent the most common locations of occurrence on a body heat map. This relative prevalence study considers the common locations for various wound types among a population of individuals already affected by some kind of lesion. It includes all wound assessments in a dataset of 23,453 different wounds from 7500 patients across 200 facilities, eliminating bias and enhancing the generality of our findings. To the best of our knowledge, the location of a variety of skin and wound conditions has not previously been represented simultaneously and compared using body heat maps.

Methods

The source data for this study are limited to facilities in the United States and comply with Health Insurance Portability and Accountability Act policies [13]. Any piece of information that

might identify residents was removed using the Safe Harbor Process [14]. We also aggregated, standardized, and normalized the data presented in this study to further protect patient health record confidentiality. In total, information from 23,453 skin and wound assessments from 7500 patients across 200 facilities was pooled for analysis. Structured Query Language (SQL) queries were used to group assessments by body location and then by wound type. Data were then summarized into count tables to report the number of each wound type at each body location. Values in the count table were scaled between 0 and 1 and then used to generate heat maps at each body location. Additional SQL aggregations were performed to isolate wound locations of a specific wound type to produce body heat maps for specific wounds.

Results

For the analyses performed, wounds were classified into 17 different categories, and 94 body locations were defined (see [Textbox 1](#) and [Multimedia Appendix 1](#)). [Figure 1](#) shows the locations on the body of all types of wounds, with the frequency at each body location indicated by a normalized heat map, giving the relative prevalence of these conditions. From our dataset of 23,453 skin wounds, the 5 most frequent types of wounds observed were abrasions (8792/23,453, 37.49%), PUs (4089/23,453, 17.43%), surgical (3107/23,453, 13.25%), skin tears (2206/23,453, 9.41%), and moisture-associated skin damage (MASD; 959/23,453, 4.09%). The relative prevalence of these wounds was mapped on the front and back of a diagram of a body ([Figure 1](#)).

Next, we determined the most prevalent locations of the 5 most frequent wound types identified from our dataset. We also analyzed diabetic ulcers, a major type of chronic wound increasing in prevalence. Abrasions were most commonly found on the arms and associated regions (inner and outer forearms, antecubitals, elbows, and back of the hands), with a total prevalence of 37.49% ([Figure 2](#)). With regard to the forearms, we note that there was a 1.5 times greater occurrence of

abrasions on the outer (extensor aspect) compared with the inner regions.

PUs were most frequently located on the coccyx and sacrum (1267/4089, 30.99%), heels (836/4089, 20.45%), buttocks (750/4089, 18.34%), and ischial tuberosities (174/4089, 4.26%; [Figure 3](#)).

A majority of skin tears were located on the arms: more than half of all skin tears (1138/2206, 51.59%) were located on the forearms, elbows, and dorsa combined ([Figure 4](#)). However, unlike PUs, skin tears were also frequently located on the legs (433/2206, 19.62% on shins and calves).

Surgical wounds were more likely to be located around the hips (499/3107, 16.06%), knees (465/3107, 14.97%), thighs (307/3107, 9.88%), abdomen (396/3107, 12.75%), and spine (98/3107, 3.15%; [Figure 5](#)).

MASD can be a precursor to PUs and similar to this wound type, the most common locations were the coccyx (183/959, 19.1%), sacrum (123/959, 12.8%), buttocks (233/959, 24.3% for left and right), and groin (107/959, 11.2%; [Figure 6](#)). There are four categories of MASD, including incontinence-associated dermatitis. Given that incontinence is common among skilled facility residents, these findings are unsurprising. However, unlike other common PU sites, heels are not a prominent site of MASD.

Finally, diabetic wounds were predominantly localized on the feet and heels: more than three-quarters of all these wounds were located in the toes, heels, and feet (306/353, 86.7%; [Figure 7](#)).

The coccyx, sacrum, and forearms, particularly the inner and outer regions, were frequent sites of a number of wounds, which prompted us to take a closer look at the most frequent types of wounds that occur at these regions ([Figure 8](#)). Both coccyx and sacrum had wound frequencies in close agreement, with the most frequent being PUs (675/962, 70.2% and 592/818, 72.4%, respectively), MASD (183/962, 19.0% and 123/818, 15.0%, respectively), and abrasions and rashes (56/962, 5.8% and 62/818, 7.6% combined, respectively).

Textbox 1. List of wound types reported in this study.

- Abrasion
- Arterial
- Blister
- Burn
- Cancer lesion
- Diabetic
- Hidradenitis suppurativa
- Laceration
- Lesion
- Moisture-associated skin damage
- Mole
- Pressure ulcer
- Rash
- Skin tear
- Surgical
- Unclassified
- Venous

Figure 1. Unbiased analysis of 17 wound types in 94 anatomical locations from a dataset of 23,453 wounds, giving a view of relative prevalence of these conditions. (A) Bar chart indicating the 8 most prevalent wound types and their frequency. (B) Front and back body heat maps of all wounds.

All wounds

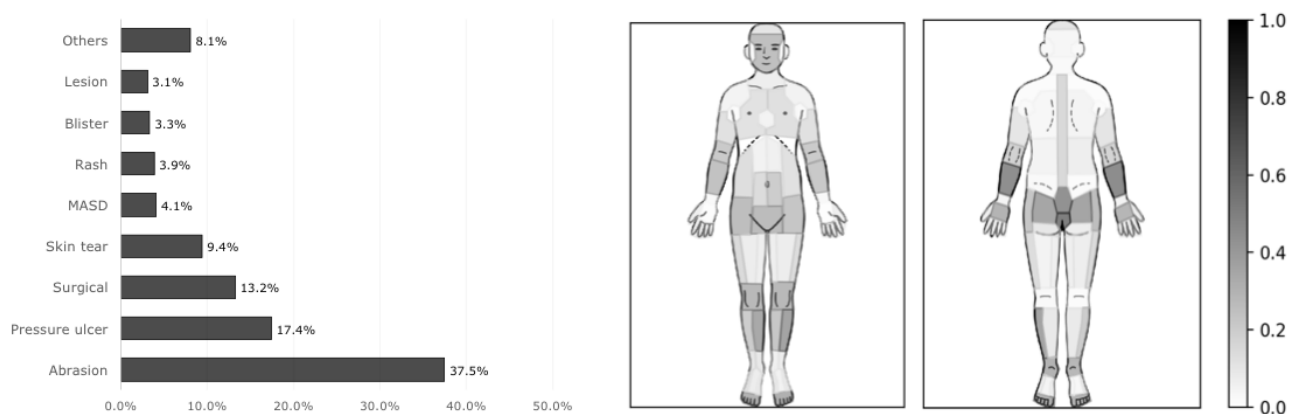


Figure 2. Anatomical distribution of abrasions. (A) Bar chart indicating most prevalent locations of abrasions. (B) Front and back body heat maps of abrasions.

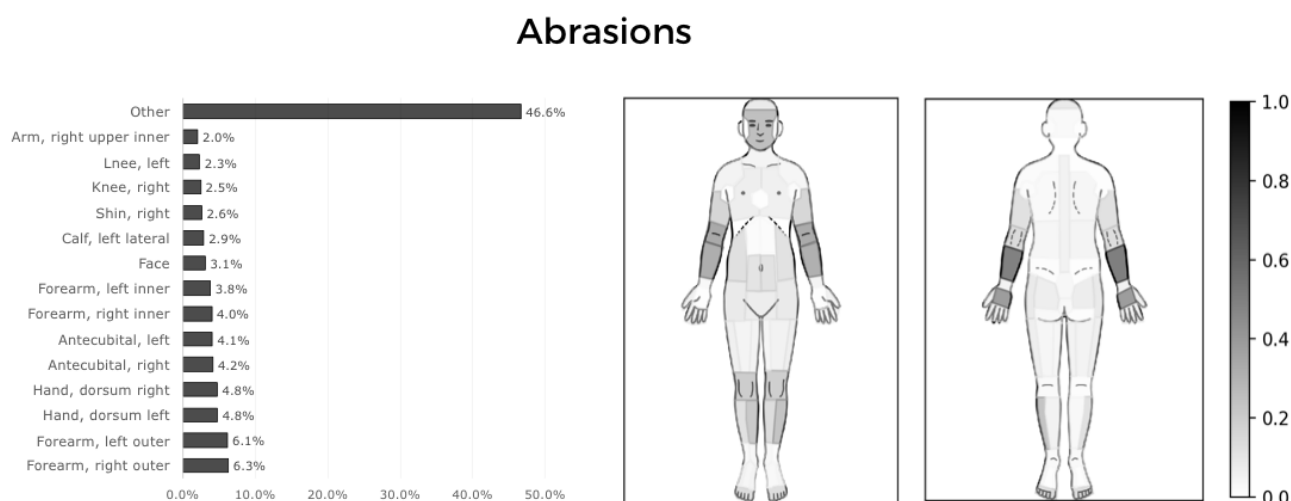


Figure 3. Anatomical distribution of pressure ulcers. (A) Bar chart indicating most prevalent locations of pressure ulcers. (B) Front and back body heat maps of pressure ulcers.

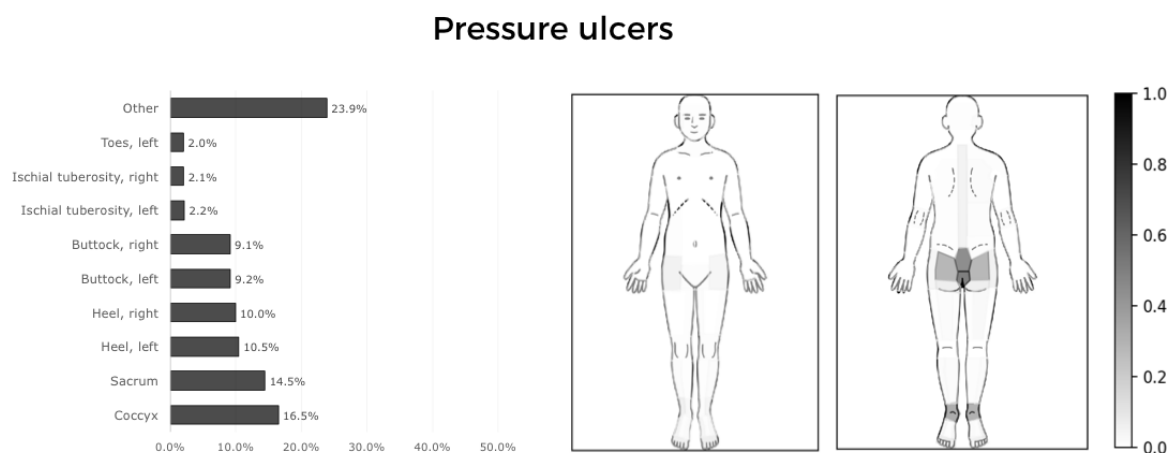


Figure 4. Anatomical distribution of skin tears. (A) Bar chart indicating most prevalent locations of skin tears. (B) Front and back body heat maps of skin tears.

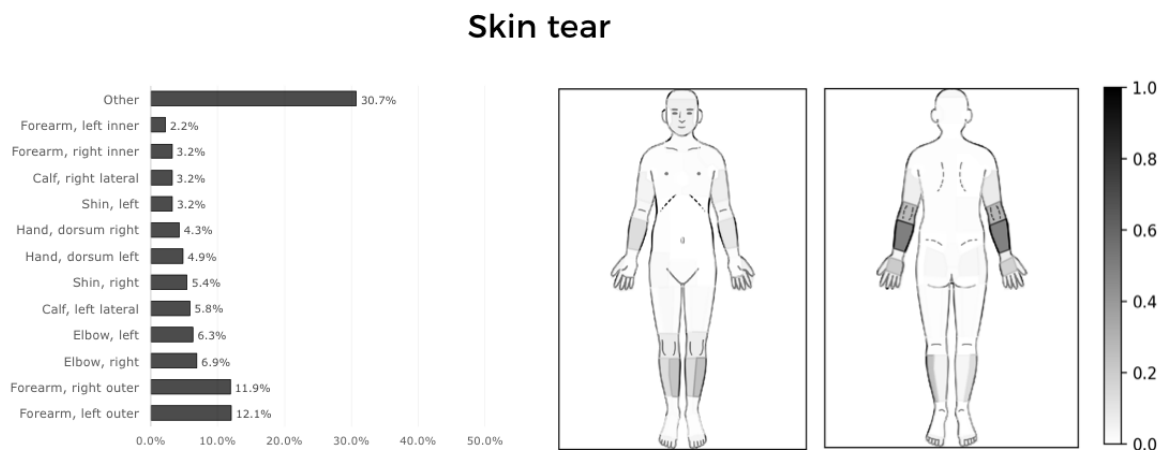


Figure 5. Anatomical distribution of surgical wounds. (A) Bar chart indicating most prevalent locations of surgical wounds. (B) Front and back body heat maps of surgical wounds.

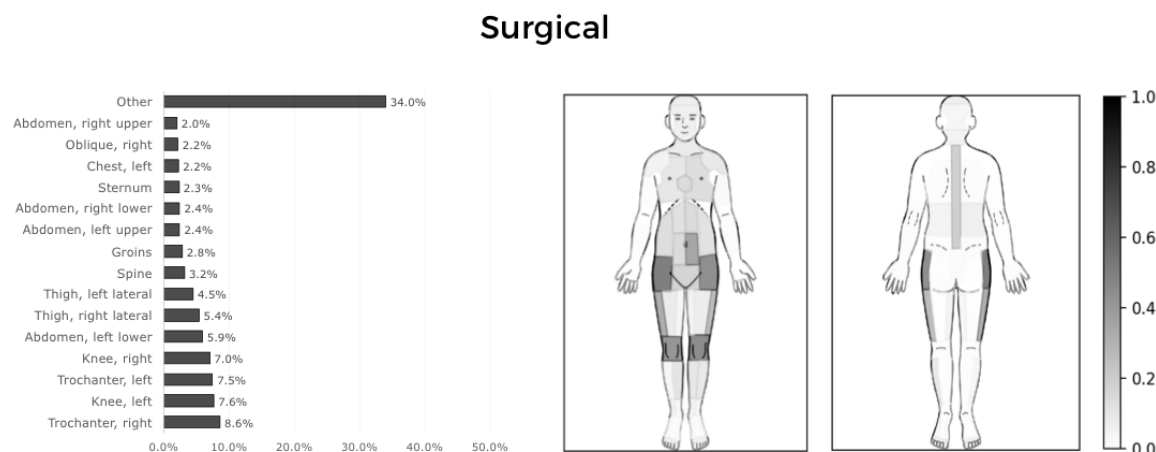


Figure 6. Anatomical distribution of moisture-associated skin damage. (A) Bar chart indicating most prevalent locations of moisture-associated skin damage. (B) Front and back body heat maps of moisture-associated skin damage.

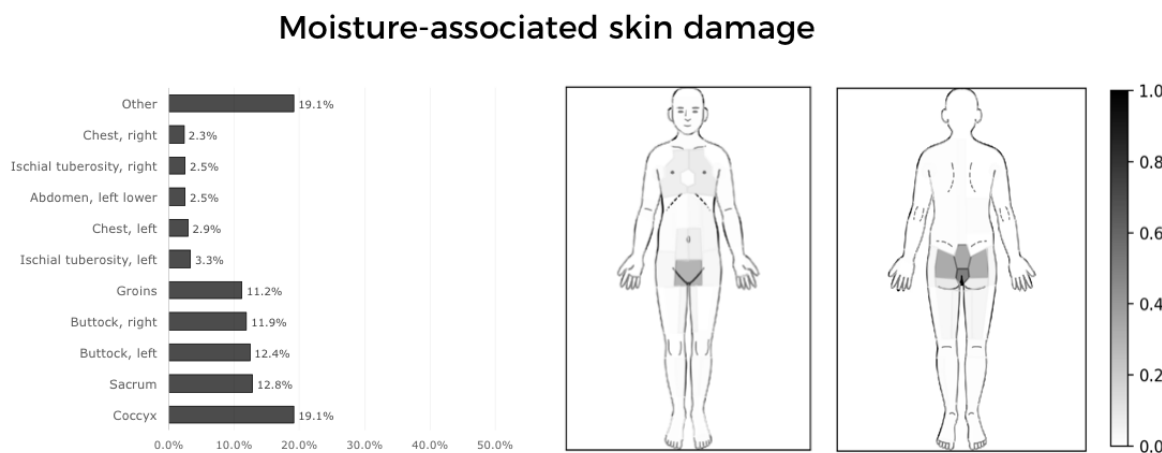


Figure 7. Anatomical distribution of diabetic ulcers. (A) Bar chart indicating most prevalent locations of diabetic ulcers. (B) Front and back body heat maps of diabetic ulcers.

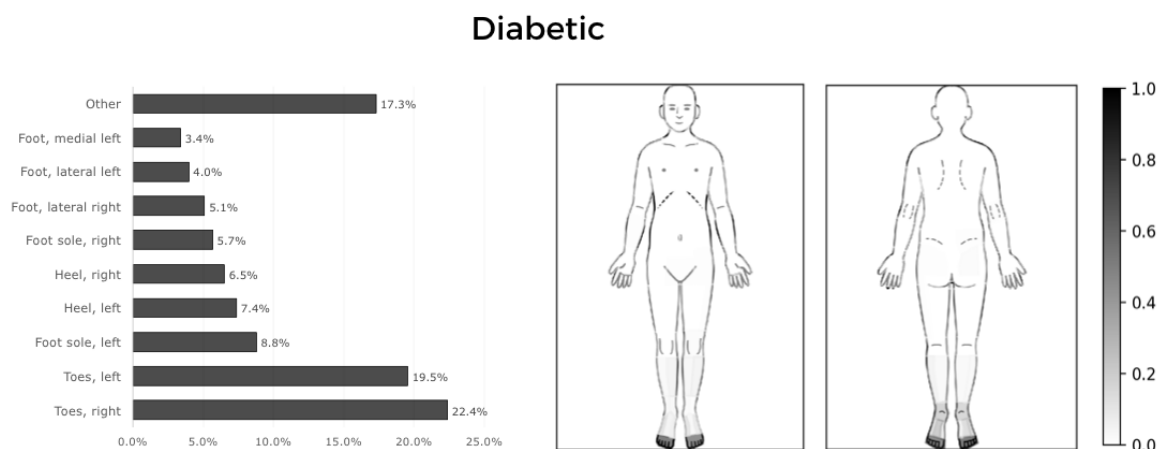
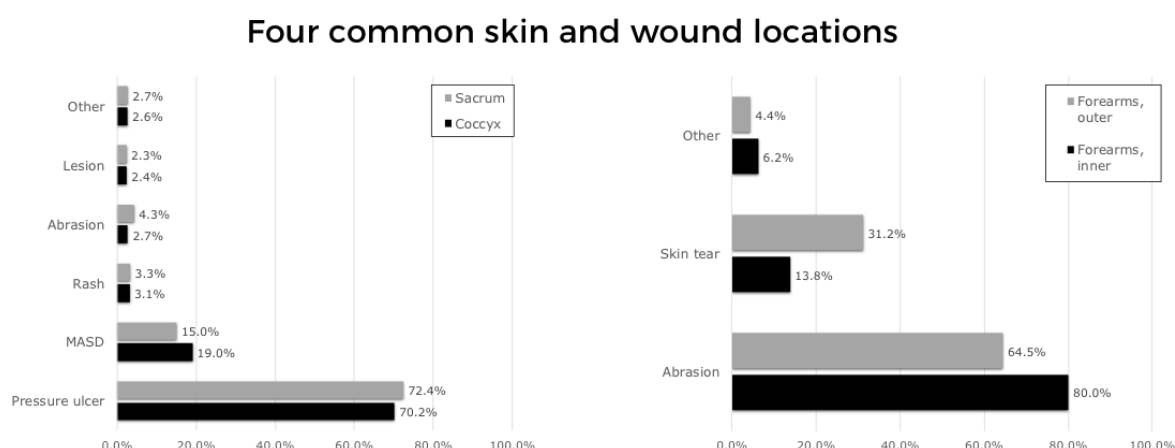


Figure 8. Distribution of wound types located at four anatomical locations. Bar charts showing proportion of different wound types located at the regions indicated.



As noted previously, although abrasions were the most common wound type on forearms, their distribution was not the same; although abrasions accounted for 80.0% (685/856) of all wounds on the inner forearm, they only accounted for 64.46% (1092/1694) on the outer forearm. Instead, outer forearms had more than double the frequency of skin tears compared with inner forearms (31.2% vs 13.8%).

Discussion

Principal Findings

The objective of this study was to understand the location of skin and wound lesions in patients in skilled nursing facilities by analyzing data generated by Swift Skin and Wound. At the same time, we sought to demonstrate the relative ease and power of using big data in the analysis of wound information acquired using point-of-care wound visioning technology.

Abrasions, PUs, skin tears, and wounds resulting from surgery are a serious concern in skilled nursing facilities. Some of these wounds may already exist at the time of a resident's admission, whereas others are acquired during the care period. The common locations of wounds on the body are not well understood and have not been visualized previously using heat maps. Past studies have examined the presence and location of a single wound type to assess a patient's risk of developing such a wound. Indeed, very few studies on wound prevalence have examined more than one wound type simultaneously. We are unaware of any previous study that has been able to assess as many different wound types in an unbiased manner using real-world data at this scale.

Limitations

Although the size of the dataset that we used to conduct this analysis was sufficient, a larger study could be performed. The advantages of such a study could be to analyze some of the rarer skin and wound conditions that occur in a more statistically robust fashion. In addition, the dataset that we used is primarily in the setting of skilled nursing facilities only; meaning that its generalizability of the results in different health care settings such as acute care settings is limited.

Comparison With Prior Work

Our findings on PUs, which accounted for 17.43% (4089/23,453) of all wounds in our dataset, underlined the validity of our study. The most common locations observed were the coccyx or sacrum (1267/4089, 30.99%), heels (836/4089, 20.45%), and buttocks (750/4089, 18.34%). This aligns with 2 previously published studies: A 17-year study of almost 448,000 patients in long-term postacute care facilities found that the most common sites of PUs were located in the sacrum (28%), heels (23.6%), and buttocks (17.2%) [3]. Another study, a 6-year study on acute care facilities involving almost 32,000 patients, reported that the 2 most frequent sites of stage I and II PUs were the sacrum and heels (30.7% and 23.2%, respectively) [9].

Conclusions

The design of Swift Skin and Wound enabled our study, which was generated from data acquired over 2 years from over 23,000 wounds. This illustrates the immense speed and power of focusing computational approaches on the analysis of large datasets acquired as a matter of routine workflow.

A consequence of our study was the generation and use of body heat maps to display data at a depth and consistency not possible in previous studies. In our opinion, heat maps represent a better way to display skin and wound information, allowing better visualization of common locations for different skin and wound issues. Beyond the visual benefit, rapid insights can be gained by looking at a map. For example, the preponderance of PUs on the buttocks and heels highlight the importance of correctly managing the continence, turning, repositioning, and mobility of patients. The frequent occurrence of abrasions on arms suggests that, where possible, the use of protective sleeves might be helpful. Alternatively, these could be signs of possible resident mistreatment, which could highlight the need to assess staff or caregiver conduct and performance. These examples highlight the benefits, at an organizational and management level, of adopting a digital system that provides accurate and reliable skin and wound care measurements with automated documentation, allowing facility performance to be monitored in near real time.

Finally, insights generated by studies such as this will have a positive impact on patient care. Informing primary care workers of wound hot spots can prevent or reduce the occurrence of chronic wounds. Identifying the locations prone to different types of wounds will help educate primary care workers and ultimately improve the delivery of patient care.

Acknowledgments

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Conflicts of Interest

SCW is a cofounder and chief medical officer of Swift Medical; YA, ML, and KT are employees of Swift Medical.

Multimedia Appendix 1

List of anatomical locations examined in this study.

[[PDF File \(Adobe PDF File\), 266KB - derma_v1i2e11875_app1.pdf](#)]

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Abbreviations

MASD: moisture-associated skin damage

PU: pressure ulcer

SQL: Structured Query Language

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Corrigenda and Addenda

Correction: Skin and Wound Map From 23,453 Nursing Home Resident Records: Relative Prevalence Study

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In “Skin and Wound Map From 23,453 Nursing Home Resident Records: Relative Prevalence Study” (*JMIR Dermatol* 2018;1(2):e11875) by Au et al, the acronym “CMO” in the Conflicts of Interest section was incorrectly expanded to “chief marketing officer”. This has been changed to “chief medical officer” to accurately reflect Sheila C Wang's relationship with Swift Medical.

Additionally, the authors have advised that the degrees for Yunghan Au should be changed from "MBA, PhD" to "PhD, MBA".

The correction will appear in the online version of the paper on the JMIR website on October 17, 2018, together with the publication of this correction notice.

References

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