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## Population-based whole-body skin screening for melanoma

Survival from melanoma is strongly associated with depth of invasion. Early diagnosis of melanoma therefore appears essential and skin screening, defined as a visual inspection of the whole body, may be one method of achieving it. The US Preventive Services Taskforce in a 2001 review concluded, however, that there was insufficient evidence to recommend for or against routine skin screening for skin cancer.<sup>1</sup> Currently in Australia and in New Zealand,<sup>2</sup> The Cancer Council Australia and The Cancer Society of New Zealand does not recommend routine skin screening for average risk individuals, similar to the recommendations of the Royal Australian College of General Practitioners.<sup>3,4</sup> However, the American Cancer Society<sup>5</sup> supports regular screening on its own or linked to a general health check.

### 2.1 Proportion of population undergoing whole-body skin examination

Although there is no substantial evidence of its effectiveness, skin screening is being conducted in a significant proportion of the population. In most Australian studies, the twelve-month frequency of skin screening ranges from around 10–50% depending on the definitions of skin screening.<sup>6–10</sup> One large cross-sectional Australian study conducted in 1998 found 11% of participants reported having a whole-body skin screening examination in the previous twelve months, and 20% in the previous three years.<sup>6</sup> In this same study, some 45% intended to have a clinical skin examination within the next twelve months.<sup>11</sup> More recent data from Queensland indicates that 45% of men report ever having a whole-body skin screening examination by their doctor.<sup>12</sup> In a New Zealand population-based study carried out in 1993–1995, 40% of participants reported having a skin examination by their doctor in the previous five years, but only 5% reported a whole-body skin examination.<sup>13</sup> In overseas studies the frequency of skin screening ranges from 14–20%.<sup>14–17</sup>

Those attending a screening examination are more likely to have sun-sensitive skin, higher levels of education, and an increased awareness of skin cancer and perceived risk of skin cancer. An Australian study<sup>18</sup> found those aged 40–49 years, with fair skin, a previous history of non-melanoma skin cancer, or a concern about a suspicious spot or mole, were more likely to attend an open-access skin screening clinic. Men and women of all levels of education attended in essentially equal numbers, similar to results in a further Australian study.<sup>19</sup> In US national health surveys, both men and women were equally likely to report having a skin examination, with 60% stating the main reason for the examination was for routine screening. Additionally, 29% of those screened indicated they sought an examination due to concern about a specific lesion.<sup>14</sup> Analysis of data from open-access skin screening programs in the US show those attending the program were predominantly female and aged between 35 and 65 years. Approximately one-third reported a history of a spot or mole changing and 3% reported a personal history of melanoma.<sup>20</sup> Similar results have been seen in other overseas skin screening programs.<sup>21–23</sup> In the majority of studies,

following adjustment for confounders, analysis has shown the strongest predictors of attending a skin screening examination are a previous history of skin cancer, self-perceived susceptibility towards skin cancer, and a concern about a mole or spot.<sup>6,10,11,14,17–21,24–26</sup>

Evidence summary	Level	References
Studies are mostly descriptive and show both men and women attend skin examinations in similar numbers. Studies consistently report that those attending a skin screening examination are more likely to be at heightened risk of melanoma and/or have a high level of self-perceived risk	IV	6, 10, 11, 15, 18–21, 24, 26

## 2.2 Accuracy of whole-body skin examination by health professionals

Accuracy of clinical whole-body skin examination has been assessed in a number of studies conducted mainly within screening programs. Patients were self-selected in all studies, with some programs focussing on attracting participants with a number of risk factors for skin cancer (increased number of naevi, spot or mole of concern, sun-sensitive skin). The use of various screening definitions (whole-body, part-body, specific lesions only) has made comparisons across studies difficult. In most screening programs skin examinations have been conducted by dermatologists or other specialists, with only one study to date reporting on the clinical outcomes of a melanoma screening program where whole-body skin screening examinations were conducted by a general practitioner.<sup>27</sup>

In analysis of data from an Australian skin screening program the positive predictive value (PPV) for a diagnosis of melanoma was reported as approximately 11% where a whole-body skin screening examination was performed by a specialist.<sup>28</sup> One study in Queensland has examined the clinical outcomes of a screening program where a general practitioner has conducted whole-body skin examinations within a skin screening program. Of over 1300 lesions where a histological diagnosis was available, the PPV for a diagnosis of melanoma was 20.5% (based on 161 suspected melanomas and 33 confirmed on histology).<sup>27</sup> Similar values have been reported in a study of general practitioner screening for melanoma in individuals aged 50 years or more.<sup>29</sup> PPV values of 6–17% have been observed in programs where participants have self-selected on the basis of the presence of skin cancer risk factors and/or a suspicious skin lesion.<sup>30–32</sup> Analysis of the American Academy of Dermatology (AAD) skin screening program reported a PPV for a melanoma diagnosis of approximately 11%, which increased to 21.1% when analysis was restricted to men over the age of 50 years.<sup>33,34</sup> Similar results have been seen in other skin screening programs.<sup>35</sup>

Few studies have examined the sensitivity of the screening examination. Fritschi et al matched screening participants with a population-based cancer registry. Of 7436 skin screening examinations 23 melanomas were detected during screening and an additional 10 were false-negative screens giving sensitivity in the first year of 69.7% when body-site was ignored. Further analysis of this data two years after the original skin screening examination found an additional 15 melanomas and a subsequent decrease in sensitivity to 49% with increasing specificity.<sup>28</sup> A Queensland study<sup>27</sup> reported the specificity of a skin screening examination at 86% which compares favourably with screening programs for breast cancer, colorectal cancer

(faecal occult blood test) and prostate cancer (prostate specific antigen).<sup>36</sup> In a prospective Australian study of a sample of men and women aged 50 years and over, which was 'enriched' with patients with previously diagnosed suspicious pigmented lesions, general practitioners achieved sensitivity of 95% and specificity of 49% for detecting melanoma in men and women aged 50 years and over.<sup>29</sup> A small Dutch study followed-up, by record linkage, patients who had been screened negative by a dermatologist and reported data suggesting 100% sensitivity (lower 95% confidence bound 61%) for melanoma, though two melanomas diagnosed 30 and 33 months after screening were discounted as false negatives on the grounds they were 'not present or discovered at the screens'.<sup>37</sup> Studies that included only a follow-up of biopsied or excised lesions report sensitivities for diagnosing skin cancer ranging between 40% and 80% with associated high specificities.<sup>38-40</sup> However, in most of these studies accuracy for diagnosing melanoma is somewhat lower. The PPV for a diagnosis of melanoma within general practice has been reported to be between 20 and 40%.<sup>29,39,40</sup>

The yield of skin cancer screening programs for melanoma varies. Reported melanoma detection rates range between one and nine per 1000 individuals screened.<sup>22,27,32,33,41-43</sup> Higher yields of melanoma have been observed when analyses have been restricted to men 50 years and over.<sup>33,34,44,45</sup>

Evidence summary	Level	References
Most studies that have reported on the accuracy of a skin screening examination for detecting melanoma have been primarily descriptive and have reported on the outcomes of screening programs. In most studies screening was undertaken in the specialist setting (primarily dermatologists). Positive predictive values ranged from 6% to 20%	IV	22, 27-35, 37, 39, 45
One study examined the outcomes of screening when undertaken by a general practitioner within a melanoma screening program	IV	27

### 2.3 Thickness of melanoma detected through skin screening by health professionals

There is evidence that melanomas detected during a screening examination are thinner than melanomas not so detected. A large population-based study of 3772 melanoma cases in Queensland found lesions detected by a doctor during a whole-body skin examination were significantly more likely to be < 0.75mm in thickness<sup>46</sup> whereas melanoma detected incidentally were more likely to be thicker.<sup>46,47</sup> The authors of the Queensland study acknowledge, however, that it has not been shown that the increased detection of thin melanomas corresponds to a reduction in the incidence of thick melanoma and an improved survival.<sup>45</sup> In the AAD screening program, over 90% of melanomas detected were in situ or lesions ≤ 1.5mm in thickness. The proportion of lesions diagnosed less than 1.00mm in thickness during this screening program was significantly less than that found in a population-based register.<sup>20,33</sup> In an early detection campaign in Italy, Rossi and colleagues<sup>48</sup> found that 92% of melanomas diagnosed during the screening campaign were

less than 1.5mm and when compared to pre-campaign data, there was a significant trend towards thinner tumours ( $P < 0.02$ ). Similar results have been found in other studies.<sup>42,49–51</sup>

One issue for a skin screening program is whether such a program would result in diagnosis of melanomas that would not otherwise present clinically during the patient's life ('overdiagnosis').<sup>52</sup> A recent examination of trend data from Queensland found in situ melanoma has increased by 10.4% per year among men and 8.4% per year among women. Thin invasive lesions ( $< 1.00\text{mm}$ ) increased by 3.8% in men and 3.0% in women. While invasive melanomas ( $\geq 1.00\text{mm}$ ) were observed to increase by only 2.0% per year in men and 0.9% per year in women.<sup>53</sup> Increases of around 10% in rates of in situ lesions have been seen in other cancer-registry based data.<sup>54–56</sup> While trend data has consistently shown in recent years an increase in the detection of thin melanoma, this has not been accompanied by a subsequent decrease in thicker melanoma. It is known that the rate of melanoma progression can vary. Histological types such as nodular melanoma have a faster vertical growth phase while superficial spreading melanomas tend to have a longer radial growth phase. It is possible that aggressive lesions may be advanced at the time of detection. However, the future challenge is how to identify those lesions that do not threaten health or life; there is no known way of doing this at present. Further research is needed to investigate the impact of skin screening on melanoma incidence and survival.

Evidence summary	Level	References
Most studies, while descriptive, provide evidence that melanomas detected during a screening examination are thinner than those that present in other ways	IV	20, 33, 42, 47–50
One Australian case-control study has shown that melanomas detected during a skin screening examination performed by a doctor are significantly more likely to be $< 0.75\text{mm}$ than those found incidentally	III–3	46

## 2.4 Cost-effectiveness of population-based skin screening by health professionals

Currently there is no direct evidence showing that population-based screening for melanoma is effective in reducing melanoma morbidity or mortality. Thus studies examining the cost-effectiveness of skin screening to date have been based on theoretical models.

An Australian study in which the sensitivity of the screening examination was set at 60% and specificity at 98% estimated for bi-annual examination that the cost per life year saved was approximately \$12,000 for men and \$20,100 for women. Screening was estimated to be more cost-effective if conducted every five years (\$6,900 for men and \$11,100 for women) than more frequently.<sup>57</sup> Burton reported that the costs per life year saved where men were screened every two years by a general practitioner were \$12,137 and \$6,853 for screening every five years.<sup>29</sup> Using a number of assumptions, Freedberg<sup>58</sup> calculated a cost-effectiveness ratio of approximately \$36,450 per year of life saved with skin screening compared with no screening. Recent work using a US population estimated that screening once by a dermatologist at 50 years of age would cost US\$7,400 per year

of life saved.<sup>59</sup> These theoretical studies have concluded skin screening was reasonably cost-effective when compared with other cancer screening tests, particularly for men 50 years and over. The estimated costs of diagnosing and managing suspicious skin lesions detected during a population-based melanoma screening program have been assessed in an Australian study. The average cost to the health care system per referred patient was \$193, with the average cost per treated lesion calculated at \$118.<sup>60</sup> The study found that over 60% of costs were attributed to individuals 50 years or more.

Evidence summary	Level	References
Studies assessing the cost-effectiveness of skin screening are theoretical and based on statistical models that assume effectiveness. These studies have concluded that the cost-effectiveness of skin screening is comparable to that of other screening modalities, and that screening is more cost efficient when conducted in those $\geq 50$ years. A more thorough examination of the costs of screening to both the patient and the health system should be undertaken	IV	57–59

## 2.5 Effectiveness of whole-body skin examination by health professionals in reducing melanoma mortality

A recent examination of melanoma mortality data in Australia<sup>61</sup> shows a statistically significant decrease in mortality rates in both men and women younger than 55 years of age. Additionally, rates in those aged 55–79 are stable for both men and women. It is possible that this reduction is due to the beneficial effect of earlier detection although there has been no rigorous examination of the relationship between trends in indicators of earlier detection and trends in melanoma mortality.

Currently, no studies have been completed examining whether whole-body clinical skin examination reduces mortality from melanoma. Aitken et al aimed to examine the effectiveness of a community-based melanoma screening program by way of a randomised controlled community intervention study in Queensland.<sup>62</sup> The first (pilot) phase of this trial was conducted over a three-year period. The trial involved 18 communities (nine intervention and nine control) in rural and regional Queensland, with approximately 60,000 adults aged  $\geq 30$  years. The intervention included the provision of additional skin screening services in intervention communities. The rate of clinical skin examination increased significantly in intervention communities while remaining stable in the control group.<sup>63</sup> However, due to funding constraints, the full trial involving a total of 44 communities – some 500,000 adults – did not proceed, and the first phase of the study lacked power to examine for any changes in melanoma thickness or mortality.

Evidence summary	Level	References
No adequate randomised controlled intervention study has been conducted to see if whole-body skin examination is effective in reducing mortality from melanoma	n/a	n/a

Recommendation	Grade
1. In the absence of substantive evidence as to its effectiveness in reducing mortality from melanoma, population-based skin screening cannot be recommended	<b>C</b>

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