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Title: Effectiveness of interventions to support the early detection of skin-cancer through skin self-examination: a systematic review and meta-analysis

Running head: Systematic review of early detection of skin-cancer by skin self-examination

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Research ethics: not applicable.

What is already known about this topic?

- Few skin self-examination (SSE) intervention-development and evaluation studies have been identified to aid early detection of skin cancer, and no systematic reviews nor meta-analyses have been undertaken.
- SSE interventions employ varied delivery elements including technological, written and face-to-face material.

- Interventions focus on identifying melanoma and non-melanoma skin cancer in the population and amongst high-risk groups.
- Evaluative studies currently only utilise self-report outcome measures, including knowledge and self-efficacy in conducting SSE

What does this study add?

- Few SSE intervention-evaluation studies have a low risk-of-bias
- More studies employed interventions focused on surveillance, targeting those at higher risk, compared to screening SSE practices, for those at no increased risk of skin cancer.
- Interventions can effectively increase SSE-behaviour, but few are underpinned by behaviour change theory.
- There is a need to promote structured SSE, but we require more theory-based interventions and rigorously designed studies to evaluate their clinical impact.

Summary (abstract)

Background: As skin cancer incidence rises, there is a need to evaluate early detection interventions by the public using skin self-examination (SSE), however, the literature focuses on primary prevention. No systematic reviews have evaluated the effectiveness of such SSE-interventions.

Objective: To systematically examine, map, appraise and synthesise, qualitatively and quantitativelystudies evaluating the early-detection of skin cancer, using SSE-interventions.

Methods: Systematic review (narrative synthesis and meta-analysis) examining randomised controlled trials (RCTs), quasi-experimental, observational, qualitative studies, published in English, using PRISMA and NICE [1] guidance. Electronic databases: MEDLINE, EMBASE and PsycINFO, through to April 2015 (updated April 2018 using MEDLINE). Risk-of-bias assessment was conducted.

***Results*:** Included studies (n=18), totalling 6836 participants, were derived from 22 papers; these used 12 RCTs and 5 quasi-experiments (and 1 complex-intervention development). More studies (n=10) focused on those targeting high-risk groups (surveillance) compared to those at no higher risk (screening) (n=8). Ten (45%) study interventions were theoretically underpinned. All the study outcomes were self-reported, behaviour-related and non-clinical in nature.

Meta-analysis demonstrated intervention impact on the degree of SSE activity from five studies, especially short-term (up to 4-months) (OR 2.31, 95% CI 1.90 to 2.82), but with small effect sizes. *Limitation:* Risk-of-bias assessment indicated that 61% (n=11) were of weak quality.

***Conclusions*:** Four RCTs and a quasi-experimental study indicate that some interventions can enhance SSE activity and so are more likely to aid early detection of skin cancer, however, the actual clinical impact remains unclear and this is based on overall weak study (evidence) quality.

Introduction

Melanoma and non-melanoma skin cancer (NMSC) are rising in incidence and prevalence[1], as exemplified in the UK[2.] NMSC primarily leads to to surgical disfigurement, but melanoma has a much higher risk of metastases and therefore mortality. The American Cancer Society estimate for 2017 that 87110 people have been diagnosed with melanoma and 9730 will die of it [3]. Diagnostic delay for melanoma may lead to an increase in Breslow thickness and so poorer prognosis and survival [4]. However, SSE and subsequent clinical presentation rely on individual health-behaviours. Few SSE-related studies have targeted high-risk groups, including those with a skin cancer history, e.g.[5]. Highest mortality risk is associated with older white men with rising melanoma incidence [6].

Most skin cancers are self-detected [7]. However, early detection challenges include: 1) poor public awareness, motivation and competence to undertake SSE; 2) inability to recognise suspicious lesions; 3) limited awareness of the importance of early medical presentation [8] and lack of effective strategies to address such factors [9].

At the outset of this review we were interested in the extent to which these behaviour challenges were identified and therefore wanted to embrace developments in behaviour-change theory [10,11]. We also wished to explore the extent to which these had been integrated within the design of SSE-interventions and related evaluation studies ~~and the~~and the extent to which the public/ patients were engaged in intervention co-design.

The literature on skin cancer prevention, including the empirical evaluation studies focuses on primary prevention interventions. Secondary prevention research has addressed SSE-behaviour to assist in early-detection eg: [12], using educational interventions eg [13, 14]; however, knowledge may not be the only relevant behaviour-related factor operating. Furthermore, many interventions employ digital technology strategies to facilitate the SSE process eg: [15, 16], however, there are no meta-analyses of their effectiveness, other than a single narrative review it is restricted to smartphone interventions [17]. Also few qualitative studies have explored relevant factors, such as patients' symptom appraisal e.g. [18]. These evidence gaps highlight the need for a systematic review of SSE-interventions.

The review questions examined were: 1) Are there effective interventions that aid the early-detection of skin cancer by promoting SSE by adults in the community? 2) What factors determine their effectiveness?

Materials and methods

The search strategy, quality appraisal criteria, data extraction and the meta-analytic processes employed are now summarised.

Protocol and registration: The protocol was registered on PROSPERO, the international prospective register of systematic reviews[19]; the completed review registration is (No 29267). The review protocol drew on NICE guidance [1].

Literature search: scope, criteria and process: The search employed the PICOS criteria to determine the focal population, intervention, comparators, outcomes and study design. Participants included those over 16 years and all racial groups in the community. Selected interventions were those involving SSE directed towards the early-detection of skin cancer (melanoma and non-melanoma). Key comparators, were both inactive controls (placebo,

standard care, no treatment, or a waiting list control) and active controls (a different variant of the same intervention). Outcomes embraced any UV protective behaviour-change related to SSE early detection activity, including subsequent self-referral for a related investigation leading to either to a diagnosis or a dermatology referral. Length of follow-up was not specified.

The following database portals were used: OVID, EBSCO, Cochrane and Web of Knowledge. Databases were searched from 1990-April 2015 including: Cochrane Library, EMBASE, MEDLINE, CINAHL, PsycINFO, and Web of Science, with MEDLINE updated in April 2018. Figure 1 details the search strategy.

[Figure 1 (insert)**]**

Studies were screened for inclusion using eligibility criteria. This included a broad range of study designs due to interest in SSE health-behaviours and intervention effectiveness, including; RCTs quasi-experimental, observational and qualitative studies. We focused on published or in press English-language papers only. Three of 4 reviewers independently selected studies at each stage meeting the eligibility criteria, from title identification, to abstract and then paper review. We obtained full-text reports for all titles meeting the criteria or where there was uncertainty. Reviews occurred in pairs (SE/JD & AE/ST). We sought some additional information from study authors to resolve any queries. Disagreements were resolved through discussion or with a third reviewer from amongst the pairs. Additional papers were identified through hand-searching paper reference lists for eligibility.

*Data extraction***:** We designed a set of data extraction proforma for each type of study designs. Extraction was undertaken by two pairs of reviewers on demographic, methodological and design details. Discrepancies were managed as described previously.

Quality appraisal: Study quality was assessed using the Cochrane risk-of-bias tool [20], appraising the internal validity of RCTs. These included: - 1) selection bias, including random-sequence generation and allocation concealment; 2) performance bias: addressing participant and personnel blinding; 3) detection bias: examining blinding of outcome assessment; 5) attrition bias: considering incomplete outcome data and; 6) reporting bias: which examined selective outcome reporting.

The EPHPP tool recommended by NICE (2010) was also used to assess study quality [21] and complement the Cochrane tool. Risk-of-bias was rated using EPHPP as either high (inadequate), low (adequate) or unclear. Overall quality of the individual studies was summarised as strong, moderate or weak. In two cases, where further clarity regarding design and related bias appraisal was required, we contacted the authors and responses were obtained from one of these.

Analysis: Analysis included both narrative analysis and a meta-analytic synthesis. As our focus was on SSE practices for the early detection of all skin cancer, and due to the commonalities in the self-examination process, we did not separate the analysis for those with melanoma and NMSC. This we argue is consistent with lay surveillance, where the attention is determining the need to present to a physician with a suspected skin cancer, not diagnostic-related activities. Included studies were examined for clinical homogeneity in relation to the PICOS elements described. The meta-analytic results could only be pooled when there were more than two studies examining the same outcome that provided sufficient data, including the means, standard deviation per group, or number of events, number of participants, and highlighting if conducted within different populations. Some studies did not provide data in the required format analysis (e.g.: with no measures of dispersion). Therefore, when required, we combined data from more than two groups and applied standard formulas for calculating

standard deviations from test statistics, confidence intervals and p-values. Once data were in the required format, fixed or random effects meta-analyses, as appropriate, were undertaken; random-effects models used DerSimonian and Laird's method [22]. Where studies used different outcome measures, but measured the same underlying concepts, standardised mean-differences were reported. The I^2 statistic was used to assess heterogeneity between studies; this is more effective than the X^2 statistic when there are small numbers of studies included in a meta-analysis [23,24]. To aid interpretation an I^2 value of 25% was considered 'low' heterogeneity, 50% 'moderate' and 75% 'high'.

Results

This review combines a critical narrative summary of the 18 included studies, with 9 studies having suitable and sufficient data to be meta-analysed.

Study characteristics: The literature search and retrieval process are summarised using a PRISMA flow-diagram (Figure 2). From 22 included papers, [12-16,25-40 41], detailed in Table 1, we identified 18 included studies, as 3 additional papers [16,32,33] reported on the same set of studies, with some reporting additional outcomes.

[Figure 2: (insert)**]**

Interventions analysis and categorisation: We used the Template for Intervention Description and Replication Framework checklist and reporting guideline (*TIDieR*)[42] to delineate and categorise the intervention components (see Table 1). Typically, the SSE-interventions used a varied delivery modes (Table 2). Three incorporated digital technology-based to teach SSE (DVD/video; mobile phones; computer-tablets). Most studies were delivered at home (n=11), followed by delivery at a clinic or GP surgery only (n=7) and both home and clinic (n=5)'

then in the community (n=2). Intervention duration was not always clear, but ranged from 5-40 minutes, to application that was sustained between 6 months and 2-years.

More intervention studies (n=10) engaged in surveillance SSE practice were targeted at those of known risk due to their prior medical history or older men [12,13, 25,26, 28-31,38,41] rather than those that focused on screening SSE practice (n=8), for people at no increased risk of skin cancer, including healthy volunteers, [14,15,27,34,35,37,39,40]. Most studies (n=11) focused on SSE to detect melanoma, with the remaining ones not differentiating between melanoma and NMSC, but focusing on the detection of skin cancer or not.

Just under half of all studies (n=8)[25, 26, 28-31, 34, 37, 38,] reported using underpinning behaviour change theory within the intervention. However, none sufficiently examined how these factors had informed an understanding of their potential mechanism of action.

Further to the TIDieR intervention analysis, few studies employed patient co-design within the intervention development, nor engaged in Patient Public Involvement (PPI) approaches in study refinement; however, the exceptions include [28,38]

Methodological quality of studies: The Cochrane risk-of-bias review [43] and the EPHPP [21] appraisal tool recommended by NICE (2010) are summarised (Table 3). They reveal high risk-of-bias and several reporting issues. Comparing the outcome of both quality assessment methods, only one study had a global rating as 'strong' [25] (5%, n=1) [15]; six studies (33%) were rated 'moderate' quality [15,26,29,34, 35, 41,]; with most studies being rated as 'weak' quality (61%, n=11)[, 12,13, 14, 27,28,30, 31, 37-40.]

Outcome domains and measures: These are summarised and grouped under the 14 domains (Table 4) and where stated, the measures used to assess them are specified in Table 1. These

outcome domains and the related measures used across the included studies were heterogeneous in nature (Table 4). Most studies employed only self-reported outcome measures. The most common domain was 'knowledge of SSE and skin cancer' (used in 66% of studies (n=12), followed by 'performing SSE' focused on confidence/ self-efficacy, that was used in 61% (n=11) of studies.

From our review only one study employed an objective measure of SSE, with observer assessment of checking proficiency in conducting SSE [35]. They developed and used the Skin Examination Rating Scale (SERS), a 28-item pass/ fail appraisal, based on American Cancer Society guidance and tested using reliability analysis, although the tool has not been published. Four studies involved the physician checking the patients' skin for cancer or not and so was not an appraisal of their SSE performance, eg: [41]. To assist in health professional assessment of the proficiency of skin self-examination for skin cancer, guidance has been developed (Table 5):

Meta-analytic results:

i) *Any impact on SSE activity:* this refers to any of the outcome domains listed in table 4 that provided sufficient data for inclusion in the meta -analysis depicted in Figure 3 (embracing 6 studies, reported across 6 papers). Here we included where any specific part of the body was examined for signs of skin cancer, synthesising study findings from heterogeneous outcome measures, where the interventions had *any* impact on SSE activity, such as frequency, measured at different time points (n=6195): short-term (2-3 months, 4 studies, n=1788 participants), medium-term (6-7 months, 2 studies, n=1887) and long-term outcomes (12-13 months; 4 studies; n=2520). Figure

3 reveals that all SSE-related outcome improvements favoured the intervention, with short-term effects being most pronounced (OR 2.31, 95% CI 1.90 to 2.82, p<0.001); and slightly reduced effects in the medium (OR 2.03 95% CI 1.58 to 2.61, p<0.001) and longer-terms (OR 1.93, 95% CI 1.38 to 2.70, p<0.001). However, these are relatively small effect sizes and levels of heterogeneity in both the interventions and outcomes are high.

[Figure 3: (insert)**]**

ii) *Whole body SSE:* Whole body SSE measured at different time points (n=2561): short (3-4 months, n=502), medium (7 months, n=869) and long-term (12-13 months, n=1190) outcomes (Figure 4). Whilst the direction of effect was in favoured the intervention, these differences were not statistically significant (OR 1.04, 95% CI 0.65 to 1.66, p=0.873; OR 1.28, 95% CI 0.94 to 1.74, p=0.114; OR 1.55 0.95 to 2.55).

[Figure 4: (insert**)]**

iii) *Self-efficacy in performing SSE:* Four studies provided suitable data to be included in this meta-analysis (n=1099) (see Figure 5). The pooled estimates favoured the intervention (i.e. greater self-efficacy) at both time points, immediately after in 2 studies (n=170) and after 4-months in 4 studies (n=929), but the results were not statistically significant (SMD: 0.62, 95% CI -0.18 to 1.43, p=0.131; SMD: 0.24, 95% CI -0.19 to 0.67, p=0.277).

[Figure 5: (insert)**]**

Two studies [33 34] provided sufficient data on the number of skin cancers detected, to include in this meta-analysis. The pooled estimate demonstrated higher rates of skin cancer/severe

dysplasia detection in the intervention compared to the control group, but this difference was not statistically significant (OR 1.38, 95% CI 0.82 to 2.33, p=0.222).

Discussion

This review updates the evidence on the nature and effectiveness of SSE-interventions to support the early detection of skin cancer.

Summary of review findings: Our review of 18 studies revealed that there are effective interventions that can promote SSE activity by the public or patients, drawing on statistically significant effect data pooled from 6 studies. By increasing SSE activity, interventions may provide a foundation to enable the early skin cancer detection. Despite the small number of pooled studies on other behaviour-related factors, such as self-efficacy, those on whole-body SSE, and the non-significant effect data, the forest-plots do point towards favouring SSE-interventions. The small effect sizes could perhaps be explained by interventions insufficiently targeting known determinants of SSE. Few studies targeted high-risk and -hard-to-reach groups, including those with a history of skin cancer, family history and older men, with some exceptions e.g.: [28]. Although older-men have been targeted [36], this important group has been give insufficient attention in the research literature [44]. An equal number of studies (n=9) focused on screening (not targeted at high to risk groups) as surveillance, that were targeted on those with a history of melanoma skin cancer or older men. Almost all outcomes were self-reported, focussing on the conditions under which SSE behaviour may be achieved, such as the underpinning knowledge, attitudes and self-efficacy. In only one case did we identify that the proficiency of the SSE conducted was observer assessed[35].

We have not identified studies that directly link SSE to clinical outcomes by exploring the impact on, or association with factors known to be linked to skin cancer prognoses, such as

the Breslow thickness of melanoma. Nor did we identify studies that examined any impact that SSE-interventions may have on reducing the time to diagnosis, by supporting early self-referral to a physician for a suspicious-lesion.

It is difficult to identify and attribute the precise variables that may account for interventions effectively increasing SSE activity, as observed across the pooled data. However, given their varied modes of delivery, we believe that these modes provide a guide to some of the factors that may be operating (Table 2). Of the five pooled intervention studies [14, 15, 16, 34, 36,38,] found to influence SSE-activity, two-thirds used printed information or face-to-face delivery (the modal methods) and a third employed video or body mapping tools. However, from these 5 studies, 6 modes of technological delivery were operating; these included video, mobile texting and web-based delivery, with one exception using written material only [14]. Intervention delivery factors are therefore likely to be important in supporting early-detection. These will require careful consideration in any new intervention development, and appropriate intervention development frameworks to evaluate the appropriate levels of intervention components [45].

In this review we also highlight the wider context of the proliferating number of interventions that are being developed as software applications ('apps') for skin cancer detection; however, few apps have been subject to published research evaluation. These interventions typically provide limited guidance on enabling individuals to undertake SSE, include no or minimal assessment of behaviour-barriers, with many being confined to the photographing suspect lesions. One important example, because it is a rare case of being supported by an evaluative research protocol, is the commercial intervention (MySkinPal app)[46] built on a limited narrative systematic-review. However, it is restricted to smartphone interventions, [17] it does

not target higher-risk groups, provides no evidence of stakeholder co-design; and the evaluative trial protocol[47] lacks economic evaluation and a clear data-analysis plan.

Limited improvements in the number of patients presenting with thick melanomas over 20-years suggest alternative intervention strategies are required[47]. This review highlights the potential for designing more rigorous studies that explore the effectiveness of interventions by embracing behaviour change techniques targeting behaviour determinants, and for utilising co-design with service users to facilitate accessible use. Only one study [28] was identified using these techniques for intervention development, albeit with limited application. From our review only one study employed an objective measure of SSE, with observer assessment of checking proficiency in conducting SSE [35], using the Skin Examination Rating Scale (SERS), based on American Cancer Society guidance and tested using reliability analysis, although the actual tool is unpublished. Four studies involved the physician checking the patients' skin for cancer or not (clinical outcome) and so was not an appraisal of their SSE performance, eg: [41]. To assist in SSE intervention design, we have provided guidance on health professional assessment of patient proficiency in SSE , see Table 5. Longer term we advocate for the need to develop more high quality, effective interventions through application of the systematic complex intervention development process [47]. We propose the need to combine the application of these review findings; the integration of technology to design an online or 'app-format resource that uses images and video demonstrating SSE; the process of co-design through public and patient involvement and the application of developments in behavioral change theory including the theoretical domains framework [48], applied to this area via the MOLES Index development[49], the behaviour change wheel [50] and the HAPA model[51]; these elements may then factor in individual SSE behaviour drivers and barriers.

Limitations and strengths: With a third of included studies having a global quality rating as weak and only one as strong, the evidence-base for SSE-intervention effectiveness is currently limited and requires both improved intervention and evaluative study design. The results should be interpreted with caution with the relatively small number of studies that were included in the meta-analysis and the high levels of heterogeneity in the interventions and outcomes across most of the meta-analyses. Also, intervention evaluation studies relied on self-reported outcomes only and so there is scope to explore the use of clinical impact measures. There is limited data on interventions that target high-risk groups, and therefore, the external validity of this review is restricted amongst groups such as older men and those with a personal skin cancer history. Similarly, there were insufficient studies to be able to undertake the meta-analysis within each population subgroup. The quality appraisal (Table 3) highlights the number of areas where the estimation of risk of bias was unclear; due to the scale of these reporting weaknesses we did not have the resource to contact the authors in each instance, although in a limited number of cases design related issues were clarified. We also searched the grey literature database, OpenGrey.

A specific strength of our review is that it included the TIDieR Framework for describing reporting interventions [42], allowing a breakdown of their component elements. This includes, for example, the intervention target, its method of delivery and use of underpinning theory. Such analysis is important as this level of detail may help to ascertain potential mechanisms of action -that inform the development of improved SSE-interventions, and thereby, may lead to more effective approaches to promote the early detection of skin cancer.

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Figure legends

Figure 1: Skin cancer skin self-examination interventions Search Strategy: database: OVID - MEDLINE: 1946 to 2018 (April week 3)

Figure 2: Skin cancer early-detection using skin self-examination interventions: PRISMA (2009) flow diagram on search process

Figure 3: Skin cancer early-detection: Forest plot on interventions that impact on any skin self-examination activity

Figure 4: Skin cancer early-detection: Forest plot on interventions that impact on whole body skin self-examination activity

Figure 5: Skin cancer early-detection: Forest plot on interventions that impact on self-efficacy to perform skin self-examination

Table 1. Overview of included papers (n= 22) and studies (n=18) on skin self-examination interventions for skin cancer

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
1.Aneja et al 2012 [15]	RCT	1) Participation in computer assisted learning (CAL) tutorial (*SkinSafe*) (8 modules) on melanoma risk, symptoms, prevention and SSE using a laptop computer, with the addition of a hands-on SSE tutorial, monthly tele-communication reminders to perform SSEs for 12 weeks and a brochure on melanoma detection. Duration: 3 months. Lesion focus: M	No theory or tailoring reported.	Received the brochure on melanoma detection only	Patients attending dermatology clinic and their family members and friends. (n=132). USA study Focus: SG Setting: outpatient dermatology (OPD)	Confidence in identifying Melanoma, SSE performance, self-perceived melanoma risk, knowledge of ABCD, use of sun-screen & protective clothing. Questions based on self-reported behaviour.
2.Berwick et al 2000 [13]	Pre/ post test pilot study	*"Nurse education as an intervention to increase SSE for melanoma"* to determine specific factors that would be important for the design of a larger intervention. Educational session with a nurse who reviewed the clinical characteristics of cutaneous melanoma, risk factors and SSE method. Educational materials including ABCDE appraisal of moles/ melanoma and a diary to record SSE frequency and body areas by the individual or partner. Duration: 6-18 months. Lesion focus: M	Although advocated, the intervention was not tailored to the specific assessed behaviour influence.	Low risk individuals without melanoma	Participants were high-risk individuals with a history of melanoma or high multiple atypical nevi attending clinic as well as low-risk individuals without melanoma (n=75). USA study. Focus: SV. Setting: OPD	Post-test to assess change in knowledge about melanoma, ascertain frequency and thoroughness of SSE and the perceived risk of developing skin cancer. Self-reported telephone interviews.

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
3.Bowen et al 2015 [38]	RCT	*"Website with constantly changing messages about prevention"* included personal risk graphic, links to specific sites with more information and additional sessions that could be chosen including how to reduce risk, prevent sun exposure and self-screening. Prompts sent three monthly for participants to consider previously unread pages. Duration 1 year. Lesion focus: M	Perceived risk was included as an outcome measure as found to be predictive of protective health behaviours. Intervention tailored to the family's risk factors.	Delayed intervention	Families (n=331) each with at least one case of melanoma. USA study Focus: SV Setting: community	Self-reported SSE, sun protection behaviours, provider screening, and perceived risk. Physician screening, using a approach based on Weinstock [34]
4.Chao et al 2017 [14]	Pre/ post-test cohort (two group)-quasi-experimental	*"Modified pamphlet that included skin of colour section, the nomenclature "melanoma skin cancer" and an image of an individual performing skin self-examination with the help of a friend".* Lesion focus: M	No theoretical underpinning reported. Tailored to people with skin of colour (not individuals)	Conventional pamphlet	Consecutive adult patients attending dermatology clinics who identified as African/American, Asian/Pacific Islander, American/Indian, Alaskan Native or Hispanic seen in a dermatology clinic (n=100) USA study Focus: SG. Setting: OPD	Knowledge, perceived risk and skin self- examination practices through self-report survey.
5.Chung et	Pre/ post-test (cohort	*"Information sessions on melanoma disease risk factors and skin self-examination techniques"*	No theory or	NA (pre- post-	The Hispanic/ Latino rural	Pre/post evaluation survey relating to knowledge, risk

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
al 2015 [39]	-one group)-quasi-experimental	led by lay health workers. Duration: Sessions lasted 10 to 15 minutes. Lesion focus: M	tailoring reported.	test)	community in California (of low socio-economic grouping) attending a health promotion event (n=34). USA study. Focus: SG Setting: community	awareness, and self-efficacy for self-screening. Adapted version of the Risk, Concern and Knowledge Assessment Questionnaire, RCKAW, Gillespie et al 2011) Adapted version of Skin - Examination Questionnaire, SEQ Hernandez et al 2013
5.Glanz et al 2014 [41]	RCT	*"PennSCAPE"* personalised mailed communications about cancer risk and recommended sun protection. Lesion focus: ND	No theory or tailoring reported.	Generic mailings.	Caucasian adults at moderate or high risk of skin cancer recruited from primary care in the USA (n=192). Focus: SV Setting: OPD	Sun protection behaviour, sunscreen use, sunglasses, sunburns in the past three months, recent timing of last SSE n and frequency of skin exams by healthcare provider. Tool derived for the Sun Habits survey
7.Janda et al 2010 [25] Walton et al	RCT-Parallel group	*The Skin Awareness RCT"* to assess whether paper based or 12-minute video/ DVD-based intervention materials will increase the SSE. Components included video (delivered by a well-known sports personality & written material, plus 2 postcard reminders after 2 weeks to improve SSE behaviour, a body chart to record any skin lesions and a coloured brochure recommending but not guiding on	The Extended Health Belief Model (EHBM) formed the basis of the intervention to consider men's awareness of disease seriousness. Tailoring involved	Assigned brochure only recommending (only) SSE	Healthy male members of the public aged 50 years or older (n=929). Australia study. Setting: community Walton et al healthy	Surveys mailed out then phone interviews conducted at 6 & 12 months to establish improvements in SSE behaviour (frequency, extent/thoroughness), confidence in performing SSE correctly. Consultation with a doctor involved

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
2014[33] Janda et al 2011[36]		SSE. Duration: 12 months. Lesion focus: ND The Intervention group receive a DVD/Video among working men 50 +. Video covered on what skin cancer is, risk factors; the higher risk of men 50 years+ and how to conduct SSE guided by an actor. Both groups received a brochure on common features of benign and malignant skin lesions as well as highlighting the importance of SSE. Duration: 7 & 13 months (follow up point from enrolment). Janda et al (2011) focused on impact of video & postcard but this was the same trial.	BCTs used according to barriers.		volunteers (men n=494) aged 50+ years Indoor and outdoor and mixed workers. Australian study Focus: SV* (as older men at higher risk) Setting: community Janda et al (2011) as Walton et al (2014). *	clinical exam and questions including General Self-Efficacy 10-item 4-point Likert scale, perceived social support (partner support in performing SSE) and mirror use to aid SSE. Questions delivered by telephone interviews.
8.Janda et al 2013[37] Youl et al 2015[16]	RCT-Parallel group	*HealthyTexts Study* to investigate whether the programme can improve skin cancer prevention or early-detection behaviours compared to attention control in young adults. Series of 21 health behaviour change messages to young adults' mobile telephones on sun protection and SSE. Duration: 3-12 months. Lesion focus: ND *HealthyTexts Study* with participants randomised to Sun protection, SSE to receive text messages. Each group received 21 text	Social cognition theory formed the basis of the intervention. The intervention was tailored using a pilot questionnaire survey revealed the need to enhance specific 'cognitive and behaviour	Health behaviour change messages on physical activities	Healthy volunteers between 18-42 years (n=546) recruited via mail. Australian study. Focus: SG Setting: community	*Janda et al:* Sun Protection Habits Index (SPHI) on a Likert scale. Assess changes and attitudes towards sun protection, early skin cancer detection behaviours, thoroughness of SSE, mirror use to visualise difficult to see areas and recall and satisfaction of use of text

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
		messages about their assigned topic over 12 months. There were 12 weekly messages for 3 months and monthly messages for 9 months. All messages were personalised based on name, gender, skin cancer risk factors, number of times sun burnt, previous performance of SSE. These were aimed to address the constructs of social cognition model such as increasing self-efficacy. Duration: 3 months.	skills' but limited details given.		Same study as above: Focus: SG	messages. *Youl et al:* SPHI and whether someone has deliberately checked part of their skin for early sign of skin cancer.
9.Janda et al 2014 [26]	RCT-Parallel group	*"Clinical Skin Examination outcomes after a video-based behavioural intervention* a video-based behavioural intervention. Duration: 12 months Lesion focus: ND	Theoretical underpinning: Health belief model. No specified tailoring to individual based on assessment of behaviour determinants in operation.	Received written materials only.	Men aged 50-90 years old (n=930) in Australia, recruited via electoral roll with no previous history of skin cancer, but older men. Focus: SV Setting: community	Over the past 6 months prevalence and frequency of having done any type or whole-body clinical self-exam and histopathology outcomes of skin lesions treated during past 6 months. Concordance between self-report and physicians' case reports for Clinical Self-Examination (CSE) through telephone Interviews.
10.Michielutte et al 2001[27]	Pre/ post-test cohort-quasi-experimental	*"Western North Carolina Cancer Awareness Programme"* to increase knowledge & provide support services for the prevention & early-detection of breast, cervical, and skin cancer among women receiving care.	PRECEDE model incorporated elements of Health Belief and Social Learning Theory models (health	Participants in the comparison counties were sent one mailing of	Female adult community healthy volunteers randomly selected receiving care in 6 rural public health	Frequency of SSE performance, clinical skin examination (at least one skin examination in the past year), use of sunscreen when outdoors. Baseline interview

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
		Women attending 6 rural public health departments were selected as intervention group & 3 comparators. Comprehensive health education programme based on 1. Printed educational material and 2. Telephone counselling: a follow-up call was made to participants to answer questions and address any barriers to the recommended prevention and screening activities. Delivered by two health educators. Duration: 14 months. Lesion focus: ND	belief model), providing the theoretical underpinning. There was no evidence of a tailoring, but process evaluation of the intervention was conducted.	print materials dealing with nutrition and cancer without any telephone counselling calls.	departments (n=749). USA study Focus: SG Setting: community (public health)	and follow-up phone interview.
11.Mickler et al 1999[35]	RCT-parallel group	*"A comparison of 3 methods of teaching SSE"* evaluate the effectiveness of three methods of teaching SSE in increasing skin cancer knowledge, skin cancer detection skills and self-examination skills. Use of i) a video, ii) brochure or iii) nurse training (1-1). Duration 3 weeks of 15-20 minutes. Lesion focus: ND	Psychological theory was not applied. There was no tailoring of intervention to the assessed behaviour determinant.	Participants in wait-list control conditions	Healthy adult psychology students from dermatology clinic (n=143) in the USA. Focus: SG Setting: community	SSE proficiency (observer assessed), Skin Cancer Knowledge Questionnaire, Visual Picture Test and an observational measure the Skin-Examination Rating Scale (SERS)
12.Murchie et al, 2015[28]	Complex Intervention development study (Pilot)	Focus development, piloting and preliminary evaluation of the "*Achieving Self-Directed Integrated Cancer Aftercare (ASICA) intervention, a digital intervention for SSE*" to prompt, support and to respond quickly to 'total skin self-examinations' (TSSE). Tablet-based digital intervention designed to prompt and	'Information-Motivation-Behaviour skills' with 'Control Theory/ Implemented using Behavioural	Not applicable	Adults previously treated for cutaneous melanoma within the preceding 5 years (n=20) in the UK.	Qualitative assessment of intervention feasibility and acceptability and Quantitative assessment of intentions and confidence to perform TSSE.

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
		support TSSEs comprising instructional videos & electronic reporting & photos to a clinical nurse specialist in dermatology. Delivered by health professionals, (e.g. GPs, health psychologists) delivered in GPs' surgeries and at home. Duration: 6 months. Lesion focus: M	Change Techniques (BCT)		Focus: SV Setting: primary care	Questionnaire via phone about clinical, behavioural and psychological outcomes.
13.Robinson et al 2010[30]	RCT – Parallel group	*"In-person intervention and SSE workbook"* versus SSE workbook alone to increase SSE awareness (an extension of previous work). The illustrated workbook, included exercises that amplify skills and confidence, a framework for patient and partner by story-telling on the significance of melanoma referring to case examples. Accompanied by an 'enabling kit' of rule, magnifying lens, laminated card of ABCDE rule and body maps. AND: In-person intervention training: involving partners, ABCDE criteria of melanoma. Duration: 4 months. Lesion focus: ND	Self-efficacy measurement referred to as an outcome measure and so indicator of awareness of psychological theory. No tailoring of intervention based on an assessment of behaviour determinants.	Workbook only (no in-person element)	Adults with history of stage I or IIA (n=40) melanoma who had treatment in the last 6 weeks prior to participation. USA study Focus: SV Setting: OPD	Self-efficacy in performing SSE, attitudes towards SSE, and knowledge of SSE (patient and partner) recorded at baseline and 1 and 4 months follow up.
14.Robinson et al 2007[31]	RCT-Parallel group	Solo learning versus dyadic learning (with co-habiting partner). Solo learning: 10 minutes demonstration of ABCDE rule and skills training. A card with a condensed information about SSE & colour illustration of the ABCDE rule. Enabling kit: body maps to use as a diary & handheld magnifying glass to record areas of	Social cognitive & self-efficacy theories underpinned the intervention. There was no report of	Dyadic learning with same demonstration as with the solo learners.	Patients with a diagnosis of cutaneous melanoma drawn from hospital registries (n=130) and cohabitating	Assessed at 4-months follow up visit using a pre-and post-skills quiz and pre-& post SSE assessment, SSE frequency (using body map), self-reported, performance of SSE (self-efficacy) &

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those not known to be at high risk (screening, SG)	Outcome measures
		concern found during the monthly SSE. All delivered by research assistants in the home environment. Duration: 4 months follow up. Lesion focus: ND	tailoring.		partners. USA study. Focus: SV Setting: OPD	perceived importance, frequency of reviewing SSE guidelines, attitude-importance of partner assistance.
15.Robinson et al, 2014[29]	RCT-Parallel group	"*Early-detection of melanomas by patients & their partners*" to evaluate the effect of a structured SSE intervention for patients with melanomas and their partners on SSE performance and the detection of new melanomas by the dyad or physician. Pairs of patients and partners were randomised to 3 groups with intervention delivered by 1 of 3 methods i) self-guided workbook, ii) tablet personal computer- (electronic interactive) approach based on a scripted PowerPoint presentation, iii) In-person delivered by a dermatologist in the participants home or in the clinic. The intervention focused on the goal of examining 5 moles per month. Duration: 2 years. Lesion focus: ND	Used 9 of the 26 behaviour change techniques (BCTs) defined by Abraham & Michie (2008) to support SSE.	Assigned to customary-education and did not receive any of the intervention materials.	Adult melanoma patients' years with their SSE partner (n=500) in the USA Focus: SV Setting: OPD	Self-confidence of identifying and monitoring moles and knowledge of SSE ABCDE rule. Baseline and 4-month visit follow up. Self-reported by use of internet and mobile phone on a 5-point Likert scale.
16.Robinson et al 2016[12]	RCT-Parallel group	*Partner Assisted Skin Examination Study:* can at -risk patients with melanoma & their skin-check partners be trained to perform SSE and detect new melanomas*?' "Early-detection of melanomas by patients and their partners"* to evaluate the effect of a structured SSE	Theory not referred to but appears akin to Robinson et al 2014 (above) although not clearly	Customary-care/ education as control. (Treatment as	Patients with stage O-IIIB melanoma and partner being (n=494). Both study report the same trial number	SSE frequency of performance, detection of a new or recurrent melanoma by a dyad or a physician, no of unscheduled physician appointments for concerning

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those <u>not</u> known to be at high risk (screening, SG)	Outcome measures
Turrisi et al 2015 [32]		intervention (skills training). Pairs of patients / partners - randomly assigned to 3 sub-groups, i) workbook read in office and ii) taken-home booklet (duration 30 minutes) and iii) Interactive tablet personal computer intervention (duration 30 minutes). Lesion focus: M	reported.	usual)	registration. USA study Focus: SV Setting: OPD	lesion and self-reported SSE of the total body and easy-to-see and difficult-to-see regions, SSE with partner or not. Self-reported survey based on behaviour & intentional Likert measures
17.Roman et al 2016 [40]	One group pre/ post-test- quasi-experimental	*"Five-minute online video about melanoma".* Online delivery. Focus on melanoma risk factors, prevention, performing SSE and ABCDE of melanoma. No further intervention details reported. Lesion focus: M. Duration: 5 minutes	No theory or tailoring reported.		Hispanic members of the public (healthy volunteers) (n=137) in the USA Focus: SG. Setting: community	Post-intervention survey of melanoma risk factors, ways of preventing melanoma, frequency of skin-self-examination and knowledge relating to skin changes.
18.Weinstock et al 2007[34]	RCT- Parallel group	"*The "Check It Out" RCT*" to establish whether multi-component intervention can increase '<u>thorough</u>h skin self-examination' (TSSE). Skin examination group were given educational materials, including a 14-minute video, physician consultation (for any new or changing skin lesions), cues, aids (hand mirror & body diagram for noting the location of individual lesions) a brief counselling intervention by a health educator. Interventions were said to be based on strategies known to promote behaviour change (in general not in a tailored sense- see	Trans- theoretical model underpinned the intervention. But it cannot be assumed that the feedback is tailored and it was established that informational needs determined SSE behaviour.	A dietary intervention with tips to improve diet. Brief video was used to motivate, inform & improve skills with respect to using the 'Let's Eat Kit'	Patients attending routine primary care visits (n=1352) in the USA (volunteers not known to be at risk of skin cancer). Focus: SG Setting: primary care	Confidence in performing TSSE, frequency & thoroughness of SSE performance, perceived and actual skin cancer risk, skin surgery for skin cancer. 1, Perceived skin cancer risk was assessed on a 1-5 scale from ''very high'' to ''very low''; Examination of patients'

Study	Design	Intervention description and lesion focus melanoma (M), non-melanoma skin cancer (NMSC) or not differentiated (ND)	Theoretical underpinning & tailoring (linked to TIDieR framework [42]	Control	Population/sample/ setting details & risk focus on at-risk groups (surveillance, SV) or those <u>not</u> known to be at high risk (screening, SG)	Outcome measures
		opposite). Duration: 12 months. Lesion focus: ND		to decrease dietary fat intake.		medical records 3, Actual skin cancer risk: using Brief Skin Cancer Risk Assessment Tool (BRAT) scale.

Table 2: Modes of delivery of interventions for skin self-examination for skin cancer from a systematic review (n=18, included studies)

Study and citation no (#)	Components and modes of delivery employed in SSE-interventions					
	Written/ instructional materials/brochure/ generic versus tailored*	Face-to-face delivery: SSE tutorial/ read aloud, demonstration	DVD/ Video	Body mapping tools/materials to help SSE.	Computer/Email/electronic tablet/ online-website-information	Mobile phone: text messages, interviews/counselling
Aneja et al 2012 [15]						

	•	•			•	•
Berwick et al 2000 [13]	•	•		•		
Mickler et al 1999 [35]	•	•	•			
Janda et al 2010 [25] & et al 2011 [36]	•	•	•	•		
Janda et al 2013 [37] & Youl et al [16]		•				•
Robinson et al 2010 [30]	•			•		
Robinson et al 2007 [31]	•	•		•		
Michielutte et al 2001 [27]				•		•
Weinstock et al 2007 [34]	•	•	•	•		•
Murchie et al 2015 [28]	•		•		•	
Robinson et al 2014 [29]		•			•	
Robinson et al 2016 [12]	•				•	
Janda et al 2014 [26]	•		•			
Bowen et al 2015 [38]					•	
Chao et al 2017 [14]	•					
Chung et al 2015 [39]		•				
Glanz et al 2014 [41]	•					

Roman et al 2016 [40]			•			
Total of mode application across 18 interventions (within included studies)	**12**	**9**	**6**	**6**	**5**	**4**

Table 3. Quality assessment of included studies (n=18): findings of Cochrane risk-of-bias assessment and additional elements from Effective Public Health Practice Project (EPHPP) appraisal tool: Legend: Low= risk-of-bias is low; High = risk-of-bias is high; Unclear = insufficient data to determine risk-of-bias.

Cochrane risk-of-bias assessment							**EPHPP checklist additional appraisal criteria**		
Study and linked papers (in brackets)	**Random sequence generation (selection bias)**	**Allocation concealment (selection bias)**	**Blinding of participants & personnel (performance bias)**	**Blinding of outcome assessment (detection bias)**	**Incomplete outcome data (attrition bias)**	**Selective reporting (reporting bias)**	**Study design**	**Data collection methods**	**Global rating**
Aneja et al (2012)[15]	(Adequate) Low	Unclear	(Inadequate) High	Unclear	(Inadequate) High	Unclear	Strong	Weak	Moderate
Berwick et al, 2000 [13]	(Inadequate) High	Unclear	Unclear	Unclear	Unclear	Unclear	Weak	Weak	Weak
Mickler, et al 1999 [35]	(Inadequate) High	Unclear	(Inadequate) High	(Inadequate) High	(inadequate) High	(Inadequate) High	Moderate	Strong	Moderate
Janda, et al 2010 [25] (Walton et al 2014[33] & Janda et al 2011[36])	Unclear	Unclear	Unclear	Unclear	(Inadequate) High (ITT analysis performed)	(Adequate) Low	Strong	Moderate	Strong
Janda, et al 2013 [37] (&Youl et al 2015[16]	Unclear	Unclear	(Inadequate) High. (ITT analysis performed)	Unclear	Unclear	(Adequate) Low	Moderate	Weak	Weak

Robinson, et al 2010 [30]	(Inadequate) High	(Inadequate) High	Unclear	Unclear	(Adequate) Low	Unclear	Strong	Weak	Weak
Robinson, et al 2007 [31]	Unclear	Unclear	(Inadequate) High	(Inadequate-self- report outcomes) high	(Adequate) Low	(Adequate) Low	Strong	Weak	Weak
Michielutte, et al 2001 [27]	Unclear	Unclear	(inadequate) High	Unclear	(Adequate) Low	(Adequate) Low	Weak	Weak	Weak
Weinstock, et al 2007 [34]	(Inadequate) High	(Inadequate) High	(Inadequate) High	(Inadequate) High	(Inadequate) High	(Inadequate) High	Strong	Moderate	Moderate
Murchie, et al 2015 [28]	Unclear	Unclear	Unclear	(Adequate) Low	(Adequate) Low	Adequate) Low	Moderate	Weak	Weak
Robinson et al 2014 [29]	Unclear	Unclear	(Inadequate) High	Unclear	(Adequate) Low	(Adequate) Low	Strong	Weak	Moderate
Robinson et al 2016 [12] (&	(Adequate) Low	(Adequate) Low	(Adequate) Low	Inadequate High	(Adequate) Low	(Adequate) Low	Strong	Weak	Weak

Turrisi et al 2015[32])				(self-report outcome)					
Janda et al 2014 [26]	Unclear	Unclear	Unclear	Unclear	(Adequate) Low	(Adequate) Low	Strong	Weak	Moderate
Bowen et al 2015 [38]	Unclear	Unclear	(Inadequate) High	(Inadequate) High	(Adequate) Low	(Adequate) Low	Moderate	Moderate	Weak
Chao et al 2017 [14]	(Inadequate) High	(Inadequate) High	(Inadequate) High	Unclear	(Inadequate) High	(Adequate) Low	Weak	Weak	Weak

Table 4: Outcome domains used to evaluate SSE-interventions for skin cancer early-detection in frequency order: from 18 included studies reported in 22 papers

Outcome domains													
1. Knowledge of SSE & skin cancer including body map & / or ABCDE rule and / or related SSE guidelines.	2. Performing SSE – self-reporting perceived self-efficacy, confidence, intention/ including perceived ease / confidence of identifying body area with lesion	3. Perceived importance & *or* frequency SSE &/ or thoroughness	4. Knowledge of sun protection (primary prevention) & /or intention behaviours (related to early-detection)	5. Perceived social or partner support in conducting SSE	6. Clinical skin examination at least once in a year (by clinician)	7. Perceived risk of skin cancer	8. Ability to conduct any type of SSE	9. Attitudes & beliefs towards SSE / & sun protection	10. Consultation with a doctor about skin cancer	11. Scope of physician screening/ exam	12. Use of mobile telephone to support SSE	13. Proficiency in conducting SSE observer assessed)	14. Actual skin cancer risk
n=12 (66%)	**n=11 (61%)**	**n=9 (50%)**	**n=6 (33%)**	**n=5 (28%)**	**n=4 (22%)**	**n=4 (22%)**	**n=3 (16%)**	**n=3 (16%)**	**n=3 (16%)**	**n=2(11%)**	**n=1 (5%)**	**n=1 (5%)**	**n=1(5%)**

Table 5: Appraisal of objective measurement elements for health professional assessment of the proficiency of skin self-examination for skin cancer

SSE assessment element	Advantages	Issues for consideration
1. Evidence of awareness of and motivation to undertake SSE routinely (at least once a month), especially for higher risk patients	Awareness of the need for self-monitoring and motivation are re-requisites steps in conducting effective SSE.	Would need to be verified through questioning within consultation, unless potentially promoted through electronic reminder systems, (such as a text) and or verified as undertaken via an 'app' or paper log.
2. Body scan exam conducted, demonstrating behavioural ability to systematically review all body areas, including the ability to adapt the method to examine hard to see areas, such as the scalp and back using a mirror or engaging a partner	This will ensure that all potential risks sites are examined and so none are likely missed in the routine scan. Verification of the use of a method to examine the back and other hard to reach areas (such as the back and scalp) is important as they can be missed yet are important risk sites.	Not all patients will have a partner to involve, although they can always use a hand-held mirror, but this may require purchase and training in how to use it effectively. Health education paper material, or app / internet-based video can guide and support this process (various learning through demonstration).
3. Documentation of the number of lesions identified	Reduces the likelihood of lesions being missed in the self-monitoring process and shows awareness of the need to track all potential lesions over time.	Requires a method of record keeping but this may get lost if a paper record and so it could be electronic in format (an app).
4. Following SSE appraisal of the lesion as suspicious or not, using the established 1) core message and the more detailed 2) ABCDE guidance.	A key requirement is to determine if an identified lesion is suspicious or not. Convey the simple core message and verify that this is understood: -Observe and recognise whether your skin spot or moles is new, does not go away, looks unusual for you or is changing in any way, such as in size, or bleeding for more than 4 weeks, is itching or hurts, weeping or not healing [52]. One of the most common methods of doing this is the ABCDE appraisal system - which provides a basis for lay people to have criteria for a suspect lesion [53]. Devices such as mobile phones may be used for image capture.	The public/ patients will need to be trained to utilise the ABCDE tool, but this has been established for many years and provides a relatively simple criterion-based method, not requiring clinical expertise. Some lay people may find this unduly complex or difficult to use and as such emphasise the simple core message. This does require a supporting health education resource, in the paper format or electronic for ease of access (and updating). Many mobile phones have cameras that produce poor quality lesion image capture.

5. Presentation to a suitable health professional following SSE and appraisal of a suspect lesion (step 4)	The key requirement is that SSE determines whether any lesion identified is suspicious and they if so, is followed by early presentation to a health professional for expert appraisal.	Undue uncertainty as to whether a lesion is suspicious, and prevarication may delay presentation, however, this can be overcome by indicating that if in any doubt, then the need to present to their health care system.

Abbreviations used:

ABCDE =asymmetry, border, colour, diameter, elevation or enlargement

SSE= skin self-examination.

NMSC= Non-melanoma skin cancer

RCT= Randomised controlled trials.

EPHPP =Effective Public Health Practice Project

PICOS = Participants, Interventions, Comparators and Studies;

PPI= Public and patient involvement;

OR= Odds ratio

CI= Confidence interval

SMD= Standard mean difference.