Prevalence and correlates of skin self-examination behaviors among melanoma survivors: a systematic review

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Abstract

Melanoma is the most common cause of skin cancer deaths, and individuals who have had melanoma have an increased risk of developing new melanomas. Doing regular self-examinations of skin enables one to detect thinner melanomas earlier when the disease is more treatable. The aim of this systematic review is to characterize and evaluate the existing literature on the prevalence and correlates of skin self-examination (SSE) behaviors among adult melanoma survivors in the USA and Canada. A computerized literature search was performed using PubMed, Google Scholar, and ScienceDirect. The inclusion criteria for the studies were: (a) reported results for adult melanoma survivors in the USA or Canada, (b) papers described empirical research, (c) assessed SSE and related behaviors, and (d) papers were published in a peer-reviewed journal in the past 20 years. Key phrases such as “skin self-examination/SSE in melanoma survivors in the United States” and “correlates of skin self-examination/SSE” were used. Based on the inclusion criteria, 30 studies were included in the systematic review. SSE prevalence varied depending on how SSE was defined. Demographics and factors (gender, education level, patient characteristics, partner assistance, and physician support) associated with SSE were identified. Findings of this review show evidence for the need to have a consistent way to assess SSE and suggest different types of correlates on which to focus in order to promote SSE and reduce the risk of melanoma recurrence in survivors. This systematic review and its protocol have been registered in the international database of prospectively registered systematic reviews in health and social care (PROSPERO; ID: 148878)

Keywords

Systematic review, Skin self-examination, Melanoma survivors, Correlates

INTRODUCTION

Melanoma survivors are at a 10-fold higher risk of being diagnosed with a subsequent melanoma [1]. Among patients diagnosed with localized or regional melanomas, rates of recurrence for thin melanomas range from 3% to 24%, and recurrence rates for more advanced melanomas are substantially higher (e.g., 51% among those with Stage III disease) [2–4].

Reducing the risk of secondary melanomas is a health priority because it improves survival rate, as well as reduces health care costs and improves the overall quality of life among melanoma survivors. The mean total health care cost per patient per month for treating melanoma recurrences was

Implications

Practice: Clinicians and other health care providers working with melanoma survivors should focus on assisting individuals of low socioeconomic status and minority populations with tailored SSE education and instructions.

Policy: Guidelines regarding consistent ways to define and assess SSE should be developed and disseminated widely among researchers and health care providers who work with melanoma patients.

Research: Future researchers should attempt to examine social and organizational factors that are associated with SSE and query patients, partners, and physicians who are unwilling to conduct or assist with SSE in order to identify barriers to effective implementation.

estimated to be \$2,645 [5]; hence, effective diagnosis and treatment of melanoma can reduce significant health care costs.

Skin self-examination (SSE) is a potentially useful tool in reducing the serious consequences of melanoma by enabling patients to detect dysplastic (abnormal) moles, suspect lesions, or changes in existing lesions [6]. SSE is an effective behavioral strategy that can be promoted among melanoma survivors to reduce their risk of recurrent melanomas. Studies have shown that melanoma patients whose recurrences were self-detected versus physician detected have significantly improved postrecurrence survival due to the detection of thinner/earlier melanomas [7,8]. Routine performance of SSE has also been associated with thinner tumors, although examining a higher number of body areas was not associated with a decrease in tumor thickness [9].

Previous reviews, which have examined SSE, have focused on multiple types of primary and secondary behaviors associated with malignant melanoma in a small number of studies [10] or included general populations and did not assess the prevalence of SSE among melanoma survivors [11]. In contrast,

this systematic review focuses specifically on SSE in the prevention of recurrent melanomas among melanoma survivors and includes findings from more recent articles. The aim of this systematic review is to characterize and evaluate the existing literature on the prevalence and correlates of SSE behaviors among adult melanoma survivors in the USA and Canada. We included studies in the USA and Canada because of their geographic proximity and similarities in populations, cultures, skin cancer risk [12], and recommendations for SSE [13,14]. Through this aim, we seek to answer two research questions: (a) What is the prevalence of SSE, including the prevalence of comprehensive SSE, and (b) what are the factors associated with conducting SSE among adult melanoma survivors aged 18 and above in the USA and Canada?

METHODS

Search strategy

Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (2009), we conducted a computerized search for peer-reviewed studies on Google Scholar (first 40 pages) [15], PubMed, and Science Direct from June to August 2019. The following phrases were used—“skin self-examination in melanoma survivors in the United States”; “skin self-examination in melanoma survivors in Canada” “prevalence of skin self-examination in melanoma survivors”; “prevalence of skin self-examination in cancer survivors”; “correlates of skin self-examination in melanoma survivors”; and “predictors of skin self-examination in melanoma survivors.” The search was limited to studies published between 1999 and August 2019. For example, using the search phrase “prevalence of skin self-examination in melanoma survivors” and publication dates from January 1, 1999, to August 31, 2019, on PubMed, 11 citations were reviewed. This systematic review and its protocol have been registered in the international database of prospectively registered systematic reviews in health and social care (PROSPERO; ID: 148878).

Selection of studies and data extraction

Two reviewers examined studies based on their abstract and title. There was a 92.3% agreement between the two reviewers about inclusion. A third reviewer resolved disagreements. Articles were included if they met the following a priori criteria: (a) studies reported results for adult melanoma survivors in the USA or Canada, (b) the paper described empirical research, (c) the studies assessed SSE and related behaviors, and (d) papers were published in a peer-reviewed journal in the past 20 years. Studies were excluded if they were not available in the English language and targeted other populations, such as only family members of melanoma

survivors, older adults, or other individuals at higher risk for melanoma. Studies, which met inclusion criteria, were selected for independent full-text review. A list of studies was compiled and references from these studies were inspected to find any additional studies that met the inclusion criteria.

The research team developed a data extraction tool that captured information on the following: authors, year of publication and country, title of paper, sample size and setting, demographic characteristics, research design and theoretical framework, key findings, and strengths and limitations of the study. The strengths and limitations of the study were used in part to assess the risk of bias in the studies. Two reviewers worked together on extracting data from all full texts. Another reviewer looked at the extracted data from all studies to ensure that the information was accurate and properly recorded. The study selection and exclusion process are shown in Fig. 1.

RESULTS

Overview

A title-abstract search of the three databases yielded 366 articles. After duplicates were removed, the abstract, methods, and findings of 361 articles were screened. Three hundred and sixteen articles were excluded for not meeting study criteria. Fifteen full texts were then assessed for eligibility. Three additional articles were removed. Eighteen articles were retrieved by reviewing the references of the 12 previously included studies. A final list of 30 articles was obtained.

Study characteristics

Twenty-five studies were conducted in the USA and five studies were carried out in Canada. Around one third of the studies were cross-sectional surveys ($n = 12$), nine of them were randomized controlled trials (RCTs), seven of them used a prospective research design, and the rest were qualitative using focus groups, ($n = 1$) [36] or analyzed secondary data ($n = 1$) [23].

Prevalence of SSE among melanoma survivors

Patients identified up to 40% of melanoma recurrences [16]. Prevalence of SSE varied depending on how SSE was assessed and the timing of the assessment. Between 16% and 23.5% of survivors reported doing monthly SSE. Around 71.6% reported examining their skin in the past 2 months [24]. About 85%–88% of individuals had performed SSE in the past year [34]. About 50% of patients reported that they *carefully* examined their moles at least once per year [9].

The performance of SSE varied by thoroughness and body parts. The majority of patients (87%) in one study reported engaging in SSE for abnormal markings more often (vs. less often) in the last year,

Fig 1 | PRISMA flowchart illustrating how screening and selection of studies was carried out.

presumably compared to earlier in their diagnosis [21]. Between 7.5% and 32% reported doing thorough SSE (TSSE) in the past 2 months [25,32,35,42]. TSSE was defined according to what Weinstock et al. [44] described as “actually looking at all the different areas of your skin deliberately and systematically.” Weinstock et al. [44] also specified TSSE as examining the front of the body from the waist up, front of thighs and legs, bottoms of feet, calves, backs of thighs, buttocks, lower parts of the back, and the upper back.

In 2012, Bowen et al. [20] found that 73% of melanoma patients examined the front of themselves, 71% inspected the front of their thighs and legs, 38% examined the bottom of their feet, 52% looked at the back of their thighs and legs, 52% examined their buttocks and lower parts of their backs, and 61% inspected their upper back. About 27% of patients examined 9 out of 13 body areas [9] and only 14.2% of melanoma patients examined 15 body parts [24].

Factors associated with performing SSE among melanoma survivors in surveys

Four sets of factors were found to be associated with performing SSE among melanoma survivors:

sociodemographic factors, patient characteristics, attitudes, and beliefs about SSE and interpersonal determinants. Among sociodemographic factors, gender and education level were associated with conducting SSE [21,31,32,34]. In particular, females were more likely to perform SSE than males [21,34], while men more frequently examined the front of the body from the waist up and the front of the thighs and the legs [32]. Higher education level was associated with using melanoma pictures to assist with conducting SSE among melanoma patients [31]. Patient characteristics—being at a more advanced melanoma stage and having more lesions or moles—were associated with SSE-related behaviors among melanoma survivors [31,35]. For example, patients diagnosed with advanced melanoma were more likely to use a melanoma picture to assist with SSE and have someone help them with doing SSE [31].

As for belief factors, it was found that attitudes toward SSE (e.g., barriers) and self-efficacy to perform SSE were significantly associated with doing SSE [17,19,22,35,40]. Higher levels of SSE self-efficacy were associated with both intention to do SSE [17] and conducting SSE [35,40]. Additionally,

Table 1 | Characteristics, key findings, strengths, and limitations of studies included in the review

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Berger et al., 2017; USA [16]	62% male, 38% female 581 Stage II melanoma patients	Cross-sectional design No use of TF	40% of melanoma recurrences were detected through self-inspection Majority of recurrences detected by patients and physicians and rarely by routine imaging	(+) Compared SSE to other methods of melanoma detection (-) Patients were likely to be male and above 60 years
Bergeron et al., 2019; Canada [17]	52% male, 42% female Mean age = 59 232 patients, previously diagnosed with melanoma	Cross-sectional design (data taken from Time point 1 from the longitudinal study) Self-efficacy construct (no mention of TF)	Self-efficacy to do SSE had a small positive correlation with intentions to do SSE ($r = .21, p < .01$), moderate positive correlation with physician support of SSE ($r = .30, p < .01$), and a small negative association with general distress ($r = -.15, p < .05$)	(+) Valid and reliable Self-Efficacy for SSE Scale (-) Majority of participants had at least a college degree (-) Development of Self-Efficacy for SSE Scale didn't include qualitative phase
Boone et al., 2009; USA [18]	43% male, 57% female 53% aged 40–69 130 patients with cohabitating partners randomized into either the couple learning condition ($n = 65$) or the solo learning condition ($n = 65$)	Randomized controlled trial (RCT) Solo learning condition where intervention assigned to patient alone Couple learning condition: intervention administered to patient and patient's spouse or cohabitating partner	Significantly lower number of missed lesions in partner-assisted SSE vs. SSE Younger couples and patients assisted by males missed more lesions in sexually sensitive areas and hard-to-see, not sexually sensitive areas compared to older couples	(+) Blinded RCT (-) Limited sample size (-) Limited follow-up period
Bowen et al., 2015; USA [19]	44% male, 56% female; 99% White Mean age = 56 313 families (melanoma patient and family)	Web-based and interactive RCT No clear mention of TF; perceived risk construct	Improved SSE in body areas that require a more effortful exam (bottom of feet; lower back/buttocks) Higher levels of perceived risk and cancer worry were related to increased intervention effect ($p < .01$)	(+) Follow-up survey (+) Multiple outcomes (+) Strong internal validity (-) Sample mostly White Caucasian females and moderately educated
Bowen et al., 2012; USA [20]	44% male, 56% female Mean age = 56 99% White 313 melanoma patients	Baseline responses of larger RCT (Suntalk study) Cited Health Belief Model, Extended Parallel Process Model, and Theory of Reasoned Action	73% examined their fronts from the waist up, front of legs (71%), bottom of feet (38%), back of legs (52%), buttocks and lower back (49%), and upper back (61%) 22% thought they had conducted a thorough SSE 44% reported "casually checking skin"	(+) Used population-based sample (-) Sample likely to be more educated than the average region

(Continued)

Table 1 | Continued

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Chen et al., 2016; USA [21]	55% male, 45% female Mean age = 59 150 participants (82 males and 68 females)	Cross-sectional; telephone surveys No mention of TF	87% of participants reported SSE for abnormal markings more often Females more likely to do SSE than males ($p < .05$)	(+) Compared different skin protection behaviors between genders (-) Cross sectional (-) Self-report
Czajkowska et al., 2017; Canada [22]	50% male, 50% female Mean age = 49 242 (397 approached) melanoma patients	Longitudinal study Repeated measures self-report survey Cited Social Cognitive Theory (SCT) and used self-efficacy construct Intervention: 20 min individual educational session on the early signs of melanoma and a whole-body SSE	23% increase in SSE self-efficacy postintervention and increase was retained 3 and 12 months later, $p < .001$ High physician support of SSE group reported higher SSE self-efficacy at baseline, before the intervention and 12 months ($p < .05$)	(+) Reported on SSE self-efficacy over a long duration and compared participants based on a level of perceived physician support (-) Physician SSE support measure was self-report
Coroiu et al., 2018; Canada [23]	51% male, 49% female Mean age=59 188 melanoma patients	Secondary analysis of baseline data Development and validation of physician support of SSE scale No mention of TF	Physician support of SSE scale had moderate positive associations with demonstration of SSE and intentions to perform SSE	(+) Development of the first measure of SSE physician support (-) Lack of a qualitative component to inform item development of scale
Coups et al., 2016; USA [24]	49% male, 51% female; 98.9% White Mean age = 62 176 Stage 0–III cutaneous malignant melanoma patients within 24 months of surgical treatment	Cross-sectional survey No mention of TF	80.7% reported ever performing an SSE and 71.6% performed an SSE in the last 2 months An average of 7.6 body parts examined in the past 2 months 14.2% examined all 15 listed body parts 3.4% claimed that they ever used a body mole map 20.6% took a picture of their moles to help track changes 60.8% reported never having heard of the ABCDE guide	(+) Looked specifically at aspects of knowledge related to the ABCDE guide (-) Possible recall bias (-) Most participants were White and had a college degree

(Continued)

Table 1 | Continued

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Coups et al., 2019; USA [25]	51% male, 49% female Mean age = 61 98% Non-Hispanic White 411 (1,411 approached) melanoma patients	RCT: intervention and usual care (baseline information only) Internet Intervention Model and Preventive Health Model Intervention: online modules with educational information and SSE skills-building activities with immediate feedback for participants.	Only 7.5% of participants performed an SSE in the last 2 months Participants reporting a mean of 10.6 (of 15) areas of the body Less than 2% reported using a body mole map for their most recent SSE 39.2% had someone else help them Hard-to-see areas less commonly examined	(+) Adequate sample size (-) Findings of intervention not reported
DiFronzo et al., 2001; USA [26]	No age, sex, and race information 3,310 American Joint Committee on Cancer patients	Prospective design using chart reviews No use of TF	Early detection of thinner primary melanomas seem to be influenced by patient education about SSE and consistent clinical follow-ups	(+) Use of large sample size (-) Cannot determine causal relationship
DiMillo et al., 2017; Canada [27]	51% male, 48% female, % missing Mean age = 58 137 melanoma patients involved in a romantic relationship	Cross-sectional survey Patients received 20 min. dermatological education session and SSE demo Cited theory of planned behavior and social cognitive and interdependence theories	Relationship satisfaction, SSE support, general partner support, SSE comfort, and partner attendance significantly predicted patients' SSE self-efficacy SSE support and SSE comfort significantly contributed to the model ($p < .05$)	(-) Patients may not have had the opportunity to implement SSE behavior before start of investigation (-) Little variability obtained for general partner support scores (-) Patients reported SSE self-efficacy rather than SSE behavior
Garbe et al., 2003; USA [28]	43% male; 56% female Median age for males = 56 Median age for females = 52	Prospective descriptive design No use of TF	17% of recurrences discovered by the patients after a thorough educational program on self-detection of metastasis	(+) Large sample size (-) Intense follow-up procedures may reduce the likelihood of metastases discovered by patients themselves
Glenn et al., 2017; USA [29]	30% male, 70% female Mean age = 42 86.2% Non-Hispanic White 316 melanoma survivors and children (263 non-Latino White; 53 Latino)	Cross-sectional online, paper, or phone survey Based on Health Behavior Framework	28% survivors reported performing SSE once or not at all during the past year 16% of survivors reported doing monthly SSE 8% engaged in SSE every 2 months Having ≥ 2 melanoma diagnoses in the family, higher perceived severity of melanoma, and higher sun protection associated with reporting monthly SSE	(+) Focus on parent and child (+) Oversampled for Latino cases (-) Self-report (-) Social desirability bias (-) Lack of variability of some measures

(Continued)

Table 1 | Continued

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Hultgren et al., 2016; USA [30]	43% male, 57% female Mean age = 55 494 patient-partner dyads from a large Midwestern city	RCT; intervention ($n = 395$) and control ($n = 99$) Intervention consisted of a didactic skills training session at baseline and clinical reinforcement of the skills with the dermatologist No use of TF	Patient SSE self-efficacy scores increased from baseline to 4 months and 4 to 12 months Intervention group had significantly higher SSE self-efficacy compared to control group during activities with partner As partner motivation and relationship quality increased, patient self-efficacy increased	(+) Demonstrates sustainable effects of intervention on patient SSE self-efficacy with partners (+) Strong internal validity (-) Dyads aware of study examining SSEs (-) Inclusion criteria might have biased partners' motivation
Korner et al., 2013; Canada [31]	51% male, 49% female Mean age = 55 47 consecutive melanoma patients	Cross-sectional self-report survey No use of TF	Higher education associated with using melanoma picture to assist with SSE and advised to perform SSE by a health care professional ($p < .05$) Patients with advanced melanoma were more likely to use a melanoma picture and have someone else to assist with SSE ($p < .05$)	(+) Provides evidence on education being a key predictor of SSE (-) Possible recall bias (-) Self-report (-) Small sample size (-) Global SSE assessment
Loescher et al., 2006; USA [32]	53% male, 47% female; 97% White Mean age = 65 Purposive sample of 70 participants	Cross-sectional feasibility study Part of a larger study which applied the Health Belief Model and the Precaution Adoption Process	59% reported doing SSE; 32% perform a total SSE Men more frequently examined the front of the body from the waist up and the front of the legs ($p < .05$) Patients with Stage II disease more likely to examine bottom of their feet ($p < .05$) Use of a partner was significantly associated with SSE ($p = .001$) Relying on dermatologist's exam was a main reason for SSE nonperformance	(+) Examination frequency and specific body areas examined (-) Purposive sampling and small sample size (-) Cross-sectional design
Loescher et al., 2010; USA [33]	120 melanoma patients recruited from the University of Arizona cutaneous oncology program website 86 accessed the study 57% male, 43% female Mean age = 60	Pre-post study Online video intervention to increase performance, knowledge, and SSE self-efficacy No use of TF	SSE performance increased from 39% to 68% ($p < .01$) No change in SSE self-efficacy from pretest to posttest	(+) Longitudinal (+) Presented information about the participants who did not view the intervention (-) Self-report

(Continued)

Table 1 | Continued

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Manne and Lessin, 2006; USA [34]	43% male, 57% female Mean age = 54 99% White 229 melanoma patients	Cross-sectional paper survey Health Belief Model and constructs from SCT, Theory of Reasoned Action, and Transtheoretical Model (TTM)	15.7% had not performed SSE in the past year 23.5% reported conducting SSE >1 per month Only 13.7% were categorized as conducting a SSE 48.2% reported "often" to "always" having someone else assist with most recent SSE 81.7% were in the "action" stage of SSE adoption Gender and SSE barriers associated with SSE	(+) Applied health behavior theories (-) Sample primarily White and college educated (-) Refusers likely to be males (-) Self-report measures (-) SSE stage of adoption measure didn't take into account either SSE thoroughness or overly frequent SSE
Mujumdar et al., 2009; USA [35]	45% male, 55% female Mean age = 60 99% Caucasian 115 patients with first primary melanoma	Cross-sectional telephone interview Use of behavioral self-efficacy construct from SCT, risk perception construct from TTM	17% of participants conducted "deliberate and systematic SSE" Those having moles were more likely to report SSE ($p < .03$) High SSE self-efficacy associated with conducting SSE	(+) Finding applicable to nonclinical settings (-) Social desirability and recall biases (-) Participants were mostly White (-) Other potential psychosocial factors not assessed
Oliveria et al., 2013; USA [36]	37.5% male, 62.5% female Mean age = 59 48 patients	Use of eight focus groups No use of TF	Most did not do routine SSE An upcoming dermatologist's appointment prompted SSE Barriers reported: low confidence, overwhelmed by number of moles, and some believed that dermatologists would find anything suspicious before it spread	(+) Provides a broad understanding of the economic issues in a cohort of melanoma survivors (+) Random stratified sampling technique (-) Small sample size
Paddock et al., 2016; USA [8]	53% male, 47% female 58% of sample under 60 years 650 White residents newly diagnosed with cutaneous melanoma	Longitudinal study Baseline interview with intermittent follow-up through 2007 No use of TF	Risk of melanoma death was 25% lower among patients who performed SSE Risk of melanoma death increased continuously over the 20 years for patients who did not perform SSE	(+) Long-term follow-up (+) Cause of death reviewed using the CTR and National Death Index (-) Limited power
Pollitt et al., 2009; USA [9]	59% male, 41% female 95% White 59% of sample ≤60 years 321 patients	Cross-sectional survey No use of TF	26.8% examined 9 of 13 body areas 50% carefully examined their moles at least once per year Routine examination of skin associated with thinner melanomas	(+) Used separate measures of SSE (+) Completion of surveys within 3 months of diagnosis (-) Patient reported

(Continued)

Table 1 | Continued

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Robinson et al., 2010; USA [37]	48% male, 52% female Ages 21–80 40 participants	RCT0 In-person training ($n = 19$) or workbook intervention ($n = 21$) Workbook group vs. in-person group No use of TF	SSE was higher in workbook group than in-person group at 1 month (0.20 for in person compared with 1.30 for workbook) and 4 months (0.16 vs. 0.71) Intervention not effective in increasing SSE efficacy, knowledge and attitude ($p > .05$)	(+) Workbook cost-effective and easily disseminated (+) Standardization of workbook intervention reduces influence of variable components (-) Small sample size
Robinson et al., 2014; USA [38]	No age, sex, and race information 500 melanoma patients and their SSE partners (165 pairs in person, 165 pairs with workbook, 70 pairs tablet, and 100 in control)	RCT Incorporated 9/26 behavior change techniques in interventions (e.g., skill modeling, prevention planning, goal setting, action planning, and feedback)	No significant difference between in-person and tablet groups Greater understanding in in-person and tablet over workbook Significantly higher self-efficacy among in-person group In-person and tablet groups scored higher on ABCDE knowledge than workbook group	(+) RCT (+) Innovative use of technology (-) No characteristics listed for refusers (-) The majority of participants had an income higher than the national average and had at least a college degree
Robinson et al., 2008; USA [39]	50% male, 50% female 130 participants randomized	RCT (couple learning condition [$n = 65$]; solo learning condition [$n = 65$]) Couple learning condition Use of SCT	Partners' motivation to implement the intervention and perception of relationship quality significantly predicted SSE self-efficacy Partner and relationship variables important even when partners are not directly involved	(+) Provides findings on partner characteristics that are important in SSE skills training (-) Long-term effect not assessed
Robinson et al., 2007; USA [40]	50% male, 50% female 130 participants	RCT (couple learning condition [$n = 65$]; solo learning condition [$n = 65$]) Use of Social Modeling Theory	Changes in self-efficacy scores were the strongest mediators followed by SSE attitudes, comfort with someone helping with SSE, and concern about sun-damaged skin	(-) Small sample size (-) Focus on short-term effects (-) Partner variables influencing the effectiveness of partner learning
Robinson et al., 2016; USA [41]	49% male, 51% female Mean age = 55 494 patient-partner dyads	RCT Randomly assigned to in-person ($n = 165$), workbook ($n = 159$), tablet ($n = 71$), or control group ($n = 99$) No use of TF	Intervention group increased SSE at 4, 12, and 24 months vs. control ($p < .001$) Intervention dyads identified a significantly higher number of Stage 0 melanomas than control	(+) Strong internal validity (-) Pairs were aware of the study examining SSE and highly educated (-) Occurrence of unscheduled visits
Rodriguez et al., 2017; USA [42]	51% male, 49% female 57% of sample ≤ 60 169 (329 approached) melanoma patients	Cross-sectional survey No use of TF	Only 28% performed SSE regularly Melanoma-specific communication with physicians or family associated with being more likely to do SSE ($p < .01$) Participants paid less attention to hard-to-see areas (require mirror or assistance from others) during SSE	(+) Looked at melanoma-specific communication (-) No qualitative exploration of survey responses (-) Limited power for some analyses

(Continued)

Table 1 | Continued

Authors, year, country	Sample size and characteristics	Research design and theoretical framework (TF)	Key findings	Strengths (+) and limitations (-)
Ullasz and Lebowhl, 2007; USA [43]	No age, sex, and race information 877 patients (111 with more than one primary cutaneous melanoma)	Longitudinal pre-experimental design No use of TF	SSE and patient education helped in the identification of thinner second primary melanomas	(+) Large sample size (+) Long-term follow-up of patients to examine lesions and melanomas (-) Factors not controlled in analyses

patients reported a number of barriers, such as lack of confidence to examine abnormal skin marks, being overwhelmed by the number of moles on their body, and the belief that their dermatologists would be able to identify suspicious lesions [36].

Regarding interpersonal determinants, it was found that partner SSE assistance, support and motivation, physician support for SSE, and patients being educated by physicians about SSE were significantly associated with performing SSE [32,41]. Specifically, relationship satisfaction and quality, support of SSE by partners, partner motivation, and partner attendance at medical visits were positively associated with patients' self-efficacy to do SSE [27,30]. Physician support of SSE was associated with the intention to perform SSE [22,23]. Additionally, patients reported that routine education on how to do SSE helped them to identify thinner second primary melanomas [43].

Factors associated with SSE in intervention studies

Eleven studies tested the effectiveness of an intervention on SSE and factors associated with SSE [18,19,22,28,30,33,37–41]. These studies used different types of interventions—interactive websites about melanoma prevention, an in-person educational program about self-detection of metastasis using visual aids and a brochure, online video intervention, an illustrated workbook about the personal risk of developing melanoma and the biology of melanoma, an individual educational session on the early signs of melanoma and a whole-body SSE, and partner assistance in SSE skills training [18,19,22,28,30,33,37–41]. Successful outcomes of interventions included improvement in SSE self-efficacy [22,30,38–40], improvement of SSE in body areas (e.g., bottom of feet, lower back, and buttocks) that required careful examination [19], increase in SSE performance [33,37,41], and identification of melanoma recurrences [28]. Higher levels of perceived risk and cancer worry were associated with greater SSE performance in a web-based intervention study [19]. In another study, changes in SSE were associated with SSE attitudes, comfort with someone helping with SSE, and concern about sun-damaged skin [40].

Use of health behavior theories or frameworks

Less than half of the studies used a health behavior theory or a behavior change technique as part of their framework for their research (*n* = 11). Examples of health behavior theories cited were Social Modeling Theory, Health Belief Model, Extended Parallel Process Model, Theory of Reasoned Action/Theory of Planned Behavior, Social Cognitive Theory (SCT), Internet Intervention Model, Preventive Health Model, Interdependence Theory, Health Behavior Framework, the Transtheoretical Model, the Precaution Adoption Process, and behavior

change techniques, such as skill modeling, prevention planning, goal setting, action planning, and feedback on performance [18,20,22,25,27,29,32,34,35,38–40]. Nineteen studies did not use or explicitly describe any theoretical framework in their research [8,9,16,17,19,21,23,24,26,28,30,31,33,36,37,41–43]. Out of these 19 articles, 4 of them assessed self-efficacy in conducting SSE [17,30,33,37] and 1 of them assessed the perceived risk of getting melanoma [19].

Nine studies used one or more theoretical constructs and models to operationalize and measure variables and to inform the conceptual basis for surveys implemented in the study [17,19,20,22,27,29,32,34,35]. Irrespective of study design, the most commonly used theoretical construct was self-efficacy to perform SSE [17,22,27,30,35,37,39,40]. Two RCTs used health behavior models (e.g., the Internet Intervention Model and Preventive Health Model) and behavior change techniques to guide the design and implementation of intervention components [25,38], while one RCT used Social Modeling Theory to formulate the research questions and hypotheses in the study [40]. It appeared that RCTs [38,39] that used theories employed a higher number of intervention components and reported the effectiveness of a range of strategies (e.g., skill modeling and action planning) that can be used to improve SSE among melanoma survivors compared to those that did not specify any theory [18,19,30].

Risk of bias in studies

Risk of bias in the studies included in this systematic review was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach [45]. A common limitation in the observational studies was using a small sample size [8,31,32,36,42]. In addition, participants were mostly White, female, and college-educated and were likely to have access to medical care and be compliant with posttreatment care [16,19,20,24,27,34]. Due to the use of self-reports in the studies, recall and social desirability biases in addition to differential bias (i.e., patients with good prognosis might remember their SSE practices differently compared to those with serious and deadly melanomas) might have occurred. Three survey studies did not report clear inclusion/exclusion criteria for participants [16,23,31,33]. Only a few studies adjusted for covariates or controlled for confounding in their statistical models [8,20,27,34,35].

In addition, several authors reported concerns with some of the measures they employed in their studies. For instance, objective measures of physician support were not assessed [22], and the validity of an SSE physician support scale was not examined [23]. Furthermore, measures of SSE practice were not detailed [31]. Other limitations reported by authors were: the lack of measurements of important factors, such as health care-provided communication

regarding TSSE [32], measures to assess thorough SSE were not sensitive [34], findings might be biased due to flawed measurement of partner support [27], noncomprehensive examination of psychosocial factors related to SSE was not included in the study [35], and Type 1 error might have occurred due to using a significance level of 0.1 for statistical analyses [8].

Most RCTs had limited follow-up periods to examine the effectiveness of interventions over time. Only one RCT reported the use of blinding [18]. Lack of power was an issue in RCTs due to small sample sizes in intervention and control groups [18,37,40]. Only one RCT reported effect size [20]. Two RCTs pilot-tested features of their interventions [20,25], and standardization of intervention in one RCT appeared to reduce the influence of confounding factors [37]. Loss to follow-up was addressed by multiple imputations in one RCT [25]. Despite having strong internal validity, the RCTs were based on White, high socioeconomic status and motivated participants and, thus, findings cannot be generalized to other populations of melanoma survivors [18,20,30].

DISCUSSION

This study characterized and evaluated the existing literature on the prevalence of factors associated with performing SSE among American and Canadian melanoma survivors. Clearly, the prevalence of doing SSE varied across studies. Several sets of factors (i.e., sociodemographic factors, patient characteristics, beliefs, and interpersonal determinants) were found to be correlated with performing SSE among melanoma survivors. This research and review is important given that melanoma survivors are at a high risk of developing new or recurrent melanomas during their lifetime [46–48].

The prevalence of doing SSE varied across studies. Prevalence of conducting SSE monthly ranged from 16% to 23.5%; about 50% of patients reported examining their moles at least once per year and 85%–88% performed SSE at least once during the past year. Only four studies assessed the prevalence of TSSE, that is, systematic and deliberate examination of multiple body areas, and the performance of SSE differed across body parts. These findings provide evidence that SSE is not assessed in a consistent manner in studies; the frequency with which people report examining their skin depends largely on the manner in which the question is asked and a large number of melanoma survivors do not employ a careful and systematic approach to examining their skin [44,49]. Discrepancies in the way SSE is conducted might also be attributed to the lack of physician recommendations on performing thorough and regular SSE. Individuals were more likely to practice SSE if their health care providers had asked them to examine their skin [49]. Even

if there is increasing evidence on the efficacy of monthly TSSE to detect malignancies in their early stages [50], it appears that patients are not following through with this behavior.

There were significant differences between men and women in the practice of SSE. Studies showed that there was a higher frequency of SSE in women, and men were more likely to examine the front areas of their bodies. Women have been reported to do more regular examinations of their skin than men due to being more knowledgeable about skin cancer, having a higher perceived risk of skin cancer, having a more positive attitude toward doing SSE, and being more confident in their performance of SSE [49,51]. Women also felt that they had a better idea of what skin changes to look for while examining their bodies compared to men [52].

Patients who had higher education levels were more likely to practice SSE. Education level is an indicator of socioeconomic status (SES) and it has been found that the performance of SSE was nearly 70% in individuals of high SES and who had access to medical care and health insurance [51]. Education level has also been correlated with increased awareness of melanoma and its serious consequences [53], perhaps contributing to educated patients adopting behavioral strategies, such as SSE to prevent their risk of melanoma.

Patients diagnosed with advanced stages of melanoma and those who had more moles or lesions sought assistance with doing SSE and employed strategies, such as using pictures to examine their skin. This might be due to the fact that patients with advanced-stage melanoma were educated about the importance of doing regular SSE and have been shown how to look at suspicious moles and feel more confident in their ability to examine their skin [24]. Higher perceived risk of getting new melanomas among these patients could be also a contributing factor in seeking assistance and using tools such as pictures to help them examine their skin.

Several belief factors (perceived risk for melanoma, cancer worry, self-efficacy to perform SSE, lack of confidence to do SSE, feeling overwhelmed by the number of moles on their body, and the belief that suspect lesion would be identified by their dermatologist) were found to be associated with SSE. As posited by several theories, such as the Theory of Planned Behavior [54,55] and the SCT [56], self-efficacy is an important determinant in predicting an individual's intention to do/not do a certain behavior. Performance of SSE is correlated with the perceived risk of the development of melanoma or skin cancer and, based on their perceived risk, patients have been found to be motivated to perform SSE and discuss SSE with their doctors [53].

Having a partner's assistance and physician support were important in influencing melanoma patients in doing SSE. Involving a partner in SSE

increases the likelihood of conducting regular skin self-exams by providing social support and modeling behaviors, helps patients to examine hard-to-see places on their body, and can, potentially, help patients to understand instructions to do SSE [57]. The presence of a partner while doing SSE also improves individuals' self-efficacy to examine their skin and provides higher levels of comfort for patients [27]. Not surprisingly, physician support plays a major role in improving SSE practices among melanoma patients. Patients who have been instructed by physicians on how to practice SSE conducted SSE significantly more often [58].

Based on the different types of factors associated with the performance of SSE, the socioecological model for health promotion proposed by McLeroy et al. [59] could be useful to characterize current and future work. For instance, patient characteristics and beliefs to conduct SSE fit within intrapersonal factors that influence a specific behavior, while patient-partner relationships and physician support reflect the interpersonal influences that are important in helping melanoma patients in conducting routine SSE. Interestingly, no studies focused on the other levels of the socioecological model for health promotion, that is, institutional factors, community factors, and public policy. Health organizations could provide support, resources, and incentives to patients on how to conduct effective SSE; however, there are no available data to confirm that these resources would be utilized by patients at risk [60]. Furthermore, institutions provide important opportunities to build social support among melanoma survivors for behavioral changes [59] and, thus, could help melanoma patients become more confident in conducting SSE. Finally, clarifying and disseminating professional recommendations for SSE among melanoma survivors could be another strategy to enhance the engagement of performing SSE.

The use of theories was inconsistent across studies included in this systematic review, and over half of the studies did not mention any theoretical framework, hence, making it difficult to compare studies based on their use of theory. Self-efficacy to conduct SSE was the most commonly reported correlate, suggesting that self-efficacy is an important predictor to be considered when conducting SSE among melanoma patients [56]. While some studies used theory to guide the design of their surveys to assess SSE, the use of theory and behavior change techniques became more apparent in the design of interventions included in this systematic review. A range of health behavior constructs and strategies were used in designing different intervention components [25,38]—findings that are consistent with those from an earlier meta-analysis [61]. Noar et al. [61] emphasized the importance of selecting four to five theoretical concepts and using theories that include constructs such as attitudes, self-efficacy, stage of change, processes of change, and

social support to improve the effectiveness of health behavior change interventions.

As with all studies, it is important to keep limitations in mind. As noted in Table 1, the findings here are based on mostly White, moderately to highly educated, and female participants, which may affect the generalizability of the results to other melanoma survivor populations. Most of the studies relied on self-reports, which might have led to social desirability and recall biases. Although some studies (e.g., the randomized controlled trials) had strong internal validity, they focused mostly on patients in clinical settings. Small samples and drop-outs in some studies resulted in limited power to detect meaningful differences. Given the cross-sectional design of some studies included in the systematic review, a cause-and-effect relationship could not be ascertained empirically. It was also challenging to compare the prevalence of SSE across articles since different studies assessed SSE in different ways. We also did not examine other countries because of the potential dissimilarities in key variables.

IMPLICATIONS

Research

Future researchers should attempt to query patients, partners, and physicians who are unwilling to conduct or assist with SSE in order to identify barriers to effective implementation. It could be worthwhile to assess the use of technology in designing interventions that would help physicians and partners to communicate more effectively about SSE with patients and provide patients with better education and support. Since male melanoma survivors and patients with lower education levels were less likely to engage in SSE, it has been noted that interventions tailored to male and less educated survivors may prove beneficial. Given that there is a dearth of information on how organizational, community, and public policy factors influence melanoma patients in conducting SSE, it would be worthwhile to examine how these higher-level determinants influence SSE. Further, there is a need to design interventions that include comprehensive theories to improve SSE among melanoma survivors.

Practice

Demographic characteristics were associated with the quality and frequency of SSE performance. In particular, less educated patients, non-White individuals, and males were less likely to be part of SSE-focused interventions and studies. This knowledge can inform clinicians on how to best assist their specific patients with tailored education and provide increased attention to underserved populations.

Policy

Policies regarding implementing SSE in a universal way should be initiated, supported, and disseminated

widely among researchers and health care providers who work with melanoma patients. In order to reduce health disparities, funding for providing SSE instructions and workshops in less educated and minority populations could be worthwhile.

CONCLUSIONS

This systematic review provides evidence on the need to have consistent ways to define and assess SSE. The review offers implications for research, practice, and policy. For example, several types of determinants that interventions can focus on to promote SSE as a behavioral strategy in the prevention of new melanomas among melanoma patients were identified. Future research should attempt to address the aforementioned limitations of previous studies.

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Compliance with Ethical Standards

Conflicts of Interest: Trishnee Bhurosy, Carolyn J. Heckman, and Mary Riley declare that they have no conflicts of interest.

Authors' Contributions: T.B. conceptualized and led the study. T.B. and C.J.H. wrote the manuscript. T.B. and M.R. reviewed studies for the systematic review and extracted data from the studies. C.J.H. resolved discrepancies between the two reviewers.

Ethical Approval: No ethical approval was needed because data from previous published studies in which informed consent was obtained by primary investigators were retrieved and analyzed.

Informed Consent: This study does not involve human participants and informed consent was, therefore, not required.

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